RETURNING BEHAVIOUR OF MIGRATORY BIRDS FROM THE JAJIWAL POND BHOPALGARH (JODHPUR)

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ABSTRACT

Bird migration is a seasonal phenomenon in which birds comes from northern hemisphere to equator area's waterbodies of the earth. These waterbodies attract and providing suitable environment to the many migratory birds. There are many waterbodies In Rajasthan, so thousands of migratory birds reach and stay in these waterbodies and Bhopalgarh area one of area in the Jodhpur, Rajasthan, which having a great diversity of migratory bird species. At the Bhopalgarh area's waterbodies, the returning behaviour was studied from 1st march to 15th May 2020 of many migratory bird species during the stay i.e., Bar headed goose, Swan goose, White goose, Indian cormorant, Common coot, Black winged stilt Demoiselle crane, Eurasian Spoonbill, Little grebe, Knob billed duck, Indian spot billed duck, Gadwall, Pintail, Northern shoveler, Ibis, Common redshank, Marsh sandpiper, Stork, Great blue heron Common pochard etc. They show different-different returning patterns, different-different flock size etc. The returning behaviour has been observed of these migratory birds like the flock size, date and duration of return migration and other observations about migratory behaviour at Jajiwal pond Bhopalgarh where we were studied. It was observed that most of migration occur at the month of March when the temperature of environment and pond increases, they migrate in group of at least 15 to 20 birds.

Keywords: *Bird migration, Birds Behaviour, Jajiwal pond.*

Introduction

Bird migration is one of the great things of the natural world. Most of the thousands of Bird species make the journey from one part of the world to another part with seasonal change. Mainly bird migrate from area of decreasing resources to area of increasing resources for survival, shelter, food, water and nesting sites. Often Bird migration from northern breeding areas to southern wintering grounds. In the northern hemisphere, the total vegetation and other area covered by snowfall where birds travel in search of warmer places toward equatorial regions. In this journey they carry high costs in mortality and predation like hunting by humans, by other predators and they also carry germs like bird flu.

In Rajasthan as rain comes in monsoon, all water bodies become filled with water, these water bodies having abundance of water insects, frogs, fish, molluscs, planktons and aquatic vegetations etc. This type of environment attracted to these migratory birds for stay here from first week of September to last week of March. By the end of March these migratory birds start returning to their native place. A large number of Ducks, Goose, Teals, Coots, Sandpiper, Cranes, Herons, Stilt, Cormorant and other birds comes during winter at Jajiwal pond in Bhopalgarh (Jodhpur). They show different types of Returning behaviour during the end of March to mid of the May.

Materials and methods

The studies were done at the water bodies of Bhopalgarh (Jajiwal pond) in Jodhpur (D Mohan, A Gaur,2004-2005) Rajasthan; Latitude 26.32536° N and Longitude 73.24011° E. Every year in the starting of winter many migratory birds come and stay till second week of May. They show different-different types of Returning Behaviour like flock size, Date, Duration of stay and other types of behaviour in the water bodies of Bhopalgarh (Jodhpur). These studies were done with the help of binocular in three slots morning, afternoon and evening time of the day from starting of March to the second week of the May. So mainly observation method used for this study of Returning behaviour of migratory birds. Returning behaviour of these species were keenly observed and recorded in field book for better analysis.

Observations

Observations of returning pattern for each migratory bird species wise from Jajiwal pond

(from first March to half of the May month) described in this study. Migratory Birds Showing Lowering pattern during Returning period from the Jajiwal pond Bhopalgarh (Jodhpur). Different-different types of Returning behaviour shown by each migratory bird species and observations for each species as follows;

Black winged stilt (Himantopus himantopus): Black winged stilt (family Recurvirostridae) belongs to the shore birds and wader category. At the beginning of March, there number were 65 at Jajiwal pond Bhopalgarh (Jodhpur). This stilt species began to return in mid-March from this pond and 6 members of stilt birds were also present at this pond till mid-May.

Bar headed goose (Anser indicus): Bar headed goose (family Anatidae) belongs to the duck's category. At the beginning of March, there numbers were 98 at this pond. They began to return from this pond in the second week ofthe March and by the third week of March they were totally flew away from Jajiwal pond.

Swan neck goose (Anser cygnoides): Swan neck goose (family Anatidae) also belongs to the duck's category. Their numbers were 3 at the beginning of March and by the mid-May there were also three in number at this pond.

Spot billed duck (Anas poecilorhyncha): Spot billed duck (family Anatidae) also belongs to the duck's category. There were 27 spot billed ducks at Jajiwal pond in the March starting. They began to return in the end of second week of March and they were totally returned from this pond in the end of March.

Northern pintail (Anas acuta): Northern pintail (family Anatidae) also belongs to the duck's category. 23 Pintail birds were present at Jajiwal pond in the starting of March. They began to return in the end of second week of March and they totally flew away in the 4th week of March from this pond.

Northern shoveller (Anas clypeata or Spatula clypeata): Northern shoveller (family Anatidae) also
belonging dabbling duck family. In the starting of March their number were noted 25 and at the starting of April they were totally flown away from this pond.

Gadwall (Anas strepera): Gadwall (family Anatidae) numbers were observed 29 in the starting of March and totally flew away from this pond in the end of March month. It is also a type of dabbling duck family.

Knob billed duck (Sarkidiornis melanotos): Knob billed duck (family Anatidae) also called as African comb duck, their number were observed 13 in the stating of March and totally flew away in the first week of May month. This duck is an example of grazing or dabbling duck.

Eurasian spoonbill (Platalea leucorodia): Eurasian spoonbill (family Threskiornithidae) is a type of wading bird. There were 3 in number in the beginning of March and they all three flew away in the starting week of April from Jajiwal pond.

Demoiselle crane (Grus virgo): Demoiselle crane (family Gruidae) also called as Kurjaa or Koonj and this species found in central Euro-Siberia ranging from Mongolia, Black-sea and North Eastern China. There were approximately 4000 cranes in the March starting and at mid-March they were started flew, till 22 March their number will remain approx 1000 only. They flown away totally in the second week of the April from this pond.

Indian cormorant (Phalacrocorax fuscicollis): Indian cormorant (family Phalacrocoracidae) is also known as Indian shag. There were observed 13 cormorants in the Starting of March at Jajiwal pond and they were flown away in the mid of April.

Common redshank (Tringa totanos): Common redshank (family Scolopacidae) is Eurasian wading bird and there were observed 95 in number at this pond in March starting. They were totally flown away in the third week of March.

Marsh sandpiper (Tringa stagnatillis): Marsh sandpiper (family Scolopacidae) is an example of small wader bird and belonging from eastern Europe to central Asea. There were 87 Marsh sandpiper found in the starting of the March and they were all returned to their native till last week of March.

Ruff (Philomchus pugnax): Ruff (family Scolopacidae) bird a medium sized wading bird from northern and western Eurasia. There were 63 Ruff birds observed in the first week of March and all were flown away from Jajiwal pond in the 4th week of the March.

Common coot (Fulica atra): Common coot (family Rallidae) or Eurasian coot distributed in Europe, Africa, Asia. There were 159 coots observed in the first week of March and maximum number of coots were flown away in the mid-March. There were also present 2 coots till 15 May.

Little grebe (Tachybaptus ruficollis): Little grebe (family Podicipedidae) also known as dabchick water bird and their number were noted 33in the first week of March. Maximum numbers of little grebes were flown away in the mid of March and two little grebes were also there till 15th May.

Great white pelican (Pelecanus onocrotalus): Great white pelican (family Pelecanidae) also called as Hawasil bird. There were 3 in number of pelicans on Jajiwal pond in the Starting of March and all 3 were flown away in the second week of March.

Painted stork (Mycteria leucocephala): Painted stork (family Ciconiidae) is a large wader in the stork family. There were 4 painted storks present in the starting of the March and 3 of them flew away in the 4th week of March remaining one stork was also present till 151h May. **Great blue heron (Ardea Herodias):** Great blue heron (family Ardeidae) is a large wading bird in the heron family. There were 3 in number of great blue heron on Jajiwal pond in the March starting and 2 of them were flown away in the third week of March, remaining one flew away on 51h May. Common **pochard (Aythya ferina):** Common pochard (family Anatidae) is a medium sized diving duck. There were 18 numbers of Common pochard noted in the March starting and maximum number of common pochard flew away in the third week of the March month, these pochard totally flew away in the first week of April from Jajiwal pond.

Result and Discussion

Climate changes during the second half of twentieth century has resulted in a mean increase in global temperature by 0.6°C Previous studies on Migratory birds shown rapid advances in the timing of spring migration during the last 4 decades, associated with advances of spring and warming of weather.

Migration can be triggered by combination of change in day length, temperature change in food supplies and genetic predisposition.

The ability of many species to respond to climate changes has been a major reason to migrate. They migrate in a group of same species as well as some other species. Most Migratory flight occur at night to reduce their predation risk during migration and most resting, refueling between flight called migratory stopover occur during the day.

Our results highlight the potential importance of climate change during the non-breeding season in contrasting the response of migratory species to temperature changes at the both trailing and leading edge of their breeding distribution.

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EFFECT OF E-RECRUITMENT AND INTERNET ON RECRUITMENT PROCESS: AN EMPIRICAL STUDY ON MULTINATIONAL COMPANIES OF NCR (NATIONAL CAPITAL REGION, INDIA)

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ABSTRACT

Recruitment is a component of human asset the board by which an organisation can pull in the potential up-and-comers and selects the most suitable employee for the organisation. Presently a-days the individuals are widely versatile to the change and that is the reason E-Recruitment has become a mainstream practice followed by the organisation for recruiting potential employee. This is an exploratory research with the point of distinguishing how E-Recruitment and web is affecting the general Recruitment procedure of an organisation in setting of Multinational organizations of NCR Region. In this study, multinational companies of NCR Region have been taken as employer as per their interest in E-Recruitment exercises. The example was drawn from the prestigious organizations and information was gathered from different degrees of candidates in setting of the job seekers. Statistical analysis has been utilized to demonstrate that there is significant statistical analysis of how e-Recruitment is practice and the connection between E-Recruitment and generally Recruitment process. It additionally reasoned that there is a moderate connection between these two factors and the job seeker feel advantageous to look jobs for their prosperous profession. So it is prescribed that the organisation should keep on utilizing e-Recruitment and online hotspots for employing up-and-comers so they can coordinate with the worldwide business world.

In an advanced world, job seekers want to utilize e-recruitment for an opportunity looking. In this way, the clarification of the determinants of their mentality in utilizing this technology is left unobserved.. This article reports the aftereffect of a review concentrate on how clients use e-recruitment to search for jobs. We propose Perceived Usefulness, Perceived Ease of Use, and Perceived of Enjoyment as the determinants of the activity job seekers goal. Results demonstrated that those three factors impact the dynamic of employment searchers. We found additionally Perceived Usefulness is the interceding impact for job seekers in simple to-utilize and appreciate feeling. This article provides evidence that e-recruitment has to be friendly user and fun to use to attract job seekers intention.

Keywords: *E-recruitment, Recruitment, Multinational companies, Job seekers.*

Introduction

E-Recruitment strategy is the well-articulated technique for effective utilization of internet technology to improve efficiency as well as effectiveness of the recruitment process. As internet usage became widespread, the first step of e-recruiting was the addition of online career option on corporate websites itself. It was mostly accepted that corporate website recruitment has improved recruiting efficiency. Major two kinds of E-recruitment involve use of job portals and the other is online career option in the organization's web site. E-recruitment strategies provide many advantages like centralized platform, less paper work, streamline workflow, etc. But at the same time it offers disadvantages like low internet penetration in rural India, preventing face-to-face communication, authenticity of the resumes, etc. This paper is meant for detailed study of the E-recruitment strategies in the current scenario as usage of the internet is widespread now-a-days and organizations are gradually turning to virtual organizations. Data collection method used for this research is the combination of primary and secondary data. Primary data were collected using interview of E-recruitment user. Secondary data were collected by referring different web articles, research papers, journals, etc. It was found from the research that E-recruitment strategies has improved recruitment efficiency and it is widely accepted by the MNCs but at the same time major limitation is that it does not allow face-to-face communication. It will be useful for the E-recruitment user to focus on the limitation of E-recruitment strategies for eliminating the discrepancies and effectively implementing E-recruitment strategies. Recruitment is one of the important process of HRM which is effective selection and utilization of human resource. Right people at the right place and right time is the chief motive of HRM in organization. Recruitment is ultimately inviting the pool of candidates to get

selected and join the organization. The objective of the recruitment is to obtain qualified employees for the organization to achieve organizational goals. Recruitment process acts as a bridge between employee and job seeker. Recruitment is a positive process as we are inviting pool of candidates to get selected for the job. Recruitment process mainly includes,

- Application
- Screening
- Interview
- Selection.

Literature Review

Kaur discussed about that, the way toward finding and recruiting the best-qualified up-and-comer (from inside or outside of an organisation) for an employment opportunity is a timely and cost effective manner. The recruitmentprocedure includes analyzing the requirements of a job, pulling in employee to that activity, screening and choosing candidates, recruiting, and coordinating the new employee to the organisation (Kaur 2015). Essentially, the procedure includes looking for and pulling in a pool of qualified candidates utilizing different feasible recruitment methods.

Recruitment Methods

The Traditional recruitment methods used by organizations consist of contacting friends or employee referrals, engaging executive search, using newspapers classified ads, and others. (Tong &Sivanand, 2005)

According to Sills, when broken down, the term "E-recruitment" is comprised of two parts. The "E" stands for "electronic" and "recruitment". Often, E-recruitment is known as online recruiting, social recruiting or Internet recruiting, however, this thesis will refer to E-recruitment for simplicity. To add to the previously introduced definition of recruitment, E-recruitment can only be described as the process of any personnel advertising or attracting, selection and application processing via the Internet, for external candidates, or Intranet, for internal candidates. (Sills, 2014)

Laxmi identified that, the prime focus of using e-recruitment is to get a large pool of applications. It assures the organization to get a competent person for the job position from the large pool of applicants. There are two methods of recruitment followed by the organizations

Traditional Methods

Utilizing sources that are not technology supported, similar to advertisement,, flyers, Spokespersons, to draw whatever number candidates as could be expected under the circumstances to contact the organisation.

Searching Candidates - Utilizing paper-based test for candidates to make a reasonable candidates pool.

Screening- Reaching the arranged candidates by telephones and having up close and personal discussions.

Interview - Making the call, setting up, gathering and shaking hands.

Placement

II. Modern Methods

Utilizing the organisations Reputation item picture, online technology and different strategies to draw however as many as could be expected under the circumstances to the organisations sites.

Searching Candidates -Utilizing advanced, normalized online tests to screen up-and-comers, and to winnow the candidate pool to a sensible number

Screening- Utilizing mechanized employing the executives' framework to contact the most desirable applicant rapidly, before they are snapped by another organization.

Online Interview- Making the call, setting up the gathering and shaking hands

Placement Order by email

In mid 1990s, with the progression of internet technology, many have seen the change of the regular Recruitmentrecruitment to online recruitment. (joycee,2002)

E-Recruitmentis new technology mean for choosing one of the organizations' most urgent resources, for example human resources. This

technological development improves the way toward recruiting information sources by utilizing the Internet. It permits organizations to make cost investment funds, update propositions for employment and status whenever, to abbreviate the Recruitment process duration, to distinguish and choose the best information potential out of a more extensive scope of competitors and offers the organization a chance to improve its picture and profile. (Anand j,2006). According to (Anand ,2006) the basics of e-Recruitment are as per the following:

Tracking: It is useful in following the status of up-and-comer as for the employments applied by him/her.

Employer's Website: Provides details of openings for work and information assortment for same.

Job portals: Like CareerAge, Indeed, Monster, Naukri, timesjobs, etc these carry job advertisement's from employers and agencies

Online testing: Evaluation of candidates over internet dependent on different occupation profiles to pass judgment on them on different variables.

Social networking: Sites like google +, twitter, facebook, linkedin, and so on helps in building solid systems administration and finding career opportunities.

The organizations can't chance loosing qualified applicants because of bad organized workflows leading forexample to late reactions when interacting with candidates. But how can companies assure that they are able to attract large quantities of highly qualified candidates? (Malinowski, Keim,& Weitzel,2005) This question can be found in Tong and Sivanand'sresearch. According to it, Effective e-recruitment service providers often support jobseekers with comprehensive job information and some with career enhancement tools in the web sites, which they can conveniently assess for their career plan. (Tong &Sivanand, 2005). The accessibility of internet connection, great speed and moderate broadband connections the present age is investing an a lot of energy in internet. What's more, along these lines, the selection recruiters are concentrating on making online life a device for posting openings for work on famous sites so as to draw in an enormous pool of candidateswithout any geographical restrictions. (Rana& Singh, 2015)

TheEmployer must figure out how to arrive at job seekers by making profiles on Facebook, LinkedIn (long range interpersonal communication) alongside utilizing Job portal for making Recruitmentmore effective. Additionally they can can advertise job vacancies with the various online Recruitmentagencies – to support the ability chase process. (J & S, 2016)

Research Methodology

Sources of Data Collection: Primary and secondary sources of data were accumulated for the research. Primary source of data was collected through the use of questionnaires and survey interviews. The secondary sources of information were collected from past research work, books, journals, articles, internet search, etc.

Methods for collecting Primary Data: In gathering information for the study, poll and direct meeting strategies were utilized. The survey was utilized to ensure that only relevant questions were asked and furthermore to ensure that the questions were properly organized.

Data Collection Tool*:* The questionnaire was the only tool used to collect data. Likert type (close ended) questionnaire was employed to generate data. The importance of the use of close ended questions was to avoid delays in responding to the questionnaire, thus enabling the respondents who had busy schedules to respond quickly.

Another reason for using close ended questions was that coding of close ended questions did not take much time as compared to open ended questions/ and also for testing hypothesis.

Sampling: A sample of hundred (120) respondents were drawn from thirty (30) multinational companies located in ourNCR. Convenience sampling technique has been used to derive data from different levels of employees.

Analysis and Interpretation

Table-1; Correlation's

		Average of traditional recruitment	Average of E-recruitment
Average of traditional recruitment	Pearson Correlation	**1**	.590**
	Sig. (2-tailed)	**-**	**.000**
	N	**110**	**110**
Average of E-recruitment	Pearson Correlation	.590**	1
	Sig. (2-tailed)	**.000**	**-**
	N	**110**	**110**
**. Correlation is significant at the 0.01 level (2-tailed).			

0.000is the P-Value. This indicates a moderately positive (uphill) association (r = 0.590) and that the P 0.001 indicates that the correlation coefficient is moderately distinct from zero. This indicates that your two variables have a moderate association, and as one variable increases in value, the other decreases in value. The value of the second variable rises as well. This suggests that changes in one variable have a moderate effect on the other. Changes in the second variable are associated with changes in the first. As a result, we can conclude that there is a moderate level of risk. The traditional recruitment system and the e-recruitment system have a link. However, based on this statistic, we are unable to draw any more inferences regarding this association any other circumstance.

Table 2: Regression Coefficients

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.635[a]	.403	.362	.47788
a. Predictors: (Constant), E-recruitment system				

The Pearson correlation coefficient is.635, indicating a moderately positive association between the two variables. The connection is amazing. The e-recruitment system is reducing the usage of traditional recruitment system but still the traditional recruitment is using to some extent. Correlation can tell here just how much the e-recruitment is reducing the usage of traditional recruitment system. This correlation technique also works best with linear relationships: as one variable increases in size, the other increases in size (or decreases in size) in direct proportion. Curvilinear relationships don't work well with it (in which the relationship does not follow a straight line). An example of a linear relationship is shown above. They're linked and run in a straight line.

R-squared is a statistical measure of how close the data are to the fitted regression line. It is also known as the coefficient of determination. The proportion of variability accounted for by the independent variable is represented by R square. This model accounts for approximately 40.3 percent of the variability, indicating that it explains a significant portion of the variability in the response data around its mean. The greater the R-squared, the better the model fits the data in general.

Table 3: ANOVA

(The ANOVA Table shows the significance level at .000)

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	15.710	7	2.244	9.827	.000
Residual	23.294	102	.228		
Total	39.003	109			
a. Predictors: (Constant), E-recruitment system					
b. Dependent Variable: Average of traditional recruitment					

The study's hypothesis was to see if E-recruitment is reducing the use of traditional or traditional recruiting methods. The result of the Analysis of Variance (ANOVA), which yielded a F value of 9.827 and a P value of 0.000, significant at 0.000 percent, backed up this viewpoint. Hence, this implies that the e-recruitment system is reducing the practices of regular or traditional recruiting system.

Conclusion and Recommendations

Recruitment process is particularly urgent to each organisation, since the individuals can contribute deliberately and make distinction in the working environment. Today this procedure has become generally digitalized as a result of headway of technology. In the created nations, e-Recruitment has been utilized generally from a significant stretch of time. However, as we are a creating nation and numerous individuals don't have technology expertise that is the reason this situation is some way or another distinctive here. It could be finished up by the consequence of the study and understandings that, in spite of the fact that E-Recruitmentframework is decreasing the use of traditionalRecruitment framework yet at the same time thetraditionalRecruitment is utilizing somewhat in our specific situation. In private organisations, banks and multinationals has been utilizing E-Recruitmentyet they likewise utilize the traditionalRecruitment next to each other. It is highly suggested that, the directors of these organizations should keep on utilizing these two strategies one after another as long as the general public turns out to be completely digitalized. Besides, through the information assortment process, it was additionally recognized that, there are a few provisos present in the e-Recruitment framework, so these escape clauses could be secured by utilizing Traditionalrecruitment. As an initial step of improvement, the management likewise should prepare the recruiters adequately for building an effective system for online recruitment system in these organizations.. This study will additionally help the human resource manager to distinguish the pertinent components which might be contemplated during the time spent in general enrollment.

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USE OF JANUS GREEN-B AS PHOTOSENSITIZER IN EDTA–DSS SYSTEM FOR PHOTOGALVANIC CONVERSION AND STORAGE OF SOLAR ENERGY

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ABSTRACT

The object of the research work is to study photogalvanic effect in azo dye – anionic surfactant combination for enhancement of electrical output in photogalvanic cell. The photogalvanic effect studied in Janus green B-DSS-EDTA system. Here EDTA is used as an reductant, Janus green B an azo dye act as photo sensitizer. Dioctyl sodium sulphosuccinate (DSS) acts as a surfactant in aqueous solution. Electrical Parameter like photopotential and photocurrent is generated 930 mV and 435 µA respectively. The power generated from the system is 164.1 µW at its power point. The conversion efficiency of system is 1.58 % and fill factor is 0.33. The cell works 180 minutes in dark. A mechanism is also purposed for photo generation of electricity. i-V characteristic of the cell also studied.

Keywords: *Photopotential, Photocurrent, I-V characteristics, azo dye, Conversion efficiency.*

Introduction

The world energy demand is increasing tremendously, these results in higher consumption of fossil fuels, which severely damaged our environment. Energy and environment issues are closely linked with each other. Today we need renewable, cost effective, environment benign energy resources. Solar energy is most promising solution of all these, it is cheap, easily available and pollution free. Solar energy can be converted into electrical energy using solar cells like photo voltaic and photogalvanic cell. Photogalvanic cell has potential to replace existing solar cell due to its low cost and inbuilt storage capacity.

