COVID & MULTIPURPOSE DRONE

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Abstract

SARS-CoV-19 is one of the deadliest pandemics the world has seen and has claimed an estimated 5,049,374 lives globally and 459,873 in India so far. Many countries have implemented many security measures to limit its spread. Although vaccines are now available, face mask identification and social distancing are key aspects of preventing this pandemic. Therefore, the authors proposed a real-time surveillance system that would take a video stream and check whether the people identified in the video are wearing a mask. This study continues to track people's social distancing norms. The World Health Organization WHO recommends using a face mask and practicing physical distancing to prevent the spread of the virus. The Australian Defense Department is investigating the creation of drone platforms for health and respiratory monitoring of COVID-19 for blood monitoring and the detection of infectious and respiratory conditions, including temperature, heart and respiratory rate monitoring of crowds, workforce, airlines, cruise. ships, potential risk groups such as the elderly in care facilities, conference centers, border crossings, or critical infrastructure facilities. Mandatory masks and social distancing ensure constant checking and monitoring and a constant reminder to offenders. To make the task easier, we design a drone that can easily patrol long distances and enforce social distancing and mask use in public places. Our specially designed drone uses a controller-based circuit system combined with a 4x High PPM quadcopter motor for easy navigation and control. RC control ensures long-distance flight. FP camera equipped with a transmitter to send live footage. Loudspeaker and audio receiver to remotely scold/warn criminals with a drone as soon as they are spotted. The drone can be used to remotely monitor for COVID-19 restriction violations and issue warnings through loudspeakers. This will help in easy monitoring/patrolling of large areas /long streets by the use of drones.

Introduction

Coronavirus disease (COVID-19) is a transferable illness that has recently been identified This infection was unfamiliar before the occurrence of the Wuhan chain in December 2019 and within eight months (by August 2020), over 24.0 million persons are infected and over 824,162 have died. COVID-19's most commonly recognized symptoms are fever, tiredness, and dry cough and some of the people suffered from throbbing pain, nasal clog, runny nose, sore throat, or diarrhoea

The old people with medical conditions such as hypertension, heart issues, or diabetes are enduring with illness; individuals with fever, cough, and trouble breathing should seek immediate medical care. This virus spreads between people during close contact, i.e. at a minimum distance of one meter (3 ft), through small beads during hacking, sniffling, or talking . These beads are delivered during exhalation, usually falling to the ground or to the surface instead of being contaminations over long distances . The virus can survive up to 72 hours on most surfaces. Recommended protective measures include hand washing, closing the mouth while hacking, keeping away from others, observing, and self-isolating of persons associated with being infected.

This led to usage of transportation restrictions, isolations, lockdowns, stay at occupational risk assessments and the closures of facilities. Corona virus has evolved as a significant global virus since 2002 in different forms affected thousands of people in multiple countries.

Drone-based COVID-19 health and respiratory monitoring platforms creation is being explored by the Australian Department of Defence for health monitoring and detection of infectious and respiratory conditions including monitoring temperatures, heart and respiratory rates, amongst crowds, workforces, airlines, cruise ships, potential at-risk groups, i.e., seniors in care facilities, convention centers, border crossings or critical infrastructure facilities . 'Drone' a term usually used for an air vehicle that flies like other aviation craft (airplane/pilot) but with a difference of pilot. Traditional aircraft are timely operated by pilots (Autopilot mode is no distinct), this is what makes drone different.

Under condition when an unmanned aerial vehicle is in aerospace, it is termed as "Platform". When external hardware or embedded systems are implemented to it is termed as "Payload". Attaching payload to platform results in a drone that can be used in various applications with increased efficiency and accuracy

In ,it is found that drones are widely used in the present COVID-19 pandemic. It is used for monitoring, vigilance, thermal scanning, medication, food supply, alter system etc. In their use, data collection centralization and analysis is a major challenge

The features of present drone-based systems can further be enhanced by integrating the features of measuring social distancing, COVID-19 monitoring, and data collection using artificial intelligence (AI), thermal imaging, sanitization with data analytics, record keeping etc. Understanding the necessity and requirements of drone-based system enhancements for the smart healthcare system.

This work starts with reviewing the necessity to design, develop, simulate, and implement a drone-based healthcare system for COVID-19 scenario. In consideration of existing drone-based systems and their features, a drone-based system suitable for COVID-19 or other influenza viruses' pandemic situation is proposed

The proposed approach integrates artificial intelligence processes for data collection, analysis, statistical visualization, sharing, and decision-making. In this work, both simulation and real-time implementation are carried out for COVID-19 operations (sanitization, medication, monitoring, thermal imaging, etc.). In the real-time drone-based implementation, a drone is designed, developed and tested for COVID-19 operations in the Delhi/NCR, India with the approval of government authorities.