Photogalvanic cell are based on photo galvanic effect or Bequeral effect in which the effect of light results in photo chemical process in the solution of electrolyte. These are galvanic cell induced by light, absorption of light results in generation of higher energy products which subsequently undergoes redox reaction to produce current. The photogalvanic cell is firstly reported by Rideal and William1. It was systematically investigated by Rabinowitch2-3 using thionine iron system. Photogalvanic effect in Iron (II) poly (N-acrylaminomethyl-thionine) studied by Tamilarasan and Natrajan4. Murthy A.S.N. and Reddy K.S.5 Studies on photogalvanic effect in system containing Toluidine blue. Rohatgi-Mukherji K.K et al.6 have studied on Photovoltage Generation of the Phenosafranine Dye EDTA Sandwich Cell. Ameta S.C. et al.7-8 have also developed some interesting photogalvanic cells. Gangotri K.M. et al9-10 have increased the electrical output as well as storage capacity up to reasonable mark by using various photosensitizer with micelles in photogalvanic cell. Meena R.C. and Singh G.11 have reported the use of dyes and reductants in photogalvanic cell for solar energy conversion and storage. The effect of heterocyclic dyes and photogalvanic effect in photogalvanic cells for solar energy conversion and storage was studied by Genwa K.R. and Chouhan A.12 Genwa K.R. and Sonel A.13 studied an approach to solar energy conversion and stoage with Toluidine Blue- Arabinose-CPC system. Genwa K.R. and Kumar A.14 studied an approach to solar energy conversion and storage with Nile blue-NaLS system and Thiazine dye-anionic surfactant system. Genwa et al.15 have reported the Ascorbic acid-Crystal violet-Dioctyl sulphosuccinate (DSS) system in photogalvanic cell for study energy efficiency of the cell. Genwa K. R. and Singh K.16-18 have reported reasonable values of electrical output with different dyes i.e. Brilliant Blue-FCF (BB-FCF), Lissamine green-B (LGB) and Bromocresol green (BCG) as photosensitizers in photogalvanic cells for solar energy conversion and storage. Genwa K. R. and Sagar C. P.19 invented photogalvanic behaviour of Xylidine ponceau dye in Xylidine ponceau – Tween 60 – Ascorbic acid system.

The scientific society has used different photosensitizers, surfactants, reductants in photogalvanic cells for conversion of solar energy into electrical energy but no attention has been paid to the use of this system containing Janus green B an azo as energy material to increase the electrical output and performance of the photogalvanic cell. Therefore, the present work was undertaken to obtain better performance and commercial viability of the photogalvanic cell.

Experiment method

Janus Green B dye (loba chemie), ethylene diamine tetraacetic acid (EDTA sigma Aldrich), Dioctyl sodium sulphosuccinate (DSS, S.D.fine) and sodium hydroxide(Merck) were used in the present work. Stock solutions were prepared in double distilled water (conductivity 5.0 × 10-6 Sm-1). Stock solution of Janus green B dye (1.4 × 10-5), reductant EDTA (2.24 × 10-3 M), surfactant DSS (1.68 × 10-3M) were used and 1M NaOH was added for maintaining pH in alkaline range. During preparation of the dye solution the precaution was taken to protect the solution from light and to store it in a dark coloured container. 25 ml of a mixture having a known volume of dye, reductant, surfactant and NaOH solution of different concentrations was taken into a blackened H shaped glass tube. A platinum foil electrode (1.0 cm2) was immersed in one limb of the cell container containing a transparent window. The counter electrode SCE was placed in another limb. The pH of the solution was adjusted and measured by a pH meter. When the cell attained a stable potential in dark the Pt foil electrode was exposed to light source (tungsten lamp). A water filter was placed between the light source and the cell to cut-off thermal radiation. Electrical outputs of the cell like potential and current were measured with a digital multimeter (HAOYUE DT830D). The photogalvanic cell set-up is shown in Figure 1.

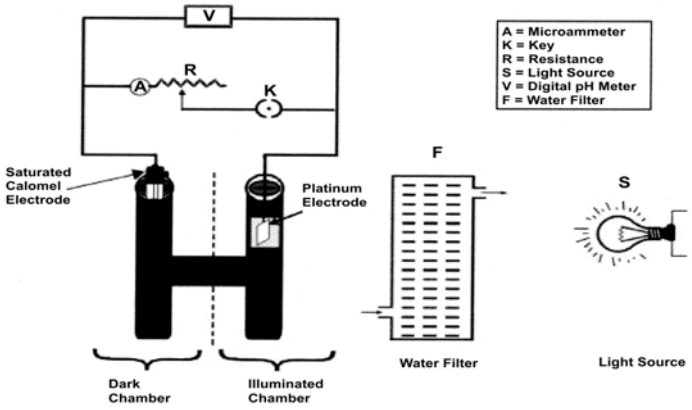


Fig-1: Experimental set up of photogalvanic cell

Mechanism of photovoltage and photocurrent generation in a cell

When dye is excited by the light in the presence of electron donating substance (reductant), the dye is rapidly changed into colourless form. The dye now acts as a powerful reducing agent and can donate electron to other substance and reconverted to its oxidized state. On the basis of earlier studies a tentative mechanism in the photogalvanic cell may be proposed as follows:

Illuminated chamber: On irradiation, dye molecules get excite.

$$\text{Dye} \xrightarrow{h\upsilon} \text{Dye}^* \quad \text{(i)}$$

The excited dye molecules accept an electron from reductant and converted into semi or leuco form of dye, and the reductant into its excited form.

$$\text{Dye}^* + \text{R} \longrightarrow \text{Dye}^- \text{(semi or leuco)} + \text{R}^+ \quad \text{(ii)}$$

At Pt-electrode:

The semi or leuco form of dye loses an electron and converted into original dye molecule.

$$\text{Dye}^- \longrightarrow \text{Dye} + e^- \quad \text{(iii)}$$

DARK CHAMBER:

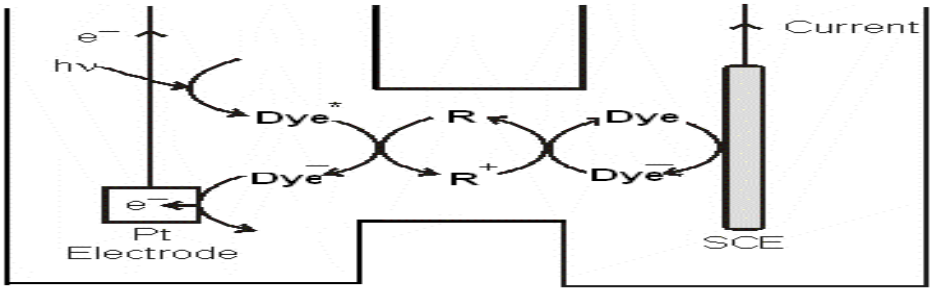
At counter electrode:

$$\text{Dye} + e^- \longrightarrow \text{Dye}^- \text{(Semi or leuco)} \quad \text{(iv)}$$

FINALLY LEUCO/SEMI FORM OF DYE AND OXIDIZED FORM OF REDUCTANT COMBINE TO GIVE ORIGINAL DYE AND REDUCTANT MOLECULE. THIS CYCLE OF MECHANISM IS REPEATED AGAIN AND AGAIN LEADING PRODUCTION OF CURRENT CONTINUOUSLY.

$$\text{Dye}^- + \text{R}^+ \longrightarrow \text{Dye} + \text{R} \quad \text{(v)}$$

Here Dye, Dye*, Dye$^-$, R and R$^+$ are the dye, its excited form, leuco form, reductant and its oxidized form, respectively. The scheme of mechanism is shown in Fig.2



SCE = Saturated calomel electrode D = Dye (Photosensitizer)
R = Reductant D$^-$ = Semi & Leuco form

Fig. 2 Scheme of mechanism

Result and Discussion

1. Variation of photovoltage and current with time

Initially the whole system was placed in the dark, potential generated in the photogalvanic cell was found to change with time, after some time it attained a stable potential and then the Pt-electrode was exposed to the tungsten lamp. It was observed that the potential increased on increasing illumination, which was due to the increase in number of excited dye molecule and their conversion into semi or leuco form after accepting the electron from reductant, and it reached a maximum constant value after a certain period of illumination. This maximum potential is termed V_{max}. When the light source was removed, the direction of potential was reversed and a stable potential was again obtained after some time. There was a rapid rise in the photocurrent of the photogalvaniccell on illumination and it reached a maximum value within few minutes. This maximum value current was

denoted by I_{max}. The current was found to decrease gradually with the period of illumination and finally reached a constant value at equilibrium. This value is represented as I_{eq} shown in Fig.3.

2. Effects of dye (Janus Green B), reductant (EDTA) and surfactant (DSS) concentration on electrical output of photogalvanic cell

The effect of variation of dye Janus Green B, reductant (EDTA) and surfactant (DSS) concentration are given in Table 1. Janus green B-EDTA-DSS system showed the best efficiency at the dye concentration of 1.4×10^{-5}M. It was observed that as the dye concentration was increased, the photopotential and photocurrent increased to a maximum value at this concentration and decreased on further increase in dye concentration. At low concentration of dye there was less number of excited dye molecule which donate electrons to the Pt-electrode, whereas at higher concentration density of dye molecules in the path of Pt-electrode was high, so light does not reach up to those dye molecules which are close to the Pt-elctrode which ,resulted in the low electrical output. With an increase in reductant (EDTA) concentration the electrical output increased and reached a maximum value at a particular concentration (2.24×10^{-3} M) of reductant. On further increase in reductant concentration the electrical output decreased. At lower concentration of reductant less number of molecules were available for electron donation to excited dye molecule so electron output is low and at higher concentration of reductant large no of reductant molecules hinders the dye molecule to reach the electrode within a required time period, as the excited species is short lived. It has been studied that pKa values of the reductant must be lower than the pH of the system. The cell output increased with an increase in surfactant concentration (DSS) but after achieving a particular value, the electrical output of the cell started decreasing. The maximum electrical parameter was obtained at a DSS concentration of 1.68×10^{-3} M. on further increasing the concentration of surfactant decrease in electrical output was also observed. Surfactants not only assist in solubilisation of dye molecule but also stabilize the system with respect to electrical output. In this system we use Janus green B dye a basic dye which remain in the solution in cationic form, DSS is an anionic surfactant so there is the possibility of forming of charge transfer complex, which increases the electrical output of the Photogalvanic cell.

Table -1. Effect of variation of Janus Green B, EDTA and DSS concentration
Light Intensity = 10.4 mW cm^{-2} , Temperature = 303 K , pH = 12.90

Concentrations [Janus Green B]$\times 10^{-5}$ M	Photopotential (mV)	Photocurrent (μA)	Power (μW)
1	832	372	309.504
1.2	878	402	352.956
1.4	930	435	404.55
1.6	883	405	357.615
1.8	828	375	310.5
[EDTA] x 10^{-3} M			
2.16	812	377	306.12
2.2	882	406	358.09
2.24	930	435	404.55
2.28	885	402	355.77
2.32	815	375	305.63
[DSS] x 10^{-3} M			
1.6	812	377	306.12
1.64	877	408	357.82
1.68	930	435	404.55
1.72	872	405	353.16
1.76	816	374	305.18

3. Effect of pH variation

It was observed that the photopotential and photocurrent of the Janus green B-EDTA-DSS system increased and reached the maximum at pH 12.90 and then decreased with an increase of pH value. It was found that the optimum electrical output obtained at a particular pH value might be caused by better availability of reductant donors formed at that pH value. It was also observed that in an acidic medium the efficiency of the cell was poor. It might be due to proton attachment to the dye and reductant molecules, which resulted in poor electron donating power of the dye and reductant molecules to the platinum electrode.

4. Effect of diffusion length

The current parameters of the cell imax, ieq and initial rate of generation of photocurrent of photogalvanic cell containing Janus Green B-EDTA-DSS system was observed with change in diffusion lengths (distance between two electrodes). It was found that, with an increase in diffusion length maximum photocurrent (imax) and rate of generation of current (□A min-1) go on increasing but the equilibrium photocurrent (ieq) shows negligible small decreasing trends. So, virtually it may considered as unaffected by the change in diffusion length.

5. Effect of electrode area

The current generation of the Janus green B-EDTA-DSS system was also studied by varying the area of platinum electrode. It was observed that with increasing the electrode area, Imax regularly increased but Ieq negligibly decreased values are shown in Koli et.al. Found that electrical output of the cell is relatively higher for small electrode, higher output at lower electrode area will reduce the cost of the cell. (Photochemical solar power and storage through photo galvanic cell: comparing performance through dye materials Energy sources part A: Recovery, utilization, and environmental effect 2017, vol. 39,555-561)

6. Effect of illumination intensity

Effects of variation of light intensity on photopotential and photocurrent were studied using a solarimeter. It was found that the photocurrent showed a linearly increasing behaviour with an increase in light intensity, whereas the photopotential increased in a logarithmic manner. The increase in the light intensity increased the number of photons per unit area (incident power) falling on the dye molecules around the platinum electrode and, therefore, an increase in the electrical output was observed.

7. Current voltage (i-V) characteristics of the cell

The Current–Voltage (i-V) characteristics of the photogalvanic cells containing Janus Green B-EDTA-DSS system is graphically represented in Figure 4. Photogalvanic cell containing (Janus Green B-EDTA-DSS) system, the short circuit current (isc) and open circuit voltage (Voc) were measured with the help of a microammeter (keeping the circuit closed) and with a digital pH meter (keeping the other circuit open), respectively. The highest value of photopotential and photocurrent were observed with the help of a carbon pot (log 470 K) connected in the circuit of microammeter, through which an external load was applied. It was observed that current voltage curve deviated from their regular rectangular shape. A point in I-V curve called power point (pp)was determined where the product of current and potential was maximum and fill factor was calculated using the formula

$$Fill\ factor\ (\eta) = \frac{V_{pp} \times i_{pp}}{V_{oc} \times i_{sc}}$$

The value the fill-factor was calculated as 0.3352 using the formula and the power point of cell(pp)=164.10μW was obtained on the system. Where V_{pp} and i_{pp} represent the value of potential and current at power point, respectively. It was noticed that i-V curve was deviated from regular rectangular shape.

8. **Cell performance and conversion efficiency**

The conversion efficiency of the cell was determined using the formula is1.5%

$$\text{Conversion efficiency} = \frac{V_{pp} \times i_{pp}}{10.4 mW cm^{-2}} \times 100\%$$

The performances of the photogalvanic cell determined in terms of $t_{1/2}$ time required to fall the power to its half at its power point in dark .cell can works 180 minutes in the dark. The result is reported in table 2 and is graphically represented in time-power curve (Figure 5

Table: 2 Performance of the cell

[Janus Green B] = 1.4×10^{-5}M Light Intensity = 10.4 mW cm^{-2}

[EDTA] = 2.24 x 10^{-3} M Temperature = 303 K

[DSS] = 1.68 x 10^{-3} M pH = 12.90

Time (Min)	**Power (μW)**
0.0	164.10
10.0	159.40
20.0	154.67
30.0	149.80
40.0	146.18
50.0	141.39
60.0	136.51
70.0	132.76
80.0	128.11
90.0	124.33
100.0	119.47
110.0	114.98
120.0	109.21
130.0	104.83
140.0	99.74
150.0	95.13

Table: 2 Performance of the cell

[Janus Green B] = 1.4×10^{-5}M Light Intensity = 10.4 mW cm^{-2}

[EDTA] = 2.24×10^{-3} M Temperature = 303 K

[DSS] = 1.68×10^{-3} M pH = 12.90

Time (Min)	**Power (µW)**
160.0	90.23
170.0	86.17
180.0	82.13
190.0	78.89
200.0	75.22

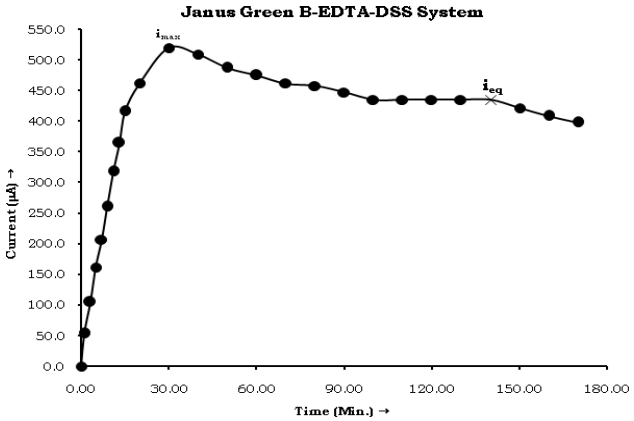


Fig. 3. Variation of photocurrent with time

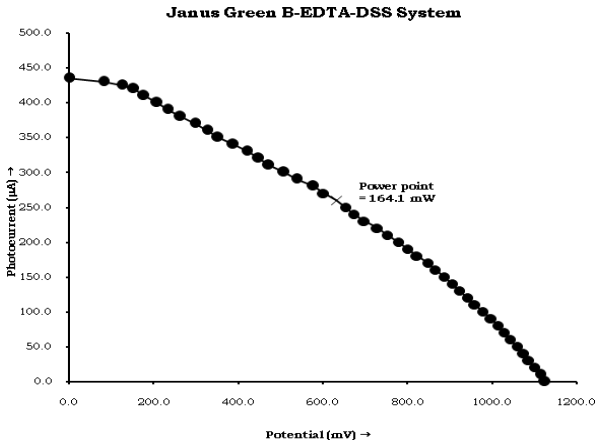


Fig. 4 Current-voltage (i-V) curve of the cell

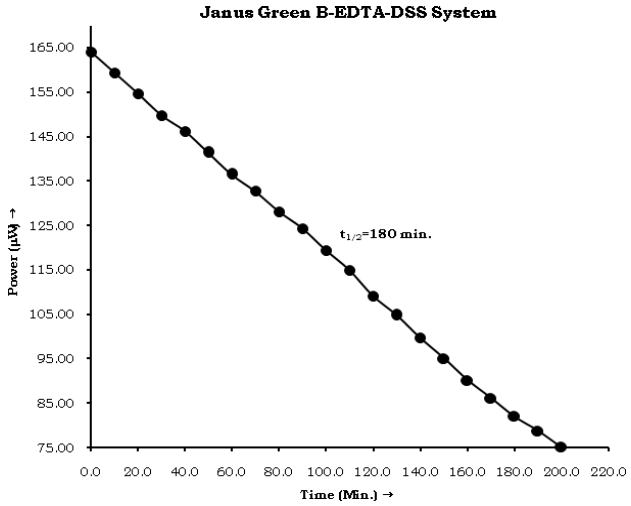


Fig. 5: Time-power curve of the cell

Conclusion

A photogalvanic cell has low conversion efficiency but has additional advantage of inbuilt storage capacity. Research should be focused on making these cell commercial viable by enhancing their conversion efficiency using appropriate combination of Dye surfactant, as these are low cost and easy to fabricate. Janus green B is azo dye cationic in nature and its combination with anionic surfactant DSS gives encouraging result. The highest value of V_{oc} (1125.0 mW), i_{sc} (435 μA), power (164.1 mW), fill factor (0.33), conversion efficiency (1.57%) and storage capacity (180.0 min.) was obtained in Janus Green B–EDTA–DSS system. Therefore, it may be concluded that efficient photogalvanic cell can be fabricated with the use of Janus Green B – EDTA – DSS system in cell for energy conversion and performance point of view.

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SCIENCE OF CARBON AND NITROGEN MINERALIZATION IN SOILS

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ABSTRACT

In this paper, we look at carbon and nitrogen mineralization in different soils, the relationship between carbon and nitrogen mineralization, and the carbon-nitrogen ratio of organic matter (C: N ratio) to see if nitrogen is mineralized or immobilized. The Carbon mineralization and crop residues Soil Nutrients Management operations concentrated on output rather than sustainability, contributing to a decrease in the agro environment and increasing CO2 emissions into the atmosphere as soil organic matter declined. Gardening techniques, including tillage, use, and organic matter management, all of which contributes to losses of organic matter, make the soil unstable, erodible, and less fertile and productive in many agricultural regions. The proposal to measure carbon and nitrogen mineralization via rewetting has been made in reference to carbon and nitrogen mineralization potential.

Keywords: *Carbon, Nitrogen, Mineralization, soils, mobilization, ratio, etc.*

Introduction

Carbon and nitrogen mineralization is a good instrument for determining the effects of various organic and inorganic additions on soil functions. Carbon mineralization is usually estimated using samples taken from the field which are wetted to 50% of their capacity and incubated in the laboratory. There is generally a period of weeks in which new product incubation occurs. Incubation time is shorter and air-drying soil facilitates routine soil testing procedures [1]. Additionally, certain tests can be done in air-drying conditions and thus avoid biochemical artifacts that may arise if soils are kept moist before analysis.

Soil is an essential component of the natural environment, and combined with plant life, it provides support for the rock upon which it sits, as well as the climate in which it exists. It is ultimately up to chance and the vagaries of nature whether or not this 'eternal storehouse of eternity' erodes or leads to the demise of the civilization it has generated. According to one estimate, the land area in the globe that faces soil deterioration is currently at the pace of 5.10 million hectares per year [2]. The primary reason for the increase in CO2 concentration is soil depletion.

Carbon is the essential building block of organic matter, and everything alive on Earth is made up of it. It is found in the atmosphere, in plants and animals, in organic stuff that does not have life, in fossil fuels, and in rocks dissolved in seas. Global Carbon Cycle: It comprises of microorganisms, plant and animal wastes, dead plant and animal matter, humus, carbonized components such as charcoal, graphite, and coal, and also fossil fuel carbon in coal, coal residue, etc.

In order for all kinds of life to exist, nitrogen (N) is a required nutrient. Reactive nitrogen includes radioactively, chemically, or biologically active nitrogen compounds that are present in the atmosphere and biosphere on Earth. Reactive N is made up of inorganic (Nl-13, NH/, NOx, HN03, N20, and N03) and organic (urea, amines, proteins, and nucleic acids) compounds that are constantly involved in different chemical processes that comprise the global N cycle [3, 4]. Perturbations to the natural N cycle, which began around half a century ago, have caused the increased buildup of inorganic reactive N in soil, water, and air, which has lead to human health problems, biodiversity loss, and environmental and climate change issues.

Carbon (C)

Organic carbon (C) content and quantity in soil have an important impact on soil nutrient supply, store water, release greenhouse gases, alter contaminant, withstand physical deterioration and grow crops in a sustainable management setting. The revision of soil

organic modifications in recent years has gained renewed interest because of the alarm about the negative impact of the inorganic fertilization of habitats and the conservation of chemicals that are characteristic of high-input agricultural development Chemical residues which spontaneously form in terrestrial environments due to the decomposition of plants and animal residues.

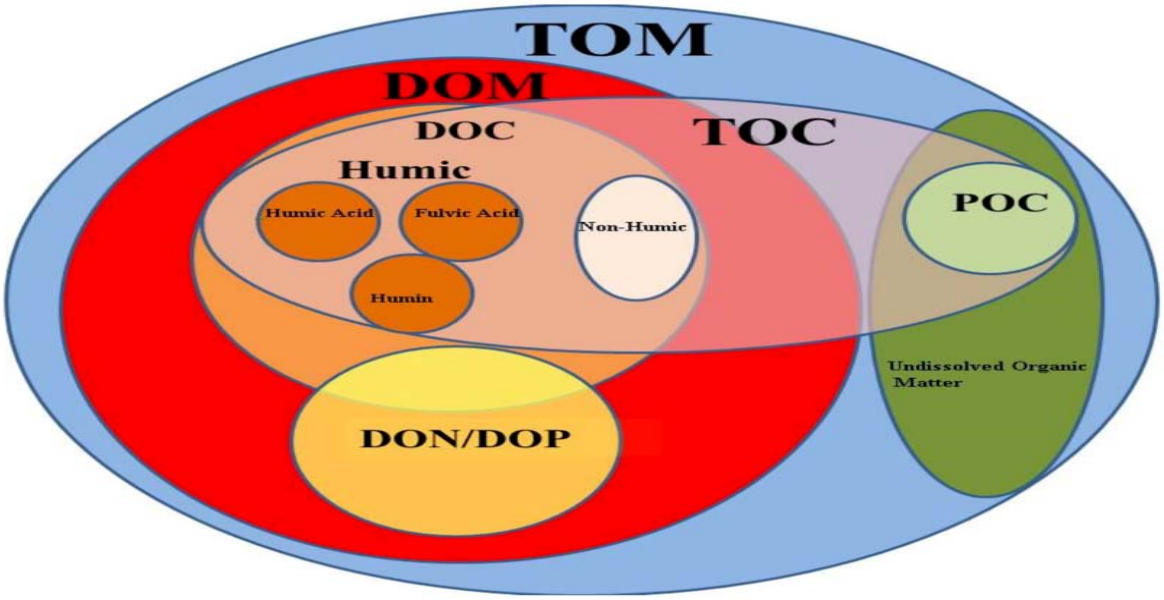

Figure 1: Carbon cycle

The oxidation rate and the nutritional content of the C compounds in the sludge are calculated by the mineralization of carbon in sewage soils. The volume of C in soil for carbon mineralization purposes may be used in the soils of a sewage or compost-enriched soil to determine the degree to which the organic substance provided by the sludge or compost is stabilized. Carbon mineralization is a flexible and thermodynamically downhill procedure that can be used to capture, store, and use CO2 to create materials with improved properties. For thousands of years, humans have changed the earth's carbon cycle through changing land use, and furthermore, the industrial-scale mining of fossil carbon from the earth's crust [5].

Nitrogen (N)

The cultivated tropical soils including laterite soil is generally insufficient and restricts crop development. Mineralization of organic soil (SOM), inorganic fertilizer, organic nutrients, and biological fixation are the primary sources of N for plant species. Approximate N injection rates and times, as well as the soil's temperature and water content, affect the nitrogen release from organic residues. Humic products are soil biodegradation tolerant but eventually degrade, leading to a persistent synthesis and disintegration of a specific soil management system. Organic soil matters are moisturized from cultivated sites instead of wild trees.

When humic acids and FA are involved, plants and toxic elements may become quite complex. Much of this is attributed to their chemical structure, in particular the absence of robust and intermittent recurring groups, for the degree of biological resistance degradation in HAs and FAs [6]. The nitrogen cycle is the biogeochemical cycle that transforms nitrogen from atmospheric, terrestrial, and marine environments. Nitrogen conversion can be accomplished by either biological or physical means. Nitrogen is the biggest source of nitrogen for Earth [7], accounting about 78% of the atmosphere. Even though atmospheric nitrogen is abundant, it is in restricted supply for use in biological processes, causing a shortage of useable nitrogen in ecosystems of various sorts.

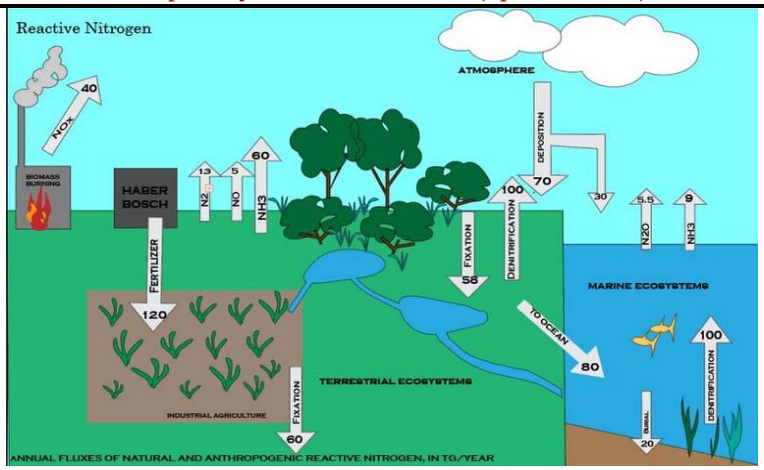

Figure 2: Nitrogen cycle

Mineralization of C and N

The degradation (oxidation) of chemical compounds into organic matter is the mineralization of soil science through which the nutrients in these compounds are released into soluble that is possible to plants. The alternative is mineralization to immobilization.

Mineralization improves the bioavailability of nutrients, particularly in their concentrations, nitrogen, phosphorus [8], and sulfur, which have been decomposing organic compounds. It depends on the abundance of organic material in the organic substance when the decomposition results in mineralization or immobilization. As a rule, if the concentration of a certain element reaches the biosynthesis or storage requirements of the decomposition, it will mineralize.

Relationship between carbon and nitrogen mineralization

Nitrogen: Are the N symbol and atomic number 7 chemical components. the Scotch surgeon, Daniel Rutherford, found and isolated it first. Nitrogen is the least often named photogenic category 15 component of the Periodic table. It is a natural factor in the universe, measured in the Milky Way and the Solar System to be around seventh in total abundance. Two atoms of the elements combine to form dinitrogen in normal temperature and strain, one colorless diatomic gas and the other odorless in the formulation N2. Dinitrogen constitutes about 78% of the Earth's atmosphere [8, 9], rendering it the uncombined ingredient of most abundance. Nitrogen exists mostly in amino acids (and therefore proteins) in all cells, nucleic acids (DNA and RNA), and in the adenosine triphosphate energy-transfer molecule.

Carbon dioxide (co_2): A colorless acid gas at around 53% greater density than dry air. Covalently double bonded with two oxygen atoms are the carbon dioxide molecules. It takes place as a trace gas in Earth's atmosphere. The existing volume concentration is approximately 0.04%, with pre-industrial amounts of 280 ppm increasing. Natural causes are volcanoes, hot springs which geyser, and dissolved into water and acids releases carbonate rocks. Because of its solubility in water carbon dioxide exists in natural waters, rivers and streams, ice-caps, glaciers, and seabeds.

More than 90% of the nitrogen in most soils is organically bound to carbon. This indicated that mineralized carbon must be strongly combined with mineralized nitrogen, this demonstrates a strong relationship between carbon and nitrogen mineralization. We did incubation on subtropical soil for ten days at 15 °C and 25 °C, to confirm this theory. To distinguish CO2 and mineral N from soil-based, organic mineralizing and absorption of glucose or inorganic nitrogen, 13C-labelled Glasco and ammonium or nitrate are applied. The findings were also examined

for improvements in microbial activities during incubation with phospholipids fatty acid (PLFA) and four exo-enzymes. The CO2 levels drop as nitrogen mineralization concentrations rise. The temperature did not affect the interaction between the mineralization of carbon and nitrogen [10]. While PLFA and the four exoenzymes have changed, carbon and nitrogen mineralization due to these modifications have not increased. These results indicate that soil mineralization of carbon and nitrogen is complicated. Future experiments should examine whether the mineralization of the same soils by carbon and nitrogen is combined with the mineralization in negative combinations instead of optimistic similarities to better evaluate the transition of carbon and nitrogen.

Ratio of carbon to nitrogen

It depends on the Carbon-Nitrogen ratio of organic matter (C: N ratio) to degrade if the nitrogen is mineralized or immobilize. Overall, organic matter contacting soil has very little nitrogen to meet the decomposed soil microbial population's biosynthesis requirements. The decomposing microbes will then consume nitrogen in mineral forms, such as ammonium or nitrates if the C: N ratio of decomposing organic matter is greater than around 30:1. It is said that this mineral nitrogen is immobilized [11]. This will decrease inorganic nitrogen concentrations in the soil and therefore plants are unable to get nitrogen.

During decomposition energy production, a phenomenon called "catabolism" disappears when carbon dioxide reduces the C: N ratio of organic matter. The further breakdown triggers mineralization through the simultaneous release of inorganic nitrogen as ammonium when the C: N ratio is lower than about 25.1. If the decomposition of organic matter is complete, the mineralized nitrogen in the soil raises the overall mineral nitrogen in the soil.

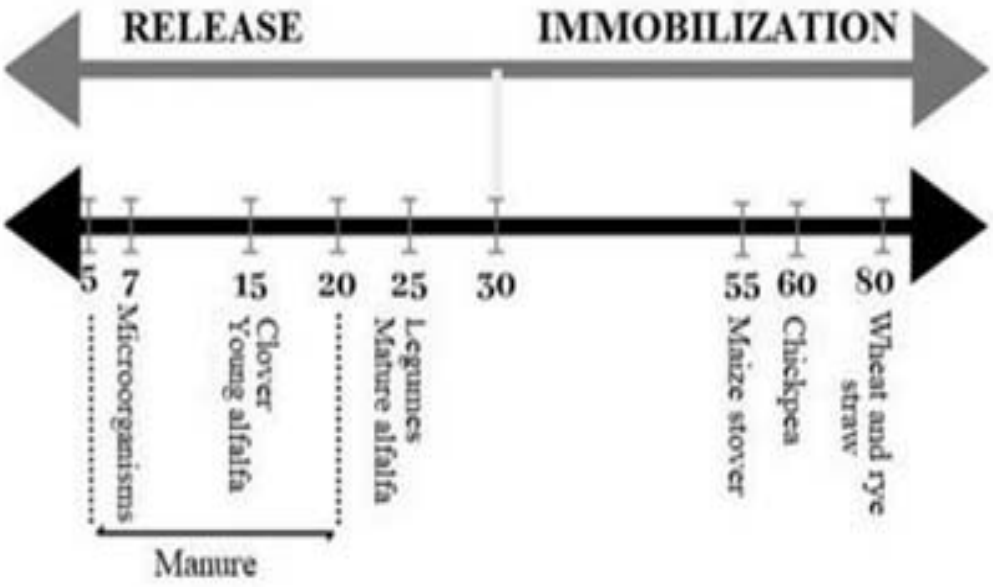

Figure 3: The carbon to nitrogen ratio (C: N)

Crop residues and carbon mineralization

Carbon mineralization and nutrient availability in wetland habitats are both affected by soil tillage and crop waste. Especially France, in arable farming, the return of crop wastes and notably cereal straw is attracting increasing study as a possible source of bio-energy. Crop residue has a direct influence on the cycling of carbon and nitrogen. Removing the crop residue

causes soils to mineralize 27% more carbon than if the crop residue remains intact. the SOC and nitrogen contents of black soils that have been continuously cropped and tilled for lengthy periods of time.

Extended cropping or growth of forage crops combined with decreased f frequency of summer fallow and more fertilizer application resulted to better soil quality. Postulated as the main cause for soil quality improvements, was that a large amount of organic carbon was applied to the continuous-crop and permanent cover soils by application of crop residues. An abundance of agricultural residue added with input of nutrients (e.g., nitrogen and phosphorus) created a relatively labile soil organic matter that [12], according to the researchers, supports increases in microbial carbon generation and soil nitrogen and phosphorus availability.

Soil biochemical indices to study carbon and nitrogen mineralization

It is made up of biochemical, chemical, and physical processes. Microorganisms, roots, and soil animals are all involved in the biochemical process. The fact that all biological processes are catalyzed by enzymes is well recognized. Long-term exposure to acid metal stress caused a variety of negative alterations to soil quality and organic nutrient cycling. Urease, dehydrogenase, and p-glucosidase are all associated with carbon mineralization, while p-glucosaminidase and arylamidase are involved in nitrogen mineralization.

Soil Nutrients

Management activities focused not on sustainable agriculture but on the output which contributed to a decline in the agro environment and increased CO_2 emissions into the atmosphere as the soil organic matter declines. One approach to raise the mass of soil that plant roots explore is clearly to maximize plowing depth. Deep plugging in times and the absence of conventional crop rotation contributed to laxation and a decline in the nutritional availability of plants. Furthermore, the organic matter content was significantly reduced. The amount of humic and fulvic acids [13], the most active component of the biological matter, was more obvious.

The benefits of soil organisms, which increase soil productivity, conservation of water, and crop output, have long been recognized by farmers. For soil stabilization, nutrient cycling, and C storage, soil organic matter is essential. Soil C and N pools can help to establish agrarian practices that improve soil quality in various tilled systems to maximize terrestrial C storage [14]. Management of no-till with intense cultivation is synergistic since soil disruption optimizes water efficiencies.

Conclusion

Managing soil carbon and nitrogen seems to be one of the major challenges faced by tropical agriculture. In tropical soils like laterite soils that prevail in areas with high temperature and rainfall, the rate of carbon and nitrogen mineralization is observed to be at a faster rate and the present study clearly indicated that there are significant differences in carbon and nitrogen mineralization among plant and organic residues of different origin. They also differ considerably in cation mobilization. More detailed field level studies need to be conducted to develop appropriate technologies to sequester more carbon in tropical soils to sustain and improve the productivity of these soils as well as to cattail the increase in atmospheric CO_2 concentration.

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THE CAPABILITY OF RAINWATER HARVESTING AND GROUNDWATER SYSTEMS AS AN ALTERNATIVE WATER SUPPLY

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ABSTRACT

Rainwater Harvesting System (RWH) is considered the Best Management Practice (BMP) which is being implemented in Malaysia. This system is not only intended to slow down the flow of runoff the surface is even used as a free andsafe alternative source of water supply used. Although, it is mentioned that the system is not viable and impractical considering the construction and maintenance costs that had to be borne by the users of the system. However, several studies inside and outside the country show the Return on Capital (ROC) factor for this system only in a short period, i.e., between two and three years. This article aims to identify the capability of the experimental study site of RabbitlandJengkaPahang, Malaysia in providing the most suitable or potential location to apply the RWH system. Moreover, to predict the capability of the RWS system as well as the ROC ability of the system. Results indicate that the level of the system's reliability is high and the ROC for the investment of the system takes only 36 months to recover the cost of the investment. The National Water Quality Standards (NWQS) for Malaysia proved that RWH and groundwater used is in class 3 that is suitable for livestock drinking, external domestic uses, and need extensive treatment for drinking purposes.

Keywords: *Groundwater system, Rainwater harvesting, Return on Capital.*

Introduction

Malaysia can be considered a country that has received high annual precipitation and high domestic water demand. As a result, Malaysia is in a good position to collect rainwater. Although the rainwater harvesting system guidelines were issued in Malaysia in 1999, the use of rainwater harvesting as an alternative water resource is still quite limited due to its slow return on investment and low public acceptance [1]. Rainwater harvesting systems can serve as an alternative water technology that is applicable to university buildings, is commercially available, and may provide a chance to reduce freshwater use. Alternative waters are long-term water sources since they are not derived from fresh surface or groundwater, and they can help to meet the need for freshwater. Rainfall harvesting is the collection, diversion and storage of rainwater from roofs for future use. According to Ayalew et al. [2], rainwater harvesting systems can be described as systems that gather rainwater and store it for later use instead of letting it waste as a runoff. Rainwater harvesting systems provide benefits such as conserving potable water, reducing flooding in urban catchments, and reducing nutrient loads to rivers. In addition, rainwater harvesting systems can offer additional benefits such as smaller carbon footprint compared to conventional water delivery systems and more efficient energy usage due to less pumping needed from source to consumer [3].

Literature Review

Rainwater was generally utilised for a variety of purposes, including landscaping, irrigation, general cleaning, decorative filling of pond and fountain, cooling tower make-up water, and toilet and urinal flushing [2, 4]. The monsoon season, which occurs from March to May and June to September, is crucial for rainwater harvesting systems. Unfortunately, most of this valuable water wasted as runoff. The development of landscape irrigation projects is built on the foundation of water harvesting technology. In solving the issues of future water scarcity and food security problems, an assessment of RWH must be done to help identify the constraints. Insitu rainwater harvesting is the most efficient and cost-

effective technique of preserving water, and the system is quite effective at retaining rainwater, especially during drought.

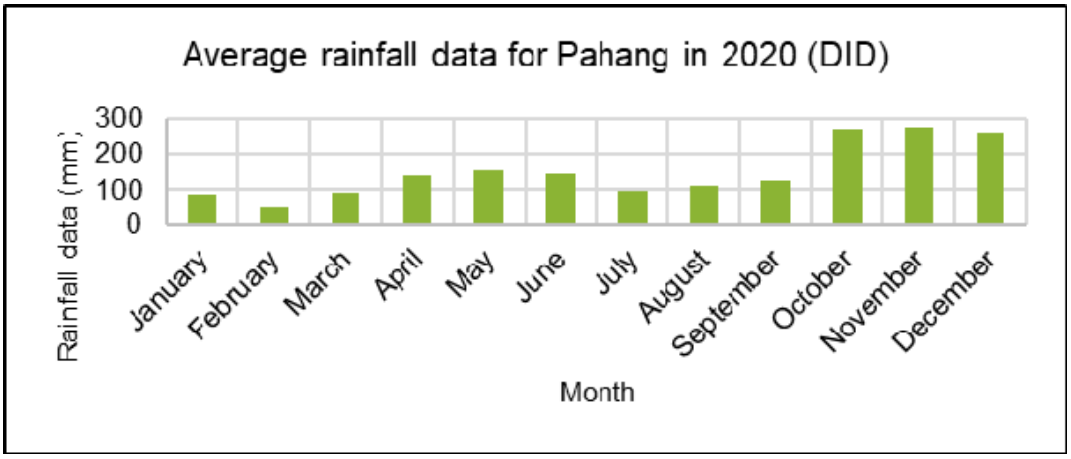

Fig. 1. Average rainfall data per month for Pahang in the year 2020.

A rainwater harvesting system is one method for making better use of runoff by gathering and storing it during periods of heavy rainfall for use when water is scarce. This system is typically constructed using either a basic technology, such as pots, tanks, and cisterns, or a complex technique, such as subsurface check dams [4].

Rainwater harvesting systems are classified into two types: roof harvesting systems (RHS) and pond harvesting systems (PHS). The RHS is more well-known and has been used in Jordan, Spain, Italy, Korea, and Malaysia [5, 6, 7, 1]. Rainwater collected from the RHS is typically used to meet both non-potable and potable water demands. RHS has two different installation storage system, which are placed on the ground and underground. The storage tank is a reservoir that is normally placed near to the agriculture field as an irrigation. The runoff that is redirected into storage for the use of Rainwater Harvesting Systems is not lost because it is utilised for water supply. This demonstrates that rainwater collecting systems can provide most of the residential water demand, reducing reliance on conventional water supplies [6].

According to Chan [1], developed countries such as Australia, Greece, Poland, and Taiwan have rainwater collecting systems that can meet 50 to 90 percent of residential water demand, with storage tanks ranging in size from 5 to 76m3. Meanwhile, the data for developing countries such as Bangladesh, Malaysia, and Southwestern Nigeria demonstrate that the domestic water demand that can be met is slightly lower (30% to 80%) than in developed countries, despite the reported size of the storage tank being generally larger. Malaysia is a tropical climate country with comparatively abundant water resources (annual rainfall is estimated to be 2400 mm in the peninsular area), has never experienced a water shortage in recent decades. However, global warming is projected to reduce future rainfall in various Malaysian states to as little as 32 to 61 percent of average monthly rainfall, particularly during the drought season from May to August. Figure 1 depicts the average monthly rainfall data for Negeri Pahang in 2020. This implies that Negeri Pahang saw extremely significant rainfall throughout the year.

Many studies and research have been undertaken on Rainwater harvesting systems to minimise reliance on water resources and prevent water shortages, particularly during drought seasons, but the potential of Rainwater harvesting system application in Malaysia has not been fully implemented. More studies are required to confirm that the gathered rainwater is fit for its purpose. This research is based on the usage of RWH systems for landscaping and irrigation in developing country with tropical climates, as these countries have a humid climate and a lot of undeveloped land. Its large storage tank capacity provides a great benefit for water supply, since it reduces reliance on ordinary tap water.

In general, the objectives of this study were to identify the capability of the experimental

study area that is the Rabbitland Area, located in Pahang, Malaysia in providing the most suitable or potential location to apply a rainwater harvesting system. Moreover, to predict the capability of the rainwater harvesting system as well as the ability to return the cost of return on investment (return on capital) of the system. Besides, it is also to classify the water quality index for the collected rainwater and groundwater tube well of the study area.

The selection of this area was due to the excessive untreated water consumption for general cleaning, livestock drinking, watering the plants, bathing the pets, fishponds, landscaping, and other external purposes. The mean daily temperature for this area is about 27 °C and the average monthly rainfall precipitation data ranged from 49 to 273 mm. The lowest rainfall precipitation data were recorded in February, with an average of 49 mm, while the highest amount is 273 mm occurs in November.

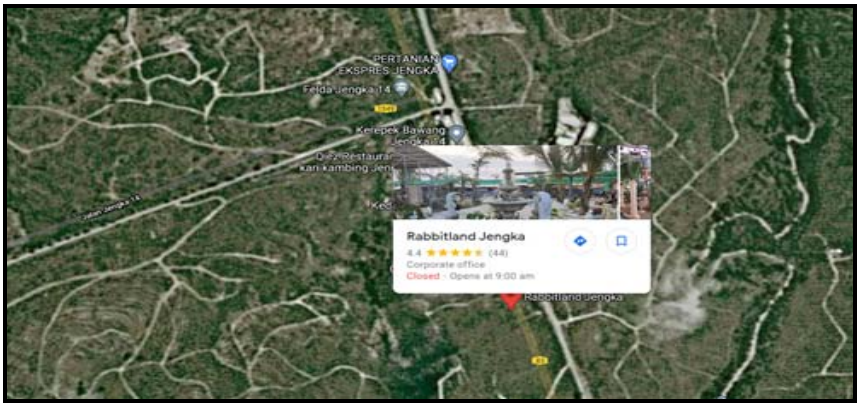

Fig. 2. Rabbitland Area, Pahang.

Fig. 3. Surrounding area of Rabbitland Jengka.

Methodology

This study was carried out in the Rabbitland located in Bandar Pusat Jengka, Pahang, Malaysia (Figure 2 and Figure 3) (3.76896,102.54904) that is about 1.5 km from Universiti Teknologi MARA Cawangan Pahang, Kampus Jengka. Rabbitland which covers an area of almost 4.5 acres is a mini zoo for about 17 species of animals and covers a 1-acre area of plants and herbaceous trees.