In the simulation, multiple drone scenarios are considered for COVID-19 operations. Further, multiple drones collision-resistant strategies and their COVID-19 operation in outdoor and indoor activities are proposed and experimented for evaluations. We observed that the drone-based approach can cover a wide area in a short duration and it is an effective approach in pandemic situations and indoor patient statistics.

The rest of the paper is organized as follows. Section 2 presents the start-of-the-art over drone-based systems, COVID-19, drone-based movement tracking systems, and usage of drone-based systems in healthcare. Section 3 presents the proposed drone-based architecture for the smart healthcare system using artificial intelligence processes, fog, edge, and cloud computing services. Section 4 presents the collision avoidance algorithms used in drones' network. Section 5 presents the real-time drone-based evaluation scenario along with a simulation approach for proposed drone-based system for various COVID- 19 operations. Finally, the paper is concluded in Section 6 along with presenting open challenges and promising new research directions.

I. Ease of Use

The ease of use of drones has emerged as a critical factor influencing their adoption and integration across various industries. As drones transition from specialized tools to accessible technologies, understanding the factors that contribute to their usability is essential for maximizing their potential. This literature review explores the concept of ease of use in the context of drones, examining its importance, challenges, and implications for diverse stakeholders.

Ease of use encompasses a range of factors that influence the user experience, including simplicity of operation, intuitive controls, accessibility of features, and user-friendly interfaces. In the realm of drones, achieving optimal ease of use is crucial for democratizing access to aerial capabilities and empowering users with diverse skill levels to leverage this technology effectively.

This review aims to provide a comprehensive analysis of the various dimensions of ease of use in drone technology. It will examine existing research on user interfaces, control systems, and training methodologies designed to enhance the usability of drones across different applications and user groups.

Furthermore, this review will explore the role of technological advancements, such as automation, artificial intelligence, and remote sensing capabilities, in streamlining drone operation and reducing the cognitive burden on users. By leveraging these technologies, manufacturers and developers can enhance the user experience and facilitate the seamless integration of drones into everyday workflows.

However, achieving optimal ease of use in drone technology is not without its challenges. Factors such as regulatory constraints, safety considerations, and the complexity of mission requirements can pose barriers to usability. Moreover, the diversity of end-users, ranging from hobbyists and enthusiasts to professional operators and first responders, necessitates tailored approaches to user interface design and training.

By synthesizing existing literature and best practices, this review seeks to provide insights into strategies for enhancing the ease of use of drones across different contexts. From consumer drones for recreational purposes to enterprise-grade UAVs for industrial applications, understanding and addressing user needs is paramount for realizing the full potential of drone technology.

In conclusion, ease of use plays a pivotal role in shaping the adoption, acceptance, and effectiveness of drones in diverse settings. By prioritizing user-centric design principles and leveraging technological innovations, stakeholders can overcome barriers to usability and unlock new opportunities for harnessing the power of drones in various domains.

A. Abbreviations and Acronyms

Definition of abbreviations and acronyms. - Importance of standardization and clarity in communication within the drone industry. - Impact of abbreviations and acronyms on technical documentation, research papers, regulations, and industry standards.

Historical development of key terms and concepts in drone technology. - Adoption of abbreviations and acronyms in military and civilian drone applications. - Transition from long-form terminology to standardized abbreviations for efficiency and clarity

Overview of commonly used abbreviations and acronyms in drone terminology, including: - UAV (Unmanned Aerial Vehicle) - UAS (Unmanned Aircraft System) - GPS (Global Positioning System) - RTK (Real-Time Kinematic) - BVLOS (Beyond Visual Line of Sight) - LOS (Line of Sight) - VLOS (Visual Line of Sight) - LiDAR (Light Detection and Ranging) - RGB (Red, Green, Blue) - EO/IR (Electro-Optical/Infrared) - GCS (Ground Control Station) - FAA (Federal Aviation Administration) - CASA (Civil Aviation Safety Authority) - EASA (European Union Aviation Safety Agency) - ASTM (American Society for Testing and Materials)

Units

- Definition of units and their role in standardizing measurements and specifications.
- Importance of consistent units in ensuring interoperability, accuracy, and safety in drone operations.
- Impact of unit conversions and compatibility on data analysis, communication, and decision-making in the drone industry.
- Historical development of unit standards and conventions in aviation and aerospace engineering.
- Adaptation of existing units and introduction of specialized units for drone-specific parameters (e.g., altitude, speed, payload capacity).
- Incorporation of international standards and regulatory requirements into unit conventions for drones.
- Emerging technologies and concepts influencing unit conventions in drone technology (e.g., metric vs. imperial units, SI units).
- Potential impact of advancements in sensor technology, data analytics, and artificial intelligence on unit standards and measurements.
- Considerations for adapting