This project acts as a sustainable model of alternative water resource which is in-line with the Sustainable Development Goals (SDGs) No 6. that ensures water availability and sustainable water and sanitation management [8].

For general cleaning, drinking water, animal baths, watering the plants, and other purposes, the management of Rabbitland uses alternative water resources that were from RWH and groundwater from the adjacent tube well.

Rainwater is collected using a gutter and was supplied into 400-gallon tanks and each of these tanks is connected to a piping system to be used from one area to another. If the collected water within the tank had dried up, the groundwater will be pumped into the tanks to be utilized as a substitute for the water. There were two parts of the methodology being carried out in this study. The first part is to measure the rainwater harvesting to determine the daily water consumption rate of the Rabbitland area. This is important to calculate the return on capital (ROC) period for the investment of the system. While the second part was carrying out in-situ fieldwork and laboratory testing to determine and classification the water quality index for the collected rainwater and groundwater of this study area.

Measurement of Rainwater Hervesting

The measurements were conducted within 3 months, first was in February 2020 which the rainfall data is the lowest, June 2020 which rainfall data was moderate and last in November 2020 which rainfall data was the highest. This is important to ensure rainfall availability throughout the year. Three RWH tanks with different locations were measured in height purposely to record the initial water level. The water level was measured at the end of each operating day to record the daily water consumption where the difference between the initial and final measurement readings represents the amount of water used within the duration of the experiment period. For daily drinking water consumption, a total of 5 drinking bottles with a capacity of 4L was placed in the rabbit cage. The initial and final reading of the water level was recorded at the end of the operating day. The total difference in water volume per day represents the water consumption of rabbit drinking water. Figure 4 shows the water level sampling for the three RWH tanks, drinking bottle location in the rabbit cage and in-situ water quality sampling test.

Water Quality Monitoring and Assessment

The chemical and physical variables of the collected RWH and groundwater were measured directly using YSL Proplus Probe. Tests were conducted according to the Standard Methods for the Examination of Water and Wastewater [9]. Five (5) parameters were selected to record during the in-situ study which are Dissolve Oxygen (DO), turbidity, temperature, Electric Conductivity (EC), and pH. To ensure the readings taken are accurate and correct, the equipment was calibrated prior to use based on the manufacturer's directions. For the laboratory testing, to reduce all the activities and metabolism of the organisms in the water body, the samples collected from the field will then be stored in a cool room with a temperature below 4°C. For the laboratory testing, five (5) parameters were being tested for determining the water quality index according to the National Water Quality Standard (NWQS), Malaysia methods which are Biological Oxygen Demand (BOD5), Chemical Oxygen Demand (COD), Suspended Solid (SS), and Ammonia-Nitrogen (NH3 -N). The water quality index will be obtained by using equation stated below:

$$WQI = 0.22SIDO + 0.19SIBOD + 0.16SICOD + 0.16SISS + 0.15SINH3\ -N + 0.12SIpH \quad (1)$$

Where WQI is the water quality index; SIDO is the sub-index of DO; SIBOD is the sub-index of the BOD; SICOD is the subindex of COD; SINH3 -N is the sub-index of NH3 -N; SISS is the sub-index of TSS; SIpH is the sub-index of pH. Sub-indexes for all parameters will be calculated from the sub-index calculation table provided by the Department of Environment (DoE) Malaysia.

Results and Discussion

This section is divided into two parts, namely the analysis of the Return on capital of the system and the second analysis of the water quality classification.

Return on Capital Analysis

To analyse the importance of investing in the proposed project, a cost-benefit analysis was done to compare the expected costs against its expected revenue. The sampling of water demand and consumption was conducted to measure the water used for drinking and

cleaning purposes. The data were tabulated in Table 1 below.

Table 1. Water demand and consumption

Item	L/ day
Livestock drinking	80
Cleaning and others	2788
Total estimated water demand	2868

According to Perbadanan Air Pahang (PAIP), the rate of bill water tariff for commercial uses is RM 1.45 per m3. Therefore, 2.868m3/d x RM1.45/m3 x 30 d = RM 125 / month and as much as RM1500 per annum can be saved from water charge bill payment expenses.

The construction cost of the whole system, including the tanks installation, piping system, fitting systems, gutter installation was around RM5000, so it only requires a total of 3 years for the return on capital (ROC) period for the investment of the system.

Water Quality Analysis

In order to determine the classification of the water quality index for the collected rainwater and groundwater tube well in Rabbitland, a laboratory test analysis has been conducted and the result is shown in Table 2.

From the data obtained, according to National Water Quality Standards in Malaysia it is proven that RWH and GW used is in class 3 that is suitable for livestock drinking, external domestic uses, and need for extensive treatment for drinking purposes. The analysis was also conducted to other parameters as shown in Table 3.

The results indicate that all parameters of GW gave higher concentration as compared to RWH. The higher groundwater concentration was also the result of high concentrations of certain elements such as sodium, sulphate, boron, fluoride, etc. [10]. Salinity refers to the amount of salt in the water.

Since dissolved ions increase salinity and conductivity, the two measures are interconnected. The high value of turbidity in GW is due to high amount of organic and non-organic substances that are suspended and dissolved, such as mud and fine sand.

The higher value of the suspended density contributes to a higher degree of turbidity.

Table 2. WQI of Laboratory Test Analysis

	SIDO	SIBOD	SICOD	SIAN	SISS	SIPH	WQI
RWH	97.09	96.3533	33.90444	42.57582	0	92.77708	62.61229
GW	92.74	101.1896	34.52271	94.2	0	96.9425	70.91648

The high value of chlorine may be associated with the presence of saltwater intrusion, mineral dissolution, industrial and domestic waste.

TABLE 3. Data of other parameters

OTHER PARAMETER	RWH	GW
SALINITY (%)	0.01	0.11
CONDUCTIVITY (mS/cm)	0.03	0.237
TDS (mg/L)	0.02	0.1535
TURBIDITY (NTU)	1.33	18.325
CHLORINE (mg/L)	0.13	0.6
IRON (mg/L)	0.01	0.015

Concusion

A rainwater harvesting system is an example of an optional water supply system that can be used in industry as well as services. This study has shown, local meteorological conditions in Bandar Pusat Jengka, Pahang, Malaysia is suitable for the development of the system. Level the reliability of the system is high and the ROC for the investment of the system takes time only 36 months to recover the cost of the investment. The National Water Quality Standards for Malaysia it is proven that RWH and GW used is in class 3 that is suitable for livestock drinking, external domestic uses, and

need for extensive treatment for drinking purposes.

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VEHICLE COUNTING SYSTEM ALONG SPECIFIC DIRECTIONS USING DEEP LEARNING

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ABSTRACT

In this paper, we introduce a vehicle counting framework that can detect, track and count vehicles moving along the desired direction in corresponding motion-of-interests (MOIs). The suggested framework includes three main modules: vehicle detection using EfficientDet, vehicle tracking using DeepSORT and vehicle counting along MOI using trajectory matching. Experiments on our own datasets built from the videos of CCTV cameras show the robustness of the method at different light conditions with high accuracy. The proposed method achieves AP50 of 92.5% for vehicle detection and the whole video process including detection, tracking and counting can achieve up to 12fps.

Keywords: *Vehicle Counting, Object Detection, Object Tracking, EfficientDET, DeepSORT.*

Introduction

Many crowded cities are suffering from severe traffic problems as their vehicle populations have become unprecedentedly large. In addition to updating road networks, local governments are developing their own intelligent transportation systems (ITS) to address the new challenges of traffic crowding. One of the basic components of an ITS is the vehicle counting system, which is designed to collect traffic flow information. In this paper, we focus on developing a vehicle counting system using deep learning that can give an accurate information of traffic moving from specific directions so that the government can use this information to control the traffic adaptively.

The rest of this paper is organized as follows. In the next section, we briefly review related works in the fields of object detection, tracking and counting. We then present our own methodology for vehicle flow detection, tracking and counting. Experimental resutls will be conducted on our collected data from CCTV videos and give the discussion. Finally, the last section draws the conclusion.

Related Works

Typically, a normal vehicle counting system will include three main stages: detection, tracking and counting. In this section, we will give a review of these stages as follows.

Object Detection is an important area in both image processing and computer vision. Thereby with the rapid development of deep learning in this field, performance of recognizing and classifying objects is significantly improved. Object detections are mostly categorized into two main algorithms as can be seen in FIGURE 1: if the algorithm uses a region-of-interest proposal, it is two- stage [1-3]; otherwise, it is one-stage [4-7]. While two- stage algorithm tends to give more accuracy, one-stage is often considered simpler and more efficient by taking advantage of predefined anchors [8,10]. In this paper, we mainly focus on one-stage detector using EfficientDet [7] because this algorithm proves its SOTA performance over other algoritms in the literature.

Object Tracking is another important area in computer vision. Object tracking is the process of tracking the path and moving trajectory to determine the position of one or more objects in each frame of the video. Object tracking can be categorized into two main problems: Single Object Tracking (SOT) [11] and Multiple Object Tracking (MOT) [12-14]. In this paper, we concentrate on MOT with DeepSORT because among the algorithms for MOT, DeepSORT has proven to be one of the fastest and most robust approaches [14].

Vehicle Counting is the most challenging problem for any intelligent transportation system [16]. Most of the methods in the

literature are based on detection- aware approach, where the object can be firstly detected by background subtraction models and then combine with the simple feature-based tracking to generate object position during video [17]. In this approach, entrance and exit region-of-interest (ROI) zones methods are used for vehicle counting.

Methodology

To achieve robust and fast vehicle counting with our own dataset, an integrated architecture that contains main modules is suggested in a sequential framework. An overview of our proposed framework is illustrated in FIGURE 2. In the vehicle detection module, object detection is used to detect and classify vehicles into 04 categories: motorcycle, car, bus and truck.

In Figure 2 each video input defines a region-of- interest (ROI) and motion-of-interest (MOI). The ROIs and MOIs will be predefined and stored in the json file as followed:

- A region-of-interest (ROI) is represented in the form of a polygon (polygon) as Figure 3, limiting the spatial area to be observed and processed for the purpose of detecting and classifying vehicles (detection), tracking multiple vehicles. By tracking, we get all the trajectories and then we count the trajectories in different motion-of-interest (MOI).
- Motion-of-interest (MOI) are numbered arrows in Figure 3, which help us identify vehicles moving in different specific directions in the video.

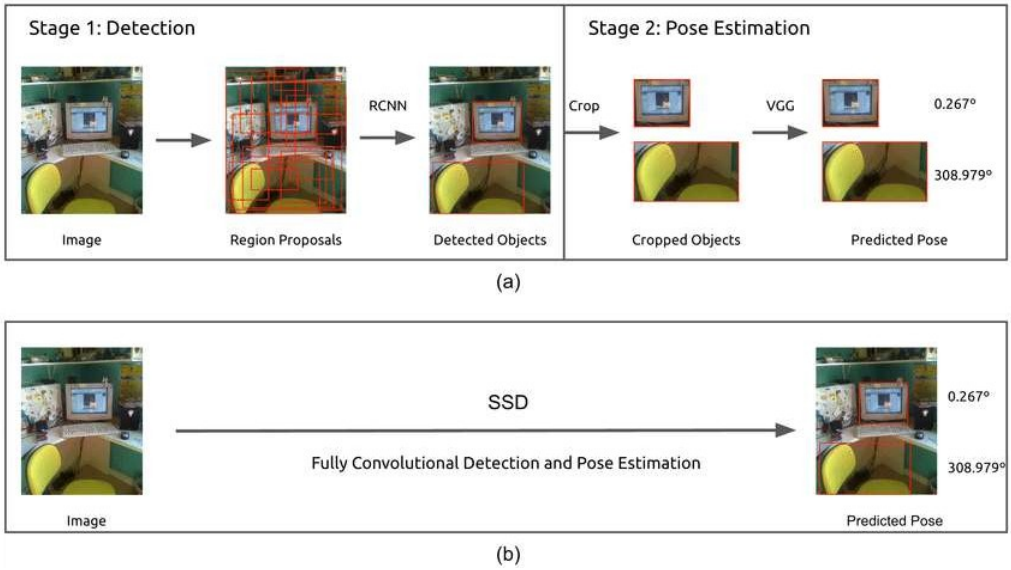

Fig. 1. Two-stage (a) vs. One-stage (b) Object Detection [9].

Then object tracking model generates trajectories of different detected objects through the whole video. After matching these trajectories with predefined directions of lanes, all eligible trajectories are counted into corresponding movements. In this section, we will introduce every module in detail.

Vehicle Detection using EfficientDet

EfficientDet is currently a State-of-the-art method in object detectors. In pratice, there is a trade-off between accuracy and detection speed.

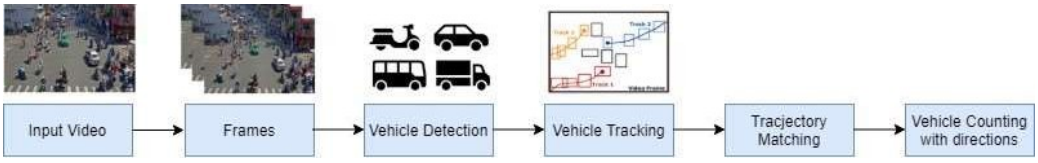

Fig 2. Vehicle Counting with directions.

To balance these two conditions, EfficientDet was born, formed from the combination of EfficientNet, BiFPN and Compound Scaling [7] as can be seen in FIGURE 4. In this paper, we will investigate different EfficientDet models from D0 to D4.

Description – a 128x1 vector in the current frame. Therefore, DeepSORT will be more improved and reduce the number of ID switches by 45% compared to SORT and achieve good performance when performing in high frame videos.

Fig. 3. ROIs AND MOIs in our problem.

Vehicle Tracking using DeepSORT

DeepSORT is used to track multiple objects at once (MOT), which is a modern method often based on the tracking-by-detection model [14,15]. That is also the algorithm that we are aiming for in this problem to implement the vehicle tracking problem. DeepSORT is an extended algorithm based on Simple Online and Real-time Tracking (SORT) [13] and has given better results for MOT problem.

Deep SORT still uses the core SORT algorithms, Kalman filtering and Hungarian. In addition, the algorithm also adds the Matching Cascade and the process of confirming new tracjetories as in FIGURE 5.

Step 2. DeepSORT uses Kalman Filter to predict new track states based on past tracks. These states are initially assigned a tentative value. If this value is still guaranteed to be maintained for the next 3 frames, the state will change from unconfirmed to confirmed, and will try to stay tracked for the next 30 frames. Conversely, if the track is lost in less than 3 frames, the status will be removed from the tracker.

Step 3. Using confirmed tracks, introduce a matching cascade to associate detections based on distance and feature metrics.

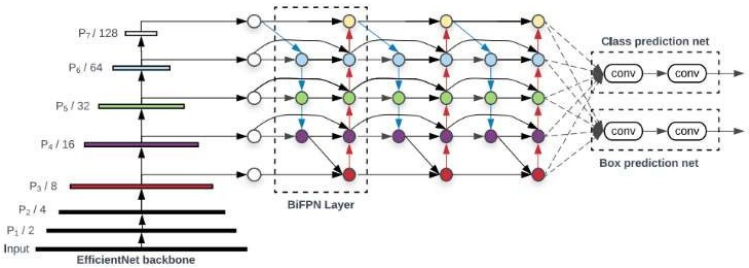

Fig. 4. EfficientDet with EfficientNet as backbone and BiFPN.

Specifically, DeepSORT's workflow is the same as SORT as followed:

Step 1. Use Faster Region CNN (with backbone VGG16) to extract Deep Appearance

Step 4. Unlinked tracks and detections will be passed to the next filter layer. Using the Hungarian algorithm to solve the assignment

problem with the IOU cost matrix for the 2nd link

Step 5. Processing and classifying detections and tracks.

Step 6. Use Kalman filter to recalibrate the track value from the detections linked with the track and initialize new tracks.

Trajectory Matching and Vehicle Counting

Vehicle Counting is counting the number of vehicles in different motion-of-interest (MOI) in the ROI region. After tracking we get a set of trajectories in vector form. In this paper, we simply use Cosine Similarity equation to compare the similarity between the synthesized tranjectory vectors with the predefined MOI in the json file. We then perform a vehicle count when the vehicle leaves the ROI.

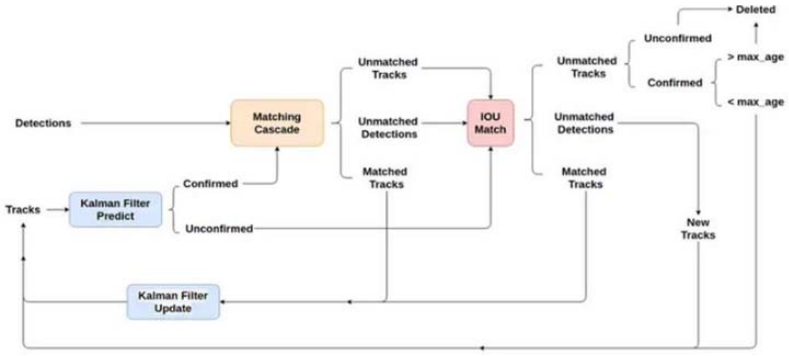

Fig. 5. DeepSORT workflow.

In the next section, we will describe our dataset and experiment results.

Experiment Results and Discussion

Data Collection and Manual Annotation for Object Detection

Our experiments are based on the video dataset from the CCTV cameras. Then these videos will be extracted into frames. Finally manual annotations with different scenarios of weather conditions can be done with the frames for 04 categories: motorcycle, car, bus and truck using CVAT [18] as in Figure 6.

Data Preprocessing and Augmentation

In the preprocessing step, we split the video into frames and resize the image to the appropriate size for each model version of EfficientDet. For example, if we want to detect and classify vehicles with EfficientDet-D2, we will resize the image to 768x768, or with EfficientDet-D4, the image will be resized to 1024x1024. Moreover, to make data more balanced for some minor categories like bus and truck, we can use data augmentation to enrich the data in the training process. Specifically in this problem we enrich the data by horizontal flipping the images contained in the datasets.

Vehicle Detection Experiment Results

All the experiments are tested on Intel i9-9900K, 64GB of RAM with GPU Nvidia RTX2080Ti with 11GB. In our framwork at Figure 2, only vehicle detection stage will rely on GPU for training and testing models. The results of vehicle detection are on Table 1. As can be seen on Table 1, the performance of EfficientDet-D4 is the best one with AP50 of 92.5% and the processing speed of 15fps.

With the usage of EfficientDet-D4, the visualization results on the images with different conditions of daytime and nighttime are shown in Figures 7 - 8, respectively, in that the model works well with daytime and nighttime (low-light condition).

Vehicle Tracking and Counting Experiment Results

Based on the output in the vehicle detection section with EfficientDet-D4, we do the tracking with DeepSORT and counting vehicles with trajectory matching in each different direction of movement. The final visualization results are in Figures 9 - 10. As you can see, the results will give the IDs corresponding to each vehicle type, the direction of travel and frame number when the vehicle has just moved out of the ROI area. From the consine similarity function we can

know in which direction the car has moved by calculating the angle between the vector of an object (start point, end point) with the MOI vector. The ability to maintain the model's IDs is quite good, the ID of the cars is mostly unchanged or switched and not lost throughout the ROI of the frames of both daytime and nighttime. The processing speed is up to 12fps.

In this paper, a detection-tracking-counting framework is applied to automatically count the number of vehicles with directions of movements (MOI).

Vehicle detection using EfficientDet-D4 with support of data augementation for minor categories such as bus and truck gives an excellent performance with AP50 of 92.5%.

Fig. 6. Manual Annotation Using CVAT.

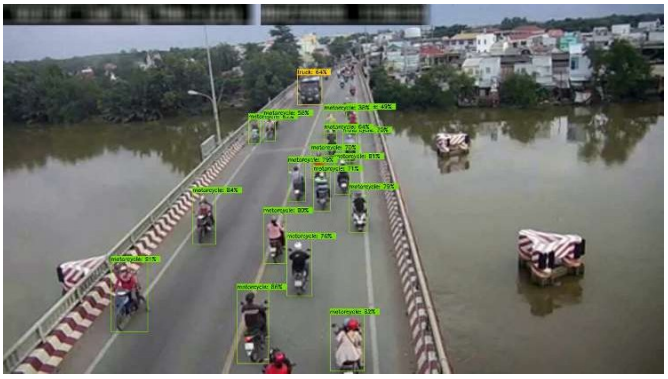

Fig. 7. Vehicle detection at daytime.

Fig. 8. Vehicle Detection at nighttime (very low light condition)

Conclusion

Moreover, the usage of DeepSORT for the vehicle tracking and counting also help improve the issues by SORT such as ID switches. Our suggested framework has realized robust and fast vehicle counting by categories and directions of movement at different light condition – daytime and nighttime. In future work, we will try to optimize each module further, with respect to speed, robustness and accuracy so that the system can achieve real-time performance with highest accuracy.

Acknowledgement

This research is funded by Ho Chi Minh City University of Technology (HCMUT) - Vietnam National University Ho Chi Minh City (VNU-HCM) under grant number T-ĐĐT- 2020-17.

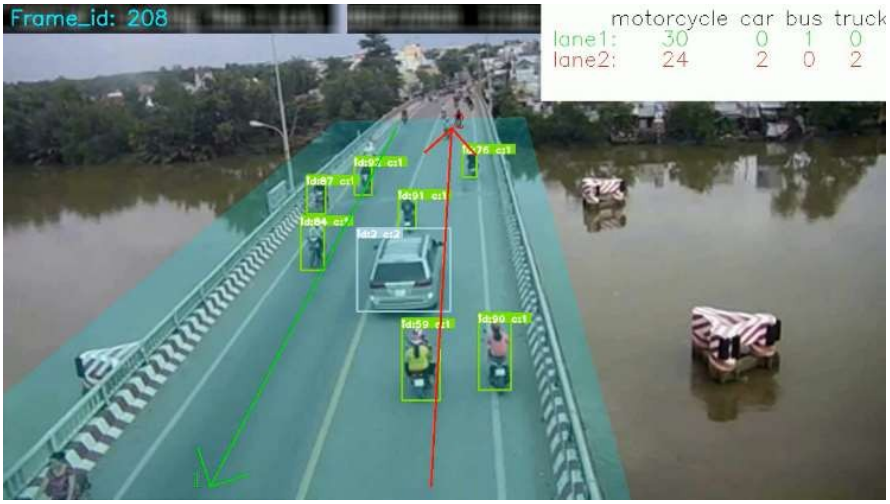

Fig. 9. Final counting results at daytime from tracking and counting.

Fig. 10. Final counting results at nighttime from tracking and counting.

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EXIT SIGNAGE SYSTEM'S COMPONENTS – IOT BASED SELF-DIAGNOSE SYSTEM PERFORMANCE AND ANALYSIS

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ABSTRACT

This paper presents the development of IoT Based Self-Diagnose System for inspection/maintenance of the installed exit signage systems. According to the Occupational Safety and Health Administration (OSHA) Code of Federal Regulations (NFPA 101), the installed exit signages are required to be maintained monthly to ensure the installed exit signage operate as it is denoted. As per conventional approach, the exit signage is checked of it's operation-ability or functionality through the push button, but due to the hassle need to press the push button for 30 seconds, many kind of just neglect the importance to conduct this inspection/maintenance process on the installed exit signage system. Also, to manually conduct the operation-ability and functionality test, it requires a personal to conduct the push button test on all the installed exit signage and this can be quite costly. With that, after reviewing the importance of inspecting/maintaining the installed exit signage, this paper proposes to develop an Internet-of-Things based Self Diagnose System for Exit Signage. The developed system is able to conduct self-diagnose of the exit signage performance such as battery State of Charge and LED lighting or bulb fault detection. Based on the obtained results, the developed system has successfully verified its operation-ability and the detection of the mentioned self-diagnose. Furthermore, the fault detection and the corrective maintenance are recorded into the web-based application and localhost computer.

Keywords: *Exit Signage, Maintenance, Status of The Exit Signage and Local Webpage.*

Introduction and Review

Exit signages which is also known as emergency lightning system is used to assist or navigate the occupancies for evacuation in the case of emergency. Exit signage is commonly installed at the top of an exit door, because in the case of evacuation the exit sign can be seen easily as shown in Fig. 1 and guide the building occupancies to immediately evacuate the building.

Fig. 1: Exit signage visibility.

The installed exit signage system should operate as immediate as 5 seconds when there is power dis-connectivity and provide sufficient illumination for at least 90 minutes [1] [2]. Hence, for the exit signage system to operate for 90 minutes after the failure of the main lightning, a backup battery is installed to power the LED or fluorescent light installed in the exit signage system for 1 to 3 hours operations.

Hence, Occupational Safety and Health Administration (OSHA) regulations require all the exit signage system to be inspected and a proper preventive maintenance record is kept in the case it is required to be referred [2]. To perform the inspection/maintenance on the exit

signage, the maintenance personal need to press the push button for thirty seconds to let the exit signage perform self-diagnose check on the LED/Fluorescent light and battery [2]. However, for most of the exit signage that have been placed at higher place or unreachable place, it is difficult for the inspection/maintenance team to conduct the push button exit signage system operation-ability or functionality. If the industry or company conduct the inspection/maintenance for exit signage installed at higher reach, then a lift or ladder is required which would cost extra and at the same time might affects the building operation.

After looking at the constraints and importance of inspecting/maintaining the installed exit signage, this research paper proposes to develop an Internet-of-Things (IoT) based self-diagnose system for exit signage. The proposed system is equipped with an inspection on the battery status and lighting system as well as able to detect and notify faulty part to the maintenance personal. In addition to that, the proposed system also is designed to monitor the installed battery charging or discharging which helps to improve the battery's lifespan. To integrate the battery status monitoring, there are few methods that can acquire the State of Charge of a battery and detect the fault battery system or lighting system. Research conducted by Martin Coleman in [3] explains that an undercharged battery will cause damage in the biochemistry of the battery, and therefore shorten the lifespan of the battery. Addition to that, overcharging of the battery also causes the electrolyte of the battery to be gassing and water loss [3]. Martin also suggested to extend the lifespan of the battery the SoC of the battery need to be maintained between 60% to 90% of the battery capacity. Murnane et. al., proposed the voltage method to acquire the SoC of the battery installed in the exit signage. The voltage method can estimate the battery's SoC during the discharge test. While conducting the discharge test, the discharge voltage value/reading is converted into an equivalent SoC value/reading using the voltage method referring to the discharge curve shown in [4].

In another research conducted by Yi Zhang [5], short circuit detection is used to detect a faulty lamp. The developed detection system will conduct in short circuit mode if a lamp is faulty. Thus, the voltage and current sensor is used to detect the faulty lamp as presented in [5]. Murat Ayaz in [6] has suggested street lighting fault detection using current sensor and relay circuitry. The current sensor is used to detect the faulty lighting, and when the lighting is faulty the relay circuitry turns off and disconnect the circuitry from the main power source [6].

Studying various ways of detecting a fault for battery and light is necessary for the development of the proposed IoT based self-diagnose system for exit signage in this research. As it been mentioned that the aim of the proposed project is also to detect the faulty battery and light, hence integration of fault detection circuitry is required to operate the proposed system. Apart from detecting the fault of battery and light, a preventive maintenance method also is required to ease the maintenance team to carry out the job of preventive maintenance or maintenance during any break down. Hence, Raspberry Pi Zero Wireless is used to wirelessly connect to the localhost database system. The localhost database system will record and store all the proposed system performances information/data and the preventive maintenance team can monitor via login into the developed service website. Therefore, this will instantly help the preventive maintenance team to get the faulty part replaced.

The remaining of these paper is arranged in four sections. In section II the applied theories to develop the proposed system is described. Section III describes the methodology used to develop the proposed IoT based self-diagnose system for exit signage as well as materials/components used to completely develop the system. Section IV describes the captured results based on the applied methodology to develop the proposed system, which directly validates the system's operation for the purpose of the development of the proposed system. Finally, the conclusion is presented in Section V as well as with the future work of the research.

Theory

This section emphasis on the theory of voltage method and battery health.

Voltage Method

Voltage method is a one of the methods used to acquire the State of Charge (SoC) of a battery. Voltage method measures the battery discharging time (voltage vs time) [4] [7]. The equation 1 explains the equivalency of SoC can be calculated when the remaining voltage is divided over the battery's rated voltage.

Equation 1,

$$SoC(\%) = \frac{V_{remaining}}{V_{rated}} \times 100\% \quad (1)$$

where,

$V_{remaining}$ refers to the remaining voltage in the connected battery and V_{rated} refers to the voltage that is rated for the connected battery, usually is given in the manufacturer's datasheet.

Battery Health

The battery capacity is always depending on the battery health and age of the battery is always depending on the battery's SoC as well as the number of charge and discharge cycles [3]. As it is mentioned that the Exit Signage required an instant illumination from the battery installed upon the main power shut down, therefore, the battery cannot be fully undercharged [3][9] or cannot be under constantly fully charge which would also cause damage to the battery due to overheating. Thus, it is suggested that battery should be charged above 50% - 100% of it fully charged capacity [3].

Material and Methodology

Overview of The Circuit Design

Since the Exit Signage is an important system in a building, two main components that need regular/monthly inspection is the light and the backup battery installed in the exit signage. Hence, Figure 2 shows the overview of the control system for the exit signage. The system is proposed to perform self-diagnose on the light/bulb and battery installed in the exit signage. The microcontroller in Figure 2 shows the self-diagnose system is bidirectionally integrated with bulb fault detection system and battery fault detection system. The principal operation of the battery fault detection system is using the battery capacity estimation to detect whether the battery is faulty or otherwise, while the bulb faulty detection system is using the short circuit method to detect the happened fault.

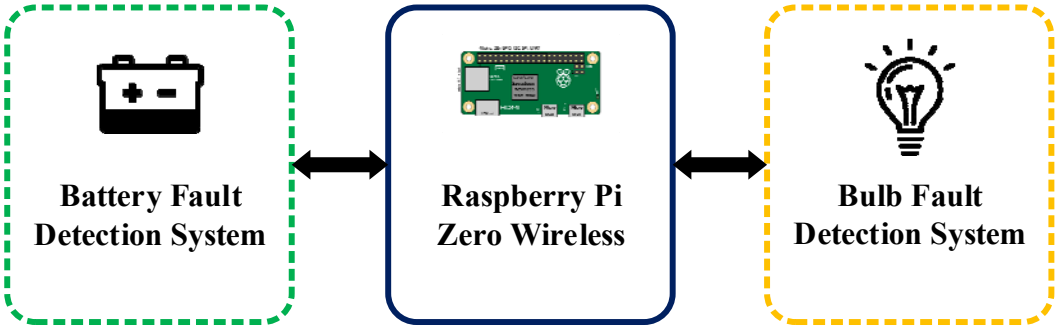


Fig. 2. Overview of the control system - exit signage.

Raspberry Pi Zero Wireless

The Raspberry Pi Zero Wireless is chosen because of small size which could easily fits into the available exit signage systems. Also, in addition to that, Raspberry Pi Zero Wireless has built-in wireless technology that would easily enable the Internet of Things application for the proposed system in this research. As it was mentioned, that for the Exit Signage to operate instantly upon main power shut down, the operation of the light and battery is extremely important. Hence, the battery fault detection system and bulb fault detection system are integrated to continuously monitor the condition of the battery and light of the installed exit signage.

Battery and Bulb Fault Detection Circuits

The battery fault detection circuit is designed in such a way that it would be able to measure the output voltage from the battery when a test is conducted. A simple voltage divider circuit is designed as shown in Figure 3.

Additional to that, since the Raspberry Pi Zero Wireless has no inbuilt Analog to Digital converter (ADC), an ADC module is integrated at the R4 resistor to send the measured battery output voltage values to the Raspberry Pi Zero Wireless.

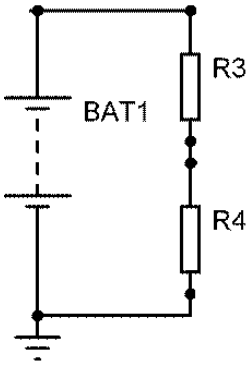


Fig. 3. Battery fault detection circuit - voltage divider circuit.

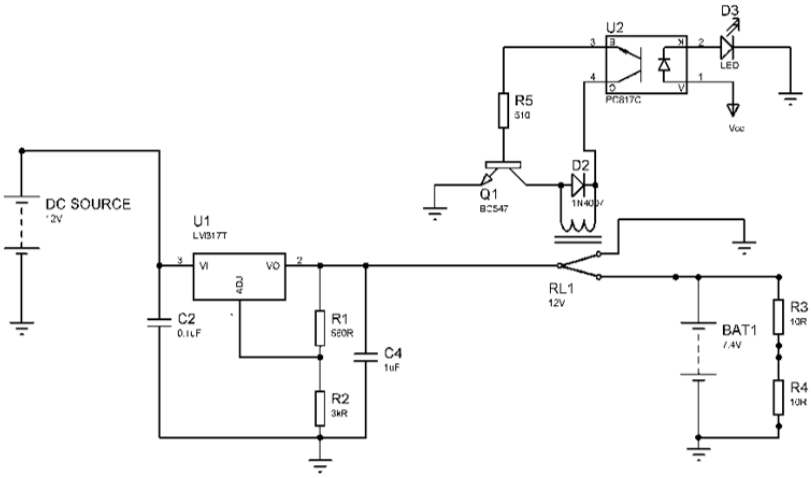


Fig. 4. Overview of the battery and light fault detection circuits.

Based on Figure 3, the battery is connected in series with the voltage divider (R_3 and R_4) resistors. The battery output voltage is collected at resistor R_4. The equation 2 is used to calculate the output voltage at R_4.

Equation 2,

$$\frac{R_4}{R_4 + R_3}(V_{bat}) = V_{R4} \quad (2)$$

where,

V_{bat} is the voltage of the battery and V_{R4} is the voltage drop at the R_4 resistor.

The battery fault detection circuit also must consider that the measured output voltage across the R4 should not be more than 4 Volts, otherwise the ADC will not be able to detect the battery output voltage for light fault.

Voltage Regulator

LM317 voltage regulator as shown in Figure 4 is used to step down the source voltage into a desired output voltage for battery charging. In this proposed system, source voltage of 7.4 Volt is used to charge the connected battery and it is to make sure that the measured output voltage should be at 7.4 Volt. The equation (3)

is used to calculate the V_(R2)at the resistor R2.
Equation 3,

$$V_{R2} = 1.25\left(1 + \frac{R_2}{R_1}\right) + I_{Adj}R_2 \quad (3)$$

Where,

V_{R2} is the output voltage and I_{Adj} is the output current at adjust terminal. In this case, I_{Adj} is equal to 0.
Based on Fig. 4, the LM 317 voltage regulator design is parallel with 2 capacitors. The capacitors are used to reduce the ripples in the output voltage.

Battery Fault Monitoring Circuit
The battery fault monitoring circuit is integrated with a relay module as shown in Figure 4 which is between the battery fault detection system and voltage regulator. The relay module is connected to the Raspberry Pi Zero Wireless and the Raspberry Pi Zero Wireless will provide instruction to the relay module to switch to battery charging or discharging mode. Hence, the battery fault detection voltage divider circuit is connected to the Normally Closed (NC) of the relay module and the battery fault detection circuit is connected to the Common (COM) of the relay module.

The battery and light fault detection circuits shown in Figure 4 are then connected with the ADC and Raspberry Pi Zero Wireless as shown in Figure 5.
Figure 6 shows the bulb and battery fault detection system embedded software execution in the Raspberry Pi Zero Wireless. The bulb and battery fault detection embedded software activate the bulb and battery fault detection system at pre-set 15 minutes scheduling that has been programmed. At the initial stage, the bulb and battery detection system are activated and the output voltage reading from the bulb and battery is recorded/stored into the Raspberry Pi Zero Wireless SD-Card Storage system. Then, the recorded/stored data into the SD-Card Storage System is uploaded into the MySQL database for online monitoring purposes. The recorded/stored output voltage data of the bulb and battery is analyzed for "GOOD" or "BAD" condition of the bulb or battery. For an example, if the recorded/stored output voltage data for the bulb is equal to zero, then this indicates the bulb is in open circuit condition. Hence, immediately a fault notification is sent to the maintenance team to perform the maintenance on the bulb. And, if the recorded/stored output voltage at the bulb is less than 2.8 Volt, it probably indicates the bulb is faulty or the battery is weak. Hence, a fault notification is sent to the maintenance team to perform the maintenance on the bulb.

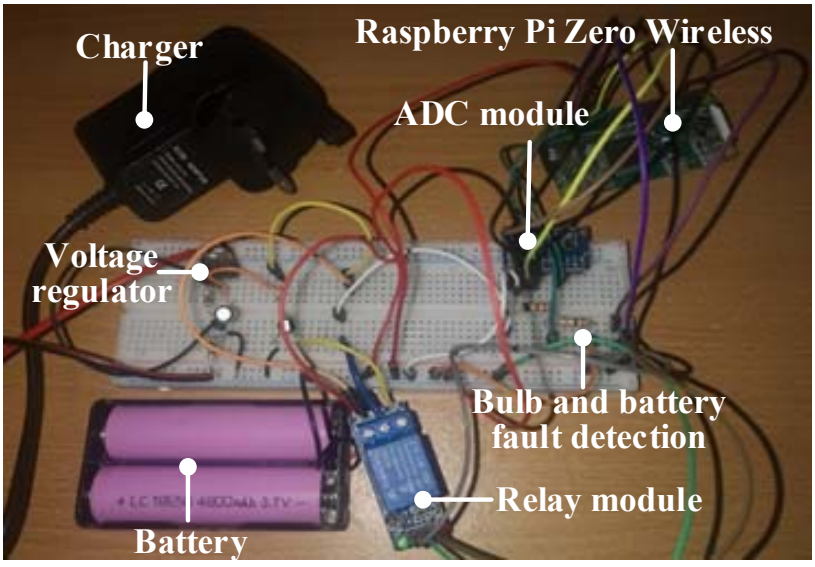


Fig. 5. Experiment setup - IoT based self-diagnose system for exit signage.

In the next stage, the Raspberry Pi Zero Wireless also do a check on the battery SoC. During this SoC check, if the battery is measured having capacity is more than 60%, the Raspberry Pi Zero Wireless will record the battery as "GOOD" into the database system. Nevertheless, if the measure battery capacity is less than 60%, a "BAD" status is recorded, and a fault notification is sent out as fault notification to the preventive maintenance team. If the battery and bulb is always in "GOOD" status condition, the fault detection system is placed under sleep mode condition and a scheduling of 15 minutes is pre-set to continuously conduct the battery and bulb fault checking.

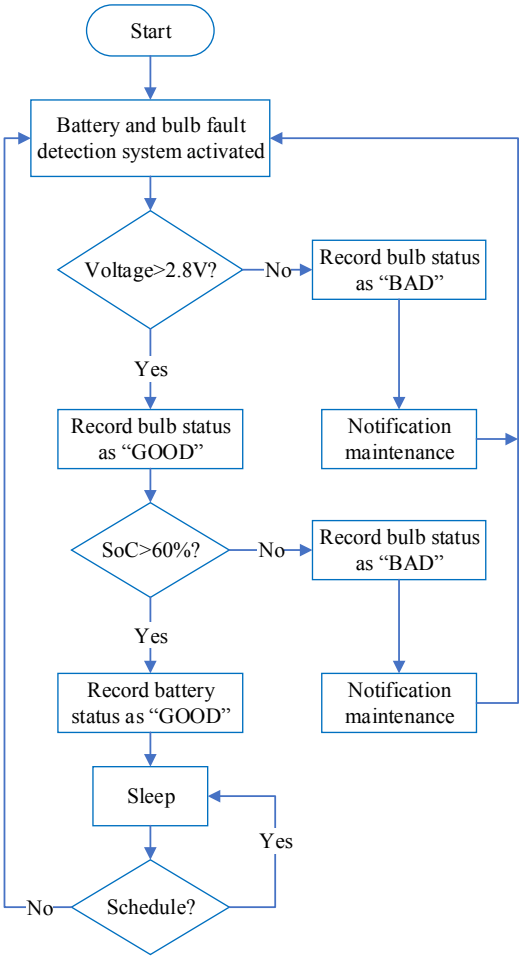


Fig. 6. Bulb and battery fault detection system flowchart.

Figure 7 shows an automatic battery charging monitoring embedded software that has been integrated into the hardware developed shown in Figure 5. The purpose of this task is to protect the battery from overcharging which is necessary to protect the battery to operate for at least 3 hours. The task shown in Figure 7 is activated when the Raspberry Pi Zero Wireless is activated and the battery voltage from the ADC channels are converted into the SoC, and if the SoC of the battery is more than 60%, the relay module is switched off, otherwise the relay module is switched on to charge the battery connected to the LED/Bulb.

MySQL Database

The MySQL database system is used as data acquisition system or storage to retrieve the battery charging or discharging voltage as well as recording the bulb output voltage which assist to analyze the "GOOD" or "BAD"

status. The MySQL database is designed to record/store voltage or SoC every 15 minutes which can be used to analyze the system performances for preventive maintenance.

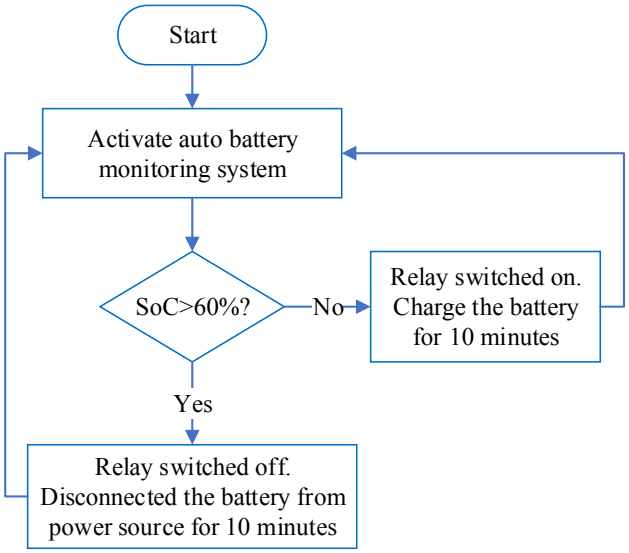


Fig. 7. Automatic battery charging and monitoring.

Results and Discussion

This section discusses about the captured results to validate the proposed methodology in Section III. The results are captured to present validation of the simulation and experimental work, the charging and discharging of the battery, fault detection system for battery and bulb and HTML interfacing for data extraction from the Raspberry Pi Zero Wireless into MySQL database system or storage.

Figure 8 shows the schematic simulation circuit for the battery and bulb fault detection circuit that has been simulated. The battery voltage 7.4 Volt has been captured and the output voltage at R4 is captured at 3.7 Volt which is a LED.

To validate the simulation results captured while conducting the simulation, Figure 9 shows the experimental result captured using the multimeter to validate the hardware output while operating. These results show that the conducted simulation which is based on the proposed methodology is valid.

Figure 10 shows the 3.8 Volt recorded voltage value for the attached bulb at point A as shown in Figure 8.

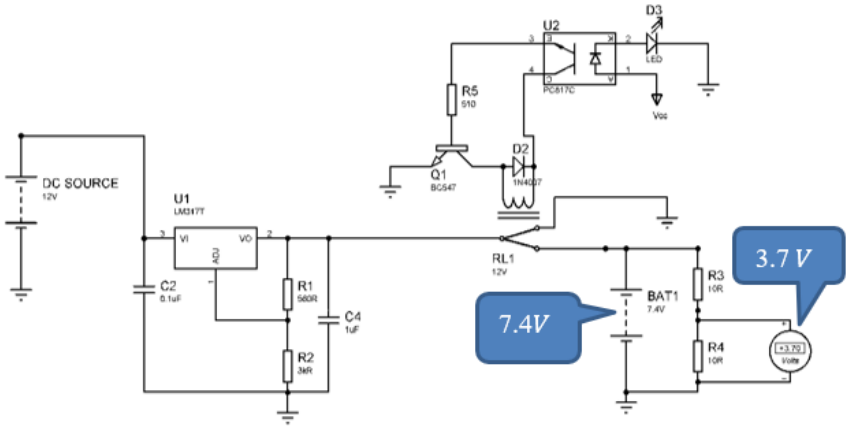


Fig. 8. Schematic simulation circuit - battery and bulb fault detection circuit.

Simulation and Experimental

This voltage value is recorded into the Raspberry Pi Zero Wireless SD-Card Storage system before transferred into the MySQL database system or storage.

Figure 10 shows the 3.8 Volt recorded voltage value for the attached bulb at point A as shown in Fig. 8. This voltage value is recorded into the Raspberry Pi Zero Wireless SD-Card Storage system before transferred into the MySQL database system or storage.

Figure 11 and Table 1 shows the voltage discharging and charging equivalent of battery SoC. Based on the discharge cycle, at voltage 0.9 Volt the discharge cycle is disconnected. While the charging cycle shows that the battery SoC is 100% when the battery voltage is 3.7 Volt.

Demonstration Fault Detection of the IoT based Self-Diagnose System for Exit Signage

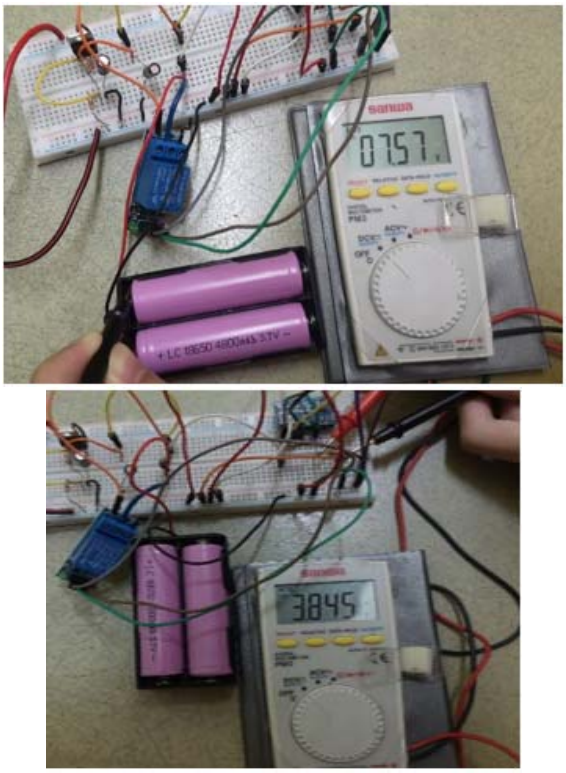


Fig. 9. Experimental results for battery and bulb circuitry.

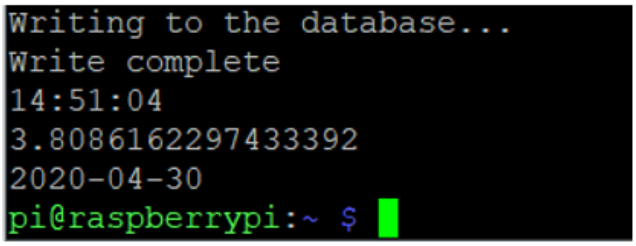


Fig. 10. Bulb measures voltage - writing to MySQL database.

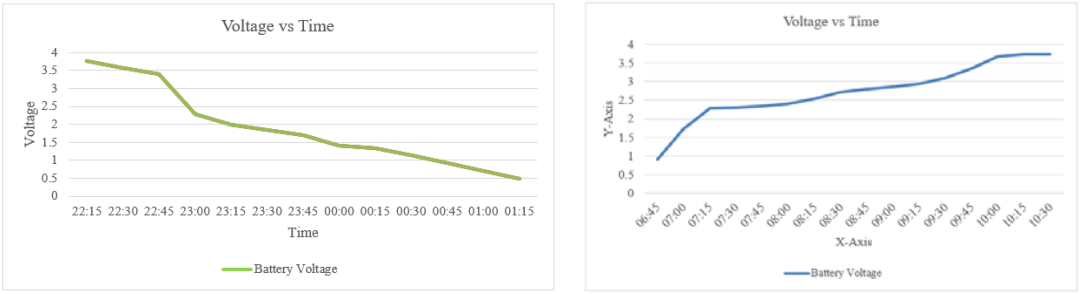
Charge Cycle and Discharge Cycle of the Batteries

Figure 11 shows the battery charging and discharging cycle to obtain the battery's SoC. According to the Figure 11, the battery discharging and charging voltage value is captured every 15 minutes to test the battery's health.

This section explains about the fault detection that has been integrated into the IoT based Self-Diagnose System for Exit Signage. Referring to Figure 12, a Red LED is connected in series with R3 resistor as shown in Figure 8 and the Red LED on the relay module is also switched ON to indicate the battery is connected for the Exit Signage

System to operate. The sensed and recorded 2.87 Volt voltage value at the Red LED is updated into the IoT database which indicates the system is in "GOOD" condition.

Figure 14 shows the practical measured voltage is 8.15 Volt which is expected higher that the 7.4 Volt nominal voltage. This shows the battery is in "overcharging" condition. When the battery is "overcharging" condition, the



(a) Battery Voltage Discharging **(b) Battery Charging Voltage**

Fig. 11. Battery charging discharging - State of Charge and health.

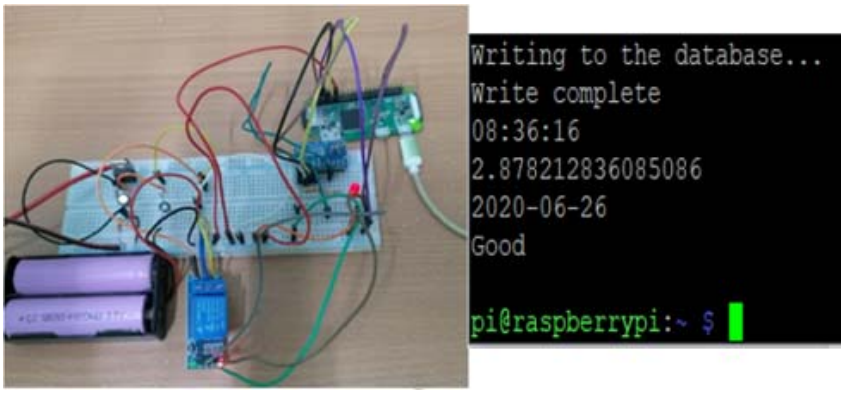


Fig. 12. Initial setup for fault detection.

Table 1: Voltage vs equivalent battery SoC

Voltage (V)	State of Charge (%)
3.7	100
3.4	80
2.6	60
1.7	40
0.9	0

Figure 13 shows the Green LED on the relay module is switched ON to indicate the main circuit which connects to the Exit Signage System is disconnected from the power source. Hence, the 0.51 Volt output voltage measured at the main circuit RED Led indicates the power from battery is disconnected due to low power and Bulb is not illuminated. Therefore, the Raspberry Pi Zero Wireless records the current status of the system and upload into database via the IoT application.

Green and Red LEDs on the relay module is switched on. During the "overcharging" condition, the Raspberry Pi Zero Wireless records the sensed and measured voltage at the battery as well as quickly switched off the relay module to disconnect the battery charging process and upload the "overcharging" condition into the database.

Figure 15 shows the short battery or bulb circuit test. During the test conduct, the RED Led at the circuit is removed and the Green and Red on the relay module is switched on. This shows the circuit is in "open circuit" condition which unable to illuminates the RED Led at the circuit. Hence, the recorded status in the Raspberry Pi Zero Wireless is updated into the database system via IoT application.

Figure 16 shows the number of fault detections such as short circuit. The highlighted red box indicates the battery is in short circuit condition and the orange box indicates overcharging condition when the system is tested under these two conditions.

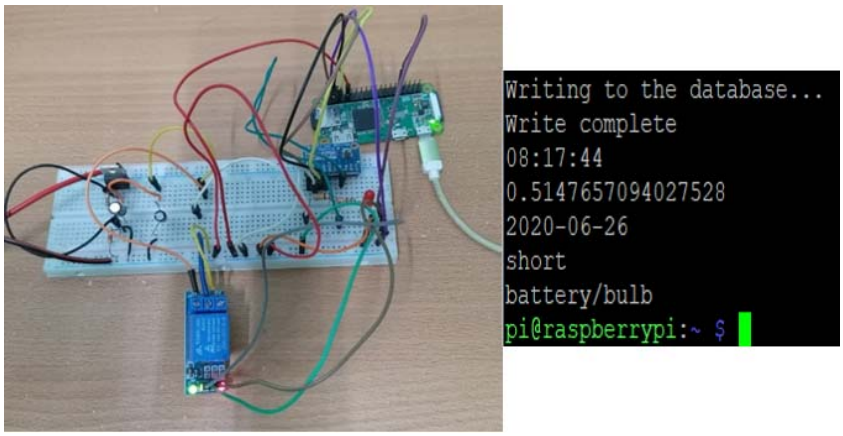


Fig. 13. Disconnectivity bulb test - circuit design.

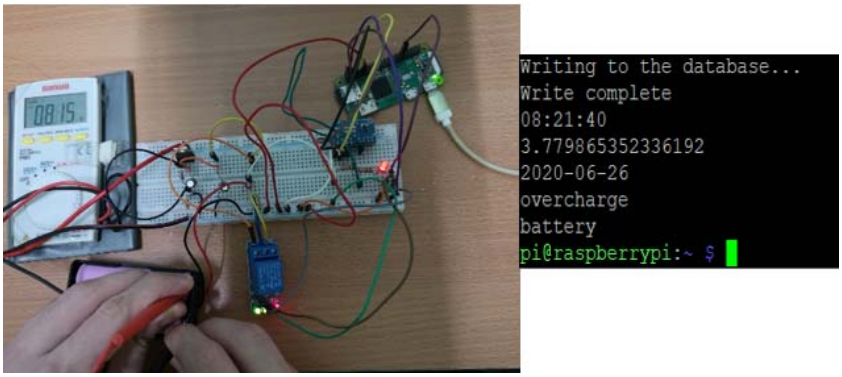


Fig. 14: Battery fault circuit test.

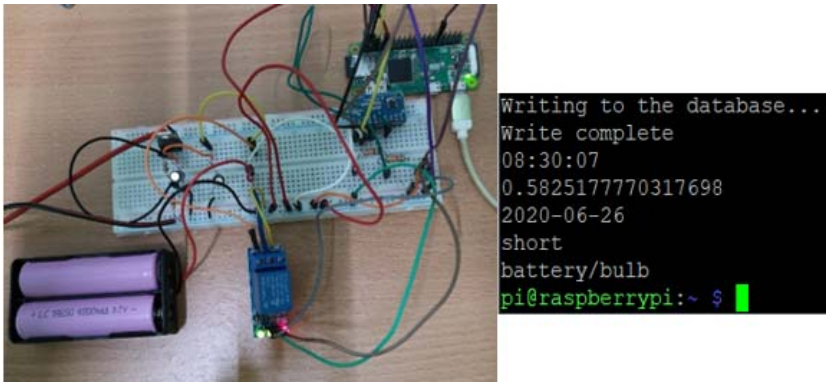


Fig. 15. Short battery or bulb circuit test.

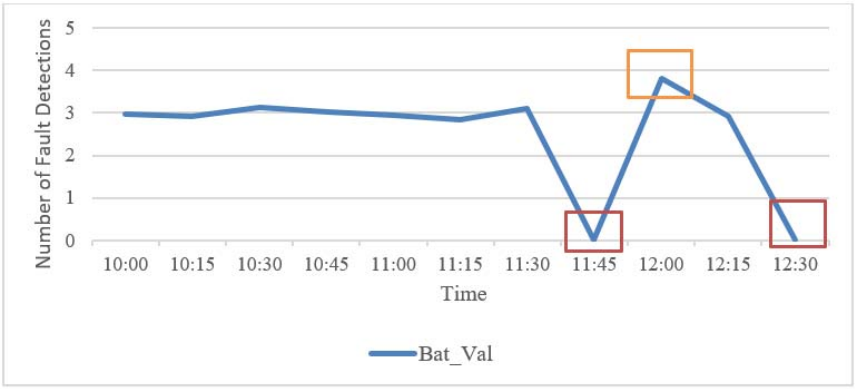


Fig. 16. Number of fault detection – failures.

Battery Monitoring System Test

To ensure the battery is always in good condition, the battery's SoC is maintained at above 60% and equal to 100%. If in case the battery's SoC is between 70% to 80%, it also shows the battery have sufficient amount of capacity to supply power to the connected LED lighting or Bulb for at least 3 hours. Figure 17 shows the automatic battery monitoring system test conducted to show the battery's health condition which indicates the battery's voltage is at 2.8 Volt to 3.2 Volt. Figure 17 also indicates the battery will be charged when the battery's voltage reached 2.8 Volt and stops when the battery is charged up to 3.2 Volt. The charging from 2.8 Volt to 3.2 Volt condition helps the battery to maintain the in usual charging situation.

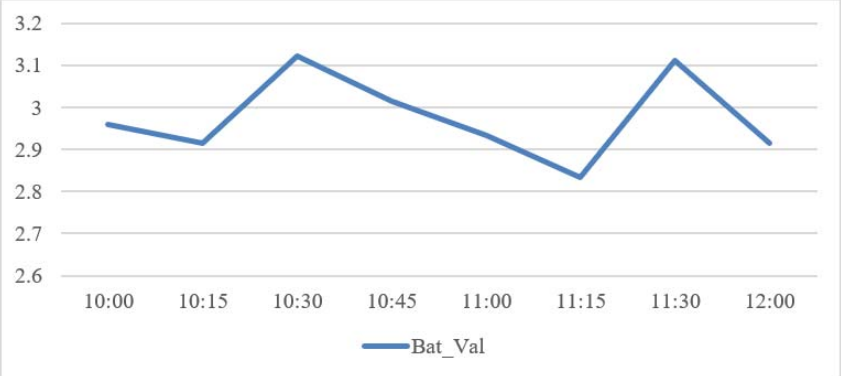


Fig. 17. Battery monitoring system test.

Fig. 18. The local HTML login webpage - IoT Self-Diagnose System for Exit Signage.

HTML Interface

Figure 18 shows the local HTML Login Webpage for the IoT Self-Diagnose System for Exit Signage to allow the maintenance team to Login to check on the Exit Signage System performances details.

Figure 19 shows the recorded details that will be extracted from the Raspberry Pi Zero Wireless SD-Card Storage System. These details will be viewed at the HTML local webpage when the maintenance team access to monitor the condition of the installed Exit Signage System.

Figure 20 shows the local website maintenance site that stores all the IoT based Self-Diagnose System for Exit Signage System. Also, the website is able records the maintenance details, such as conducted or scheduled maintenance records as shown in Figure 21.

Conclusion

Exit Signages are important and necessary to provide a clear vision to exit a doorway during an emergency evacuation of a facility building. Hence, it is very important to continuously illuminate the Exit Signage when an emergency occurs as well as the Exit Signage need to be seen clearly at visible locations.

As the objective if this proposed project is to develop IoT based Self-Diagnose System to continuously monitor the performance of Exit Signage System as well as to provide assist to personal that conduct manual testing on the installed Exit Signage Systems. With the IoT integration, the maintenance personal would be able to monitor the Exit Signage System to remotely via the web-based application and any

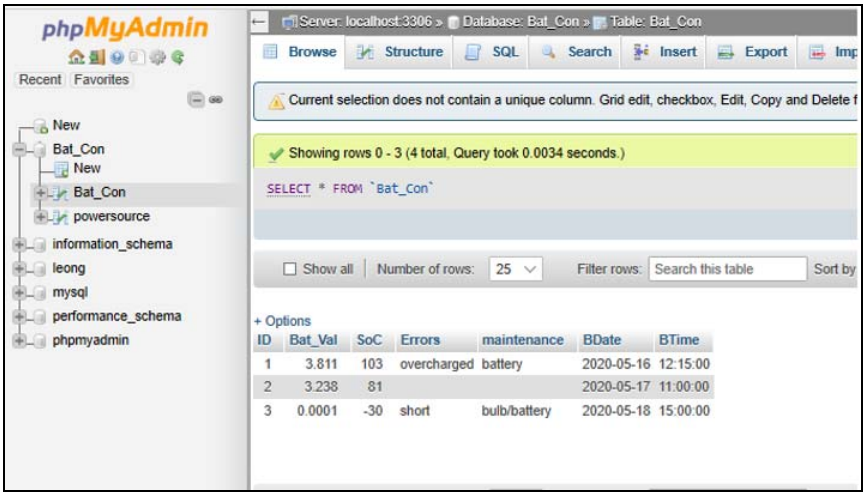


Fig. 19. MySQL table - system operation status.

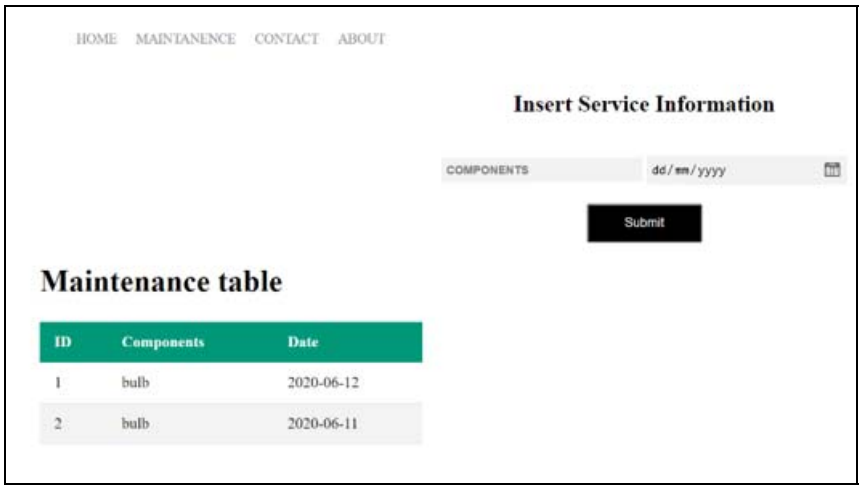


Fig. 20. Web-based service information site.

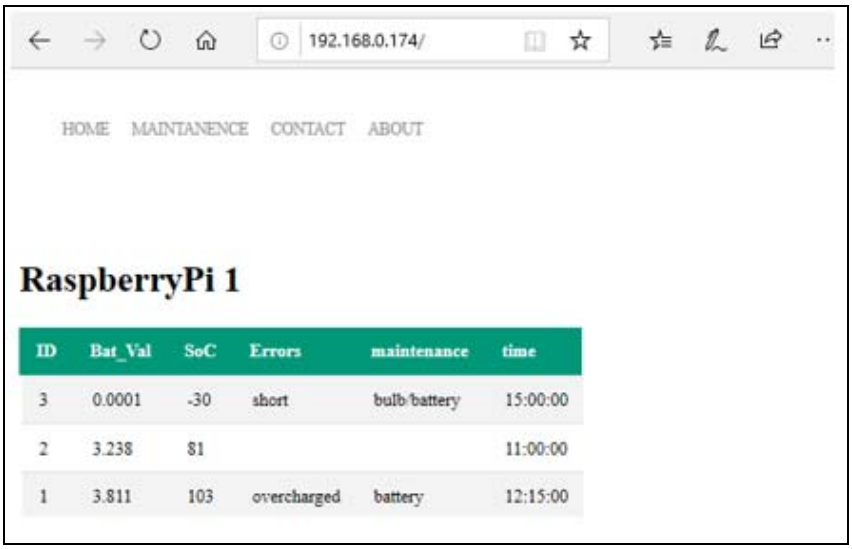


Fig. 21. Conducted or scheduled maintenance recorded.

kind of fault occurs to the Exit Signage System will be updated via the IoT application into the monitoring website. Furthermore, any kind of maintenance conducted will be recorded to analyze the system performances.

Acknowledgement

The author(s) wish to acknowledge the support from the Ministry of Higher Education of Malaysia (MOHE), Advanced Sensors and Embedded Control (ASECs) Research Group, Centre for Telecommunication Research & Innovation (CeTRI), Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer (FKEKK), and Fakulti Kejuruteraan Mekanikal (FKM) Universiti Teknikal Malaysia Melaka (UTeM), Hang Tuah Jaya, 76100, Durian Tunggal, Melaka, Malaysia. Also not forgetting Institut Kemahiran Tinggi Belia Negara, Sepang for this collaboration.

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MALAY LANGUAGE VOWEL RECOGNITION USING IMAGE OUTLOOK VIA CONVOLUTION NEURAL NETWORK (CNN)

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ABSTRACT

Non-communicable disease is among silent killer in every in the world. Even though the disease is not conveyed from one person to another, still the disease shows an increment trend from 1990 to the recent day, e.g., stroke and heart attack. One of stroke disease effects is becoming disabled from any one of an average capable person. Speech disability is one of those disabled capabilities. Rehabilitation provides an alternative to slowly train the patient to be an average person to bring back this capability. The rehab requires plenty of time to ensure the patient attends the training session. The training, however, is generally conducted manually by the physiography with a face-to-face training session. This training consumes time, human power, and difficulties, especially during the pandemic COVID-19. Vowel rehabilitation is training before the patient can attend the consonants, syllables, phrases, and sentences. Since the study on vowel /e/ in Malay language is limited, we propose an additional comprehensive dataset and simple recognition idea utilizing the Convolutional Neural Network for vowels recognition to the previously proposed work. We extend the existing five Malay language vowel dataset by contributing vowel /e/ in this paper. The result shows that the new proposed dataset's vowel /e/ recognition is relative and fit for identifying the vowel /e/ type.

Keywords: *Convolutional Neural Network (CNN), Malay Language, Recognition, Rehabilitation, Stroke Patient, Vowel.*

Introduction

Non-communicable disease (NCD) is defined as chronic diseases that transpire for a long time and could be influenced by a multi-reason, including the genetic mixture, uniform body habit, external conditions or surroundings, and behavioural circumstances. NCD kills forty-one million people every year, which is equal to seventy-one percent of global death. From this number, seventy-seven percent of the total NCD deaths are from developing and low-income countries, e.g., Malaysia. One of the most death NCD is cardiovascular disease, with 17.9 million people annually, which is reflected in stroke patients at the same time. Smoking habits, less physical activity, alcohol usage, and unsanitary nutrition boost the risk of NCD infection. Early detection, frequent health screening, speedy treatment of NCDs, and intensive care are vital components of the response to NCDs.

As the number of NCD patients increases, the number of disabled people diagnosed with NCD increases annually. Rehabilitation is the post-stroke treatment for NCD patients with a stroke problem to gain back the lost capability. The treatment requires a consistent time frame to ensure the patient's ability could be retrained back. One of the abilities for stroke patients which possibly train and learn back is speech ability. For this, we could start from the vowel in speech ability and follow with consonants, syllables, phrases, and, lastly, sentences.

To give the rehabilitation session for the patient, however, most of them are still in manual mode. It includes face-to-face "listen and evaluate" sessions from a rehabilitation centre staff or medical trainer individually for each patient. This rehabilitation session requires plenty of time to ensure that the session will benefit the patient for each session. This manual "listen and evaluate" also requires sufficient human resources if the rehabilitation has many patients to be treated. These two, time and human resources, could infer long-term period problems for the rehabilitation, which extend and prolong the recovery time for

each patient. Furthermore, when the unusual normal happened to the community, e.g., COVID-19, this also would infect the recovery treatment.

To make the rehabilitation session user-friendly to the rehabilitation and the patient, the smart speech rehabilitation system could be introduced as one solution. To design and prepare the smart speech recognition system, having a vast dataset is a must. These datasets are either in signal form for audio or image form for video analysis; currently, there is still a lack of a large dataset for this speech recognition purpose. The regional speech dataset could be the solution to ensure the analysis will directly benefit the social geography. For example, the Malay language vowel is not the same as the English vowel. Thus, this difference may affect the vowel information and the result of the conducted analysis. Therefore, for this paper, we introduce the idea of vowel recognition for the use of patient stroke recovery in the Malay language.

Since speech is produced by a vibration produced by our throat as a voice signal, these vibrations represent speech waveforms from a science perspective. This conventional understanding concept for one voice signal as a wave signal introduced a new alternative signal observation way in this paper. In most of the conducted research for voice recognition, this voice signal is considered as a two-axis signal, x and y, represented as time and amplitude. However, a traditional wave signal could not be directly utilized and applied to the recent Deep Learning by using Convolution Neural Network (CNN) approaches. For implementing the voice in CNN, the wave signal requires a modification from an audio form into an image form. This modification could be in varies depending on the approach that we employ. Here, to the extent of our knowledge, we observe the wave signal as a spectrogram image that will provide sufficient information about each vowel in the Malay language.

The Malay language is the most spoken globally by more than 33 million speakers Farid M.O (1980) from various countries in the South-East Asia (SEA) region, including Malaysia, Singapore, Brunei, and Indonesia Indirawati Z. and Mardian S. O. (2006). Malay language also categorized into Malay regional dialect e.g., eastern, northern, southern of Malaysia, borneo includes Sabah, Sarawak and Brunei, and many more in Indonesia. Since the number of Malay speakers addresses a large number, the study for stroke patients by vowel recognition became crucial for extending awareness of rehab activities Mark D. (2008), Peter C. et al. (2008), Husni T. et al. (2019), Hua-Nong Ting et al. (2012). For this, in the experimental and analysis purposes, we utilized six vowels in the Malay language as our main analysis subject, /a/, /e/, /i/, /o/, /u/ and including the second vowel /e/. To perform the classification, the utilization of CNN, which is widely occupied in various classification research, produces a stable and relative classification result. One of the simple and versatile CNN networks, VGG16 Karen S. and Andrew Z. (2015), is employed as the primary model for vowel classification in the experimental work for representing the experimental performance.

Our contribution can be summarized as follows:

• we propose a way to gain voice information by utilizing the spectrogram image,

• we introduce a new Malay language vowel dataset image with a mixed male and female subject, which consists of three lengths of six types of vowel wave signal, and

• we show that the proposed dataset images are comparable and acceptable in recognizing the vowels correctly via CNN using six classes.

Note that this paper is an extended version of the previous conference paper Nur Syakirah et al. (2021). Compared to the previous paper, we first appended an evaluation of additional vowels in Malay to confirm the performance of complete coverage of the Malay language vowel. The evaluation is conducted using six classes of vowels. Secondly, we add the previously introduced five vowels dataset to six vowels dataset images using the spectrogram as the medium to see the vowel in an image form. This paper presents Malay language vowel recognition for disabled people using Convolution Neural Network (CNN). The method introduced the use of spectrogram to replace a standard audio signal file in CNN to recognize six vowels in the Malay language. The transformation from audio form to image

form and the CNN training process are described. The rest of the paper is divided into several sections: Section II presents the related works; Section III discusses the proposed methods; Section IV explains the dataset arrangement. Section IV is later followed by Section V, which addresses the results of the proposed method's conducted experiments. Then, in Section VI, we conclude the paper and suggest several future works.

Related Works

Researchers specifically in sound or speech recognition have done several works on disabled people for rehabilitation activity, or non-NCD-related rehabilitation requires patient. The work in this area started with a conventional approach to aid the patients, e.g., with an articulation disorder Karen S. and Andrew Z. (2015). This approach uses a manual speech activity named as traditional therapy of articulation approach. Articulation disorder is speech confusion, including numerous obstacles in connecting distinct sound types, replacing sound with another one, speech mumbling, or indistinct speech. This method was focused on the phonetic placement of the error sound by training the motor skills to produce the sound appropriately by using face-to-face training sessions with flashcards and gesture training.

An alternative approach uses a hierarchy to help children establish the correct sound manually without any intelligent approach. The research on the severity of speech disorders was proposed from a mild, moderate, severe, and inability to speak level. This traditional approach teaches them how to pronounce accurately every individual sound. This approach is one of the early speech rehabilitation methods conducted by the professional in this field to fix the severity of speech disorder Sara R. and Patti S. (2016). Later, Van Riper proposed articulation drills and motor learning, which is also considered a manual rehab approach by training the tongue movement and suggested steps for the remaining articulators, for example, lips and jaw Md. Zaigham Zaheer et al. (2015).

There are many works on the dialect aspect of voice and speech recognition. One of them, which is considered to be the earlier one using CNN, is a deep learning-based system for detecting screeching by Md. Zaigham Zaheer et al. (2015). The new proposed idea of converting audio to such an image form by deploying the MFCC features. Here, audio recordings are extracted and later presented to the DL classifier to detect the screaming sound. At the same time, the other researchers focused on Gaussian Mixture Model (GMM), and with the later classification approach, Support Vector Machine (SVM), which later are compared their performance with CNN in 2D or 3D pattern signals Cristhian P. et al. (2017), Juncheng L. et al. (2017), Rahmawati R. and Dessi L. (2017), Pronaya P. D. (2016), Jacqueline I. and Dessi L. (2017), Du G. (2016).

One of the earliest approaches using Machine Learning (ML) later improved the conventional methods. The ML approach results in clinically useful major disorder disease (MDD) with their proposed risk-stratification models formed by self-reports from the baseline patient Khaing Y. H. et al. (2018). From a fruit control classification system on the Convolution Neural Network (CNN) project published in 2018, the CNN is utilized to develop a fruits classification based on CNN. Ninety-four percent of the classification's accuracy is gained 971 images from different 30 classes. Alongside, the fruit classification with the help of CNN implementation is proposed. There is also a control system work by designing an automated vision-based system via a computer vision approach by Sara R. and Patti S. (2016). Husni T. et al. (2019), Hua-Nong Ting et al. (2012) employ one technique from image processing which utilizes magnetic resonance imaging (MRI) to represent the vocal realm. Husni T. et al.'s (2019) work shows the usage of four types of frequencies to investigate the continued Malay children from seven to twelve years old via the six vowels of the Malay language.

This research paper facilitates the implementation of CNN in speech rehabilitation for disorder people project. This work also implements the CNN for evaluating the accuracy for normal and disordered people. Research using the specific vowel in the Malay language initiated from past decades. Among the proposed work Husni T. et al. (2019), Hua-

Nong Ting et al. (2012), six Malay vowels, /a/, /i/, /u/, /e/, /ə/, and /o/ and comparison study were conducted. Here, all the Malay language vowel research is still not conducted intelligently and for stroke patient purposes.

Proposed Methods

In this research, we propose a simple CNN model network, which is utilized for the comparative network model using the newly introduced six types of the Malay language vowel.

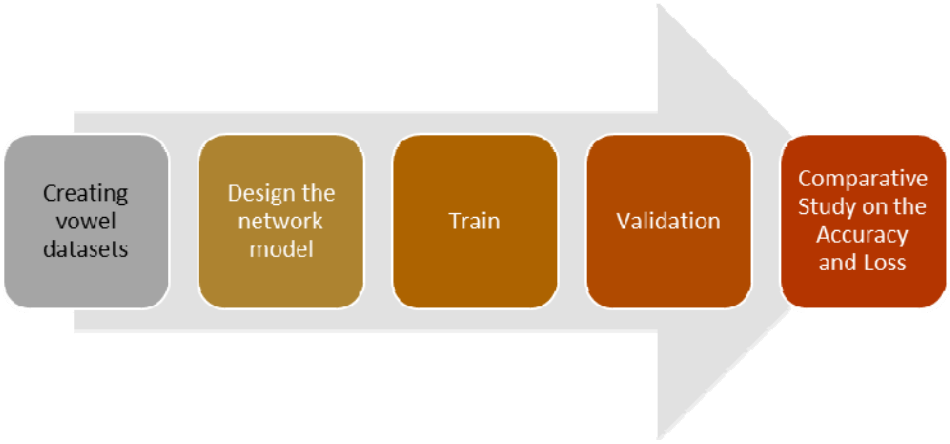


Fig. 1. Proposed workflow.

In this section, we explain how the image is gained from an audio signal file. We presented the outlook of a vowel sound into a new form, which is in the image form of information. A proper dataset of images covering various aspects is a must to design a new intelligent classification for stroke patients.

For this, we carefully select the wave signal recorded from the subject with different wave conditions. The image conversion from the audio signal is crucial for exploring the research on vowel recognition by CNN. The audio signal is converted into spectrogram images. We employed the existing network models such as VGG16, VGG 19, and ResNet with our proposed network model with six classes. Overall workflow for this paper is illustrated as the Figure 1.

The Proposed Network Model

We designed a simple network model for the vowel recognition task.

The proposed network from the CNN architecture consists of a convolutional layer, pooling layer, fully connected layer, dropout, and activation functions. This project set the input image size as 240 x 55 based on the six vowels dataset images.

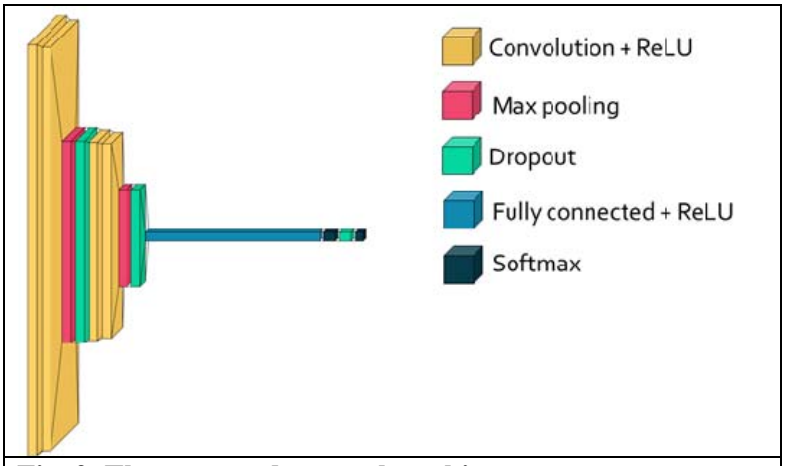


Fig. 2. The proposed network architecture.

Overall, these input images are set to be in 240, 55, and 3 before entering the convolution part. The first convolution layer, also known as Conv1 is followed by the Conv1_1, which uses

32 filters by considering the dimension of images as 238 x 53. Here, the convolution layer with 64 filters with max-pooling the images in 236 x 51 dimensions is utilized. Then, Conv2 is at the second convolution layer, which consists of 32 and 64 filters to 128 filters.

Followed by the Conv2_1, it uses 128 filters and max pooling with the image of 116 x 23. At the same time, the Conv2_2 uses 128 filters with the max-pooling of image 9x56. After that, we use 1024 units of a dense layer and five units of dense SoftMax layer for this dense layer. The image size reduction for each layer is illustrated in Figure 2. The model was designed by constructing CNN with input image dimension 240 x 55, ADAM classifier is utilized as the proposed network's optimizer and SoftMax for the activation function. Later, the model is evaluated by executing them with various batch size numbers and epoch size numbers for the comparative study.

Dataset Arrangement

In this section, we explain how the dataset images involved in the paper are captured and arranged. As to gain the information from the vowel, we converted the audio signal wave file into an image as the spectrogram images.

We will discuss the audio recording, converting the audio signal to image, and the dataset arrangement.

Audio Recording

The vowel audio signals are recorded from nine sample people aged from twenty to twenty-four years old, both male and female. Realizing one dataset arrangement should have a variety of audio vowel types, we conducted a record session with different lengths of the audio signal: short period, middle period, and long period. The three-period of audio signal from vowel /a/, /e/, /ə/, /i/, /o/, and /u/ are recorded based on person to person separately.

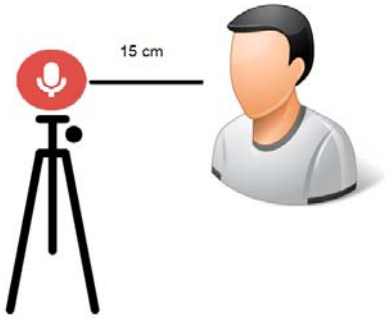


Fig. 3. The recording arrangement schematic.

```
plt.figure(figsize=(14, 5))
librosa.display.specshow(Xdb, sr=sr, x_axis='time', y_axis='log')
plt.colorbar()
```

```
<matplotlib.colorbar.Colorbar at 0x7fb8c09c6990>
```

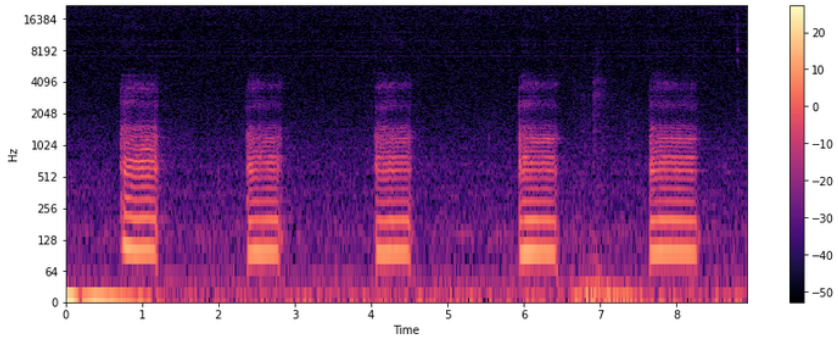


Fig. 4: The python code for converting audio vowel signal to a spectrogram image and the example spectrogram image.

To ensure that noise is less during the recording, we set the voice recorded with 15-centimeter length from each person. Here, in recording, when a short audio vowel signal is to be recorded, the person requires to say /a/ in one second. In contrast, the latter two-period audio vowel signal, middle period, and long-period signals are recorded accordingly at the 2- and 3-seconds length. We use voice recorder REMAX RP1 8Gb Digital Audio Voice Recorder to record the voice from the nine-sample people, which is like the recording arrangement schematic shown in Figure 3.

Converting wave signal to image form

The wave signal recorded are later converted into image form, spectrogram image. We set the y-axis as in log frequency for visualizing the upper region of the spectrogram with more information. The transformed spectrogram images are later manually crop as one vowel image from /a/ to /o/ at a specific size 240 x 55 pixels. To gain the images for each vowel, we manually crop the images from Figure 4 with 240 x 55 for the height x width. Then, the dataset is divided into three segments: training, validation, and testing images with a ratio of 8:1:1, as presented in Figure 7.

Dataset Images

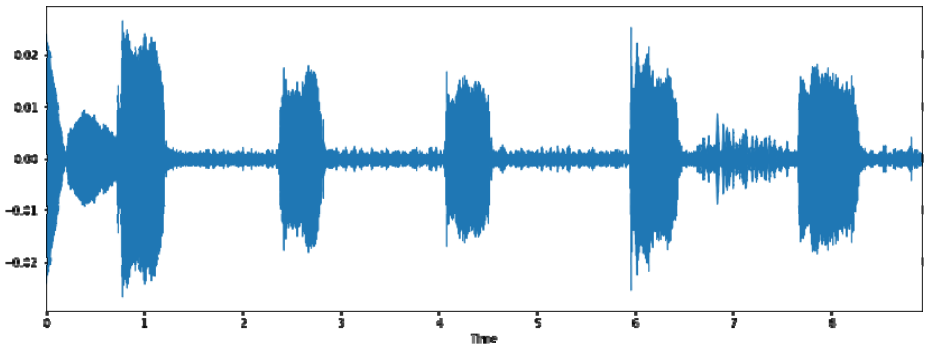
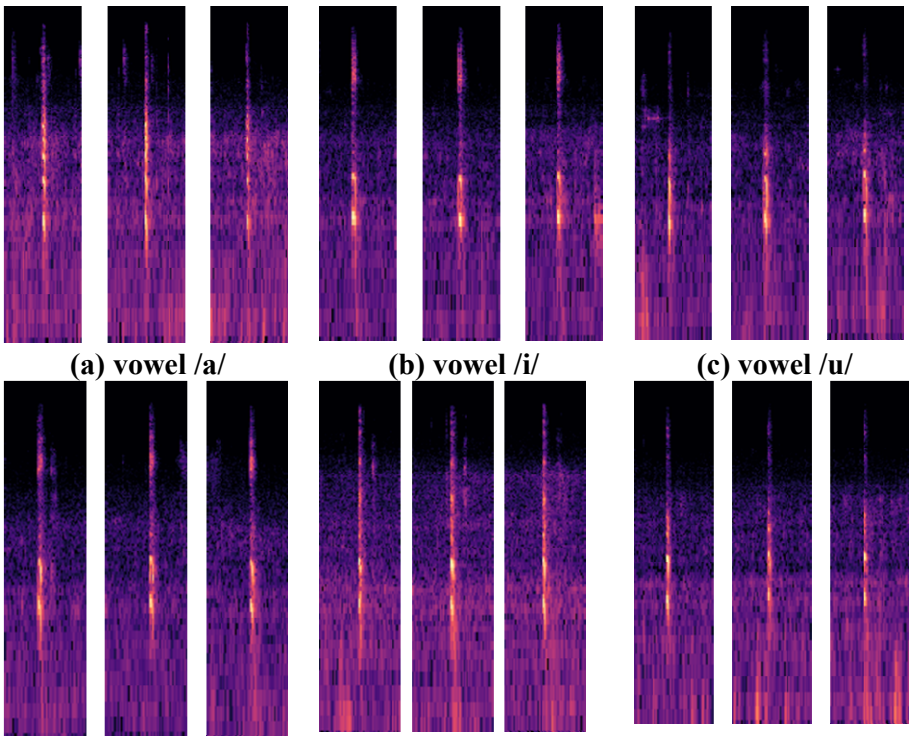


Fig. 5: Sample of vowel audio signal in time domain.



(a) vowel /a/ **(b) vowel /i/** **(c) vowel /u/**

(d) vowel /e/ **(e) vowel /ə/** **(f) vowel /o/**

Fig. 6. The example spectrogram for six vowels in the Malay language.

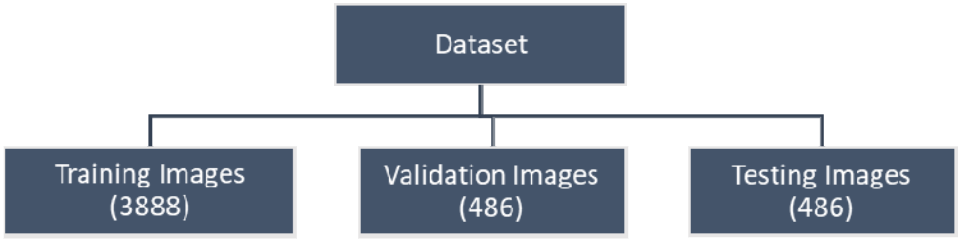
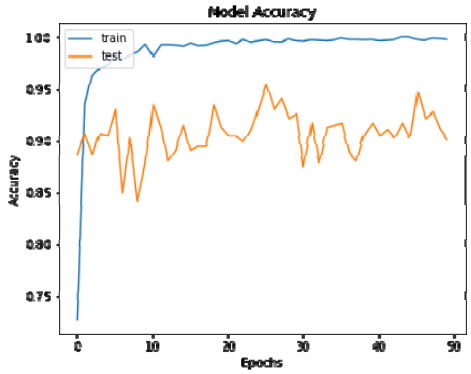
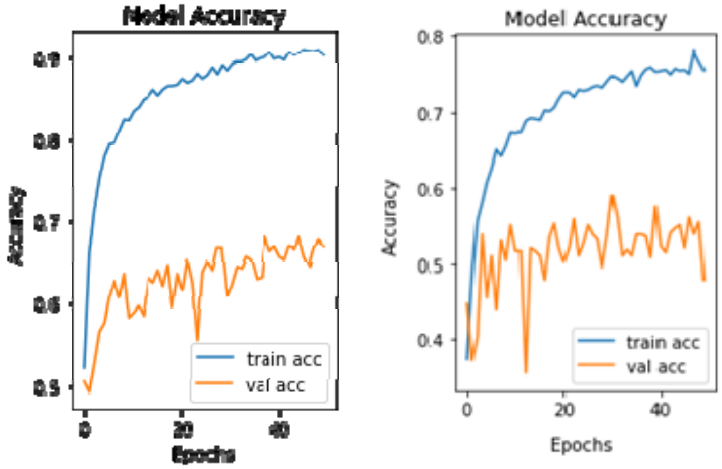


Fig. 7. The proposed dataset images in number.

These three segments are divided for gathering and investigating the relevant network for stroke patient use. will publish these images publicly on our website for future research use. These introduced new dataset images were not



(a) Proposed network model's accuracy



(b) VGG16 (left) and VGG19 (right) network model's accuracy

Fig. 8. Network model accuracy comparison.

The total number for the newly introduced dataset consists of 4860 images. Later, after getting the registration of our institution, we intended to be used only for rehabilitation but could also be utilized in various research fields.

Experimental Results

We conducted experiments based on several settings to present the model's effectiveness for recognizing the Malay language vowel for stroke patients using all vowels /a/ to /o/. The simple batch size is set to 4 images and epoch size is set to 50 epochs. The proposed network model which we proposed is compared to the VGG16 and VGG19. All the conducted experiments using the Google Colab by Google Inc with a free account require plenty of time to finalize the result.

Comparison analysis with another network model (accuracy %) from graph and overall analysis

In the first comparison analysis, all the network models were compared with training, evaluation, and testing accuracy aspects. Figure 8 shows the training accuracy for the length of 50 epochs size. Based on the figure, we understand that the proposed network model outperformed other comparative network models by 90.12%.

Table 1 shows the training, evaluation, and testing accuracy for all the comparative network models with the proposed network. The proposed network model outperforms all the two comparative models in all aspects. The testing accuracy is evaluated by using the 486 images across all the 6 classes of the Malay language vowels.

Table 1: Network model accuracy comparison in the training, evaluation, and testing

Network Model	Accuracy Percentage (%)		
	Training Accuracy (%)	***Validation Accuracy (%)***	***Testing Accuracy (%)***
Designed	**100.00**	**90.12**	**78.00**
VGG16	92.21	66.78	24.00
VGG19	70.42	47.94	23.00

Comparison analysis with another network model (accuracy %) using confusion matrix

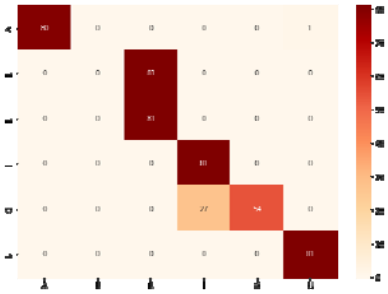
We then analyzed the testing images with the confusion matrix accordingly. Six vowels for the true class are in the columns, while the rows indicate the six classes for the prediction. Based on Figure 8, the proposed network model presents a vast and reliable network to be used as a classifier for vowel recognition. In Figure 8 (a), the proposed network model managed to classify all the vowel correctly. For the second class, vowel /e/ was not classified by the model. However, in overall, the proposed network model is comparable with another network model for all vowels in the Malay language.

Conclusion and Future Works

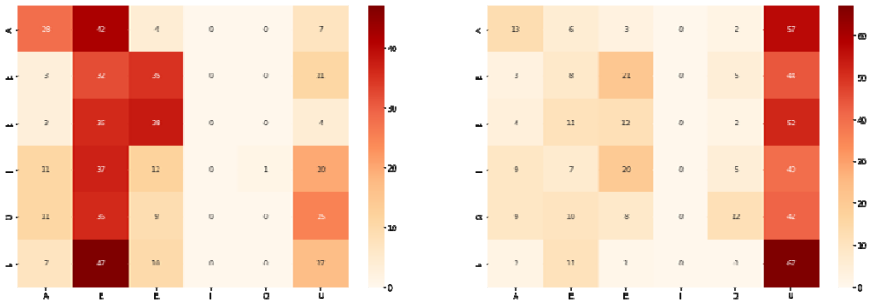
We designed a fit and reliable network model for the stroke patient purpose rehabilitation activities. The paper's contribution could help the rehab centre deliver more systematic and intelligent rehab activities for ensuring people with stroke pronounce more clearly after attending the rehab sessions. We trained and evaluated all the six Malay language vowels with the new proposed dataset images by utilizing a simple CNN model. In overall testing analysis, the proposed network model manages to classify vowels correctly with the testing images. We expected to do more analysis with the wave signal captured and recorded from the real stroke patient for future work. The study on post-vowel analysis is also considered our future work in giving more knowledge to this field and benefit the rehab centre.

Acknowledgement

The authors would like to thank Perkeso Rehab Center, Melaka for the Research Project Collaboration, and Universiti Teknikal Malaysia Melaka for the financial support through PJP/2020/FKEKK/PP/S01792.



(a) Proposed network model's confusion matrix



(b) VGG16 (left) and VGG19 (right) network model's confusion matrix

Fig. 8. Confusion matrix for all the Network model.

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DIGITAL MEDIA AND THE EXISTENCE OF PRINT MEDIA IN INDIA

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ABSTRACT

Internet has certainly established itself as a platform for news consumption in India. People are getting more attracted towards the digital media but, print media is still very ingrained in the reader's collective memory. This means that people still willing to read print media. Various Survey reports demonstrate that print media are still an important component of the new communication environment among Indian audiences. Digital media are attractive and having more features than print, but still people believe in printed material than online publication. It's true that Influences of digital media are increasing, but surveys reported that print is not going anywhere.

Introduction

Experts say that our media market is shifting towards the digital market and revenues from digital market are increasing. There are market challengers of the print media that tries to capture the attention of readers.

Firstly, here we define the print media; It is a medium that disseminates printed matter (Dictionary.com). It includes magazines, newspapers, brochures, catalogues etc. Any form of print that reaches a large audience would be referred to as print media. Digital media can be defined as digitized content that can be transmitted over the internet or computer networks. Online magazines, newspapers, social media are examples of digital media (BusinessDictionary.com).

The rapid widespread influence of the digital media in market has left a question that "Is the print media gradually dying". Even some businesses have focused their advertising target efforts merely online. Why its happening, because of digital media can be interactive in several ways. A promotion on digital media allows for business developer to communicate directly with consumers. They have many options as quick messaging, commenting, wall posting, tweeting and other method to get feedback. But it doesn't mean that print media is gradually dying. As the internet grew over the last two decades, it has emerged as a powerful platform for news. The decline of the print has become a global phenomenon. But in India, with 110 million copies sold every day, is the second largest market for newspapers, second only to China.

The print media is foundation of print technique in the world, which later developed to digitalized form.

Though the ages, the significance of print media has slightly reduced, however the importance still remains the same as back in the ancient time. The popularity of certain print journal in the past, such as "Excursion to Scotland,1832". Clearly shows that despite digital media being the most preferred form of media in the 21st century' Print media still has its sound roots in 21st century media culture.

While digital is growing big and a lot of people feel that it is a threat to print, the media owners are not looking troubled by the thought. The world is preparing for coexistence.

Reports favors to Print media:

According to Sashi Sinha, CEO, IPG, Media brands, "There is a new medium coming in and everyone thinks that it is fashionable to come under digital, which is good. But this medium (print) is growing, it's robust."

As Sinha concludes, India is the only market in the world where print continue to be dominated and is growing all aspects as circulation, readership and geography, Sinha pointed out that daily newspapers are the backbone of this industry as 5.6 crore out of the total 6.2 crore copies per day is coming from the newspapers. He explained why the overall growth of 4.87 per cent is huge, "The base of print is very big and a growth of 4.87 is huge on a base of 3.91 crore. The industry might

also double in the next seven to eight years. The ad revenues for TV and print currently stand very neck and neck at about Rs 201.2 billion, as per the KPMG report."

Sivakumar Sundaram, president – revenue, at Bennett Coleman & Co (BCCL), said that the impact of print is much higher as it allows for discoverability of ads and is the most non-intrusive ad medium. Also, higher quality of engagement and quality of the audience gives it power to influence and drive change,"

As per the Economic time of India's report, print media ad revenues grew 5.6% in 2018 to Rs 22,121.8 crore, and it is expected to go up to Rs 22,424.3 crore in 2019.

Print media is growing in India despite its decline in all the other markets, says the Audit Bureau of Circulation's (ABC) latest report.

Girish Agarwal, Non-Executive Director, Dainik Bhaskar, said, "Still, today, among the people who can read and those who actually read a newspaper, there is a gap of about 50 per cent, which tells us about a lot of scope. Add to this, the literacy rate, which will only go up. These will boost the industry further."

If we look it at world level, according to a recent **online survey conducted by Ipsos (www.ipos.com)** on behalf of Canon, adults are most likely to say that if printed materials no longer existed it would make them feel sad (47%). Only 5%, in comparison, say that they would feel happy and very few (1%) would feel relieved. One in five would feel unsure (22%) if print medium no longer existed, while at least one in ten would feel indifferent (14%).

Fewer say that the extinction of the print medium would make them feel anxious (6%) or overwhelmed (4%). • Women (50% vs. 43% of men), adults over the age of 55 (55% vs. 39% of those age 18-34), and those with a household income of at least $100,000 (53% vs. 44% of those earning less) are among the most likely to say they would be sad if printed materials no longer existed. Two thirds believe that print will eventually be phased-out and digital will rule (64%).

Registrar of Newspapers in India (RNI) released data that on 31st March, 2018 there were 1,18,239 registered newspapers in India, while in 2006-8 registered newspapers were 62,483. According to RNI 2018, Newspapers category were 17,573 and Periodicals category were 1,00,666. The numbers of new publications registered during 2017-18 were 3,704 and percentage of growth of total registered publications over the previous year were 2.98% (RNI 2018).

The important factor is also that availability of vernacular languages in Print Media. The internet in India still remains pre-dominantly English. People still prefer newspapers for content in vernacular languages. Indian readership survey says that 90% of people in India still read news in vernacular languages. If the internet affects the print, it hits the print harder, as The English newspapers growth in India has slowed down to 3.5% annually while the vernacular medium is high at 10% annually. This is basically because the English news consumers live generally in the cities. This population usually stays in the small towns and villages of India.

Some other reasons that appreciate print media

- Print Media is tangible or One can touch, paper
- Print media provide more credible and verified information
- It is more prestigious
- Print media is Traditional
- It is Eye-friendly, offers more aesthetic sensation
- More transparent than the on-line surface on monitor
- Print media can be read anywhere.
- While using print media no need for personal computer or access to the internet.

TOTAL READERSHIP :

S.N	Publication	IRS 2017	IRS 2019
1	Dainik Jagran	70377	73673
2	Dainik Bhaskar	45105	51405
3	Amar Ujala	46094	47645
4	Lokmat	18066	19691
5	Punjab Kesari	12232	12657
6	Rajasthan Patrika	16326	18036
7	The Times of India	13045	15236
8	Malayala Manorama	15999	17477
9	Eenadu	15848	15673
10	Prabhat Khabar	13492	14102

Fig in 000s (urban + rural) (Source – Indian readership survey report)

Statistics of vernacular newspapers in India:

S. No.	Newspaper	Language	Circulation (Daily)
1	Dainik Jagran	Hindi	3,410,026
2	Hindustan	Hindi	1,989,117
3	Dainik Bhaskar	Hindi	4,320,781
4	AnandaBazar Patrika	Bengali	1,075,057
5	Punjab Kesari	Hindi	1,159,489
6	Rajasthan Patrika	Hindi	3,513,756
7	Amar Ujala	Hindi	2,067,253
8	The Times of India	English	2,640,770
9	Malayala Manorama	Malyalm	2,372,25

Source: Audit Bureau of Circulations (ABC) (as of July–December 2018)

Discussion

The main finding of our study is that print media still constitute an important component of the new communication environment for people. More than half of the population reads print publications. According to Indian readership surveys readers are increased in 2019 comparatively 2017. Availability of vernacular languages in Print Media are also reason of its existence. According to RNI 2018 the number of new publications registered during 2017-18 were 3,704 and percentage of growth of total registered publications over the previous year were 2.98%. According to Epsos report 47% people would feel sad if print medium no longer existed. According to **Sivakumar Sundaram, president – revenue, at Bennett Coleman & Co (BCCL),** the impact of print is much higher as it allows for discoverability of ads and is the most non-intrusive ad medium. **According to Sashi Sinha, CEO, IPG, Media brands**, India is the only market in the world where print continue to be dominated and is growing all aspects as circulation, readership and geography. So our findings demonstrate that readers are not giving up print media so easily. Readers still favor some specific features of print like the smell and touch of paper.

Conclusion

Based on facts and surveys it can be concluded that despite the emergence and strengthening of digitalization certain consumers still insist on print media. Due to its tangibility and prestigious position people prefer print medium.

Survey's reports say that even wide spread use of digital media in India people are still liking print media. But we can't ignore the digital platform. It will be better for the Indian print medium to start working on its strengths and tackle the Internet's threat.

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DISCUSSING PHASES AND MODELS OF SOFTWARE DEVELOPMENT LIFE CYCLE

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ABSTRACT

When software is not built according to the standards and procedures that must be followed in software development, a company or organisation may be on the verge of failure. An approach known as the software development life cycle (SDLC) can be found in several of the standards. To avoid failure, it is critical that software adhere to certain software life cycle processes. In order to create high-quality software, the software development life cycle is critical. This study looked into software management methods that looked into the field of software development through development models, also known as the software development life cycle. Methodologies for the Software Development Life Cycle (SDLC) are procedures for ensuring that software meets established requirements. There are many types of SDLC models, which have their advantages and disadvantages and will work as per their needs.

Keywords: *Phases, Models, Cycle, Software, Development.*

Introduction

Software Development Life Cycle (SDLC), is a well-defined, systematic series of steps in software engineering that leads to the development of the intended software product. SDLC stands for Software Development Life Cycle. Although the concepts are similar, one refers to the life-cycle of software, while the other refers to the life-cycle of a system that includes software development. Although the focus of this essay is on software development, the same principles may be applied to systems. In addition, software development has provided the majority of the innovation and thought leadership in terms of developing models and concepts, and systems development has extensively borrowed from software development as a result.

SDLC is a conceptual framework or process that evaluates the structure of the steps involved in the development of an application, from its initial feasibility study to its deployment and maintenance in the field. Several models exist to describe different approaches to the SDLC process. The phases that are followed within the life-cycle framework are typically described using an SDLC model. It's important to remember that a model differs from a methodology in that the former merely outlines what to accomplish, whilst the latter also explains how to achieve it. A technique is prescriptive, whereas a model is descriptive. As a result, in this article, we look at SDLC models in terms of their applicability to specific types of software projects. SDLC Cycle represents the process of developing software. Below is the diagrammatic representation of the SDLC cycle:

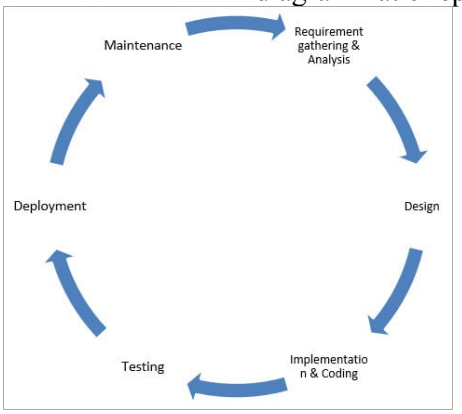

Figure 1: Diagrammatic representation of the SDLC cycle

SDLC models can also be divided into three categories: linear, iterative, and a hybrid of linear and iterative models. A linear model is a sequential one in which the completion of one stage triggers the start of the following level inexorably. An iterative model, on the other hand, ensures that all stages of the model will be revisited in the future, with the premise that

development is a continuous process of improvement throughout its existence. The iterative development process can be terminated at any point, according to a combination model. Despite the fact that there are a plethora of SDLC models available, we will focus on the most significant or popular ones. The waterfall, spiral, unified, incrementing, rapid application development, and v models are among them.

Phases in SDLC

A software lifetime contains multiple phases, which are listed below:

Requirement Phase

The Requirement Phase is the first and most important step in the Software Development Life Cycle. Gathering needs from consumers or clients is the first step. Business Analysts are responsible for this position in the majority of firms. A Business Analyst engages with customers and clients, schedules daily meetings, documents needs in Business Requirement Specifications (or Simple Business Specifications), and passes the final document to the development team. Business analysts are responsible for ensuring that every detail is recorded and documented, as well as ensuring that everyone understands the client's requirements.

Analysis Phase

Analysis Phase: Project Managers, Business Analysts, and Consultants are primarily responsible for this phase.

Design Phase

After the Analysis Phase is completed, the following step is to design the most accurate, resilient, efficient, and cost-effective architecture for the product to be developed. Typically, multiple designs are offered at this phase, and the best one is chosen based on various criteria such as robustness, durability, timeliness, cost-effectiveness, and more! Design Document Specification, or DDS, is used to document the various design architectures. There are two design approaches at this phase:

- Low-Level Design: Senior Developers undertake low-level design, in which they specify the role of each module of the product architecture that must be produced.
- High-Level Design: Architects/Senior Architects are in charge of this activity, which entails designing various feasible architectures for the product that needs to be built.

Development Phase

The development phase is where the real implementation of programming languages and frameworks for the development of the product takes place. All developers are active in this phase. Developers are expected to adhere to set coding standards and norms, as well as to complete project modules within the project's defined timeframe. In the Software Development Life Cycle, this phase is also the longest and one of the most important. A Source Code Document is used to document this phase (SCD).

Testing Phase

Testing Phase: The generated software is forwarded to the testing team, who extensively test the software and look for faults. If a defect is discovered, the testing team documents it and sends it back to the development team for correction. The company's Software Testers and Quality Analysts are in charge of this function. The testing team must ensure that each component of the software is free of errors and functions properly.

Deployment and Maintenance Phase

Following the testing phase, the initial version of the software is deployed and delivered to the customer for use. When the customer begins to use the built software, there is the possibility of bug fixing that was not found during the testing phase, as there is a chance that a few boundary instances may have been missed when a big group of end users begins to use the software. Upgrades to newer versions of the software, as well as the newest security patches and technologies, are also possible. Finally, there is potential for the software to be improved by adding new capabilities to the present software.

Models of the SDLC

The following are the most widely used SDLC models in the industry:

1. V-Model

The V-model is an SDLC paradigm in which processes are executed sequentially in a V-shape. The Verification and Validation model is another name for it. The V-Model is built on the association of a testing phase for each relevant development step, and it is an extension of the waterfall model. This means that each phase of the development cycle has a testing phase that is directly linked to it. The testing phase of the development phase is planned in parallel under the V-Model. On one side of the 'V,' there are Verification phases, and on the other side, there are Validation phases. The Coding Phase connects the V-two Model's halves.

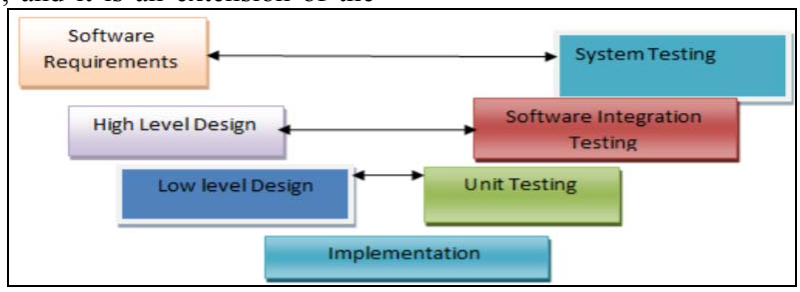

Figure 2: - V-Shape Model

2. Waterfall Model

The Waterfall Model is a sequential flow that follows a linear path. In which software implementation progress is seen as flowing steadily downwards (like a waterfall) through the phases. This indicates that any step of the development process can start only after the previous one has finished. The waterfall approach was the first and most frequently utilised approach for software development.

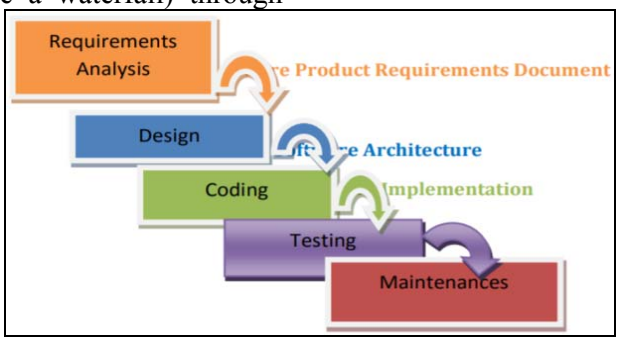

Figure 3: -Waterfall Model

3. Iterative Model

It was created to address the flaws in the waterfall model. It begins with preliminary planning and concludes with development, with cyclic interaction in between. It could be a little V-shaped model. It is employed in shrink-wrapping and huge systems that are constructed in small portions. It can also be utilised in a system with independent components, such as an ERP system. As a first iteration, we can start with the budget module, and then go on to the inventory module.

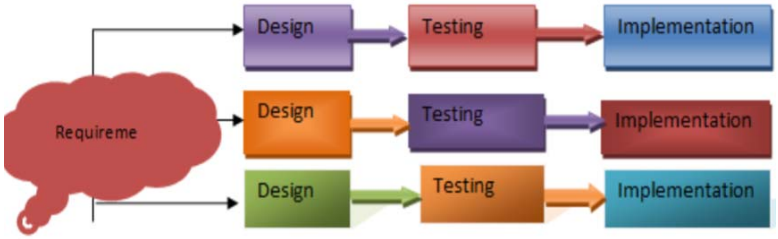

Figure 4: - Iterative Model

4. Prototype Model

The prototype model is one in which a prototype is created before the actual software is created. When compared to the actual software, prototype models have restricted functional capabilities and inefficient performance. Prototypes are made with dummy functionalities. This is a useful tool for determining what customers want.

To obtain important feedback from customers, software prototypes are produced prior to the actual software. Customer feedback is implemented, and the prototype is re-evaluated for any changes. This process continues until the buyer approves the model.

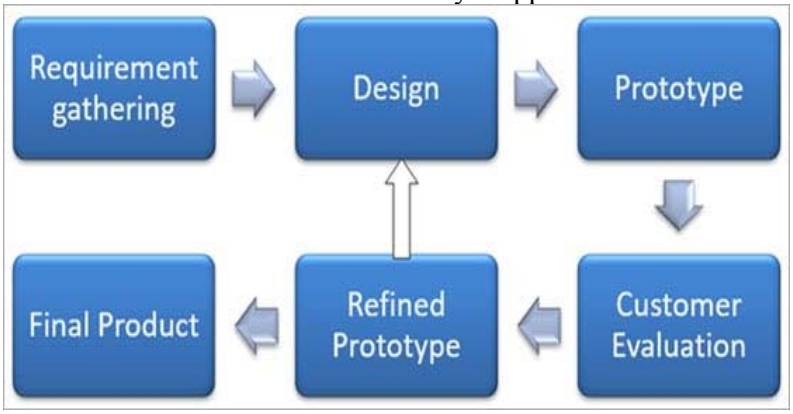

Figure 5: - Prototype Model

After gathering requirements, a rapid design is made, and a prototype is built to present to the customer for evaluation.

Customer comments and the improved need are combined to alter the prototype, which is then submitted to the customer for review. The prototype is utilised as a prerequisite for producing the actual software once the customer approves it. The Waterfall model is used to create the real software.

5. Spiral model

The spiral model is one of the most prominent Software Development Life Cycle models for risk management. It resembles a spiral with several loops in diagrammatic depiction. The spiral's exact number of loops is unclear, and it varies from project to project. A Phase of the software development process is defined as each loop of the spiral. Because it encompasses all other SDLC models, the Spiral model is referred to as a Meta Model. The Iterative Waterfall Model, for example, is represented by a single loop spiral. The spiral model integrates the Classical Waterfall Model's progressive technique. As a risk management tool, the spiral model employs the Prototyping Model, which entails developing a prototype at the start of each step. The spiral model can also be thought of as a support for the evolutionary model, with iterations along the spiral serving as evolutionary layers upon which the entire system is created.

6. Big Bang Model

There is no clear process for the Big Bang Model. Money and effort are combined as inputs, and the result is a developed product that may or may not be the same as what the consumer requires.

The Big Bang Model does not necessitate extensive planning or scheduling. The developer analyses and codes the requirements and produces the product according to his understanding. This type is only suitable for modest jobs. There is no testing team, and no formal testing is done, which could lead to the project's collapse.

7. Agile Model

The Agile Model combines the Iterative and Incremental approaches. Rather of focusing on the requirement, this paradigm emphasises flexibility when designing a product.

A product is broken down into small incremental builds in Agile. It is not created as a whole product all at once. In terms of features, each build improves. The following version is based on the previous version's features.

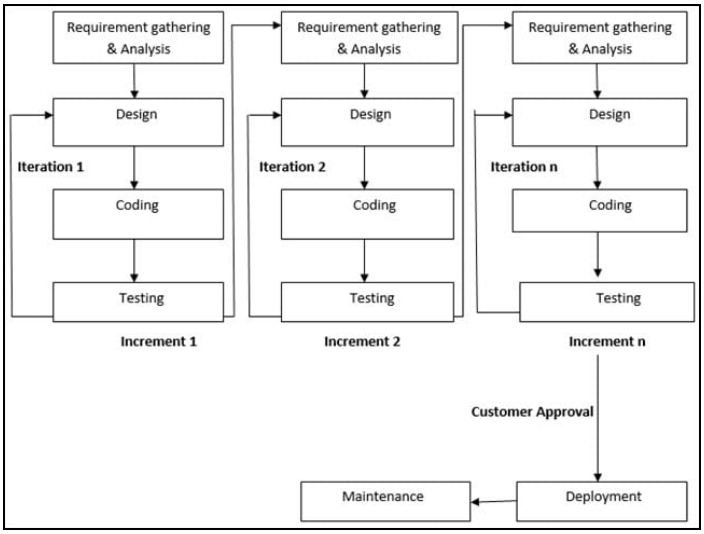

Figure 6: - Prototype Model

Sprints are the agile name for iterations. Each sprint lasts between two and four weeks. The product owner verifies the product at the end of each sprint, and following his approval, it is sent to the customer.

Customer input is gathered in order to improve the product, and his ideas and enhancements are implemented in the following sprint. Each sprint includes testing to reduce the risk of failure.

Conclusion

An approach that governs the entire development process is known as the Software Development Life Cycle (SDLC). Various software development life cycle models, such as waterfall, spiral, iterative, prototyping, and V-shaped models, are investigated in this research. Other development models can be built on top of the Waterfall model.

The primary premise is that intelligence (human or otherwise) can be represented using symbol structures and symbolic processes that can be programmed into a digital computer. There's a lot of disputes over whether such a properly programmed computer would be a mind or just simulate one, but AI researchers don't have to wait for the answer to that question, or for the hypothetical computer that could replicate all of human intelligence. Aspects of intelligent behaviour, such as problem solving, inference, learning, and language comprehension, have already been implemented into computer programmes, albeit in relatively narrow contexts, such as diagnosing soybean plant illnesses.

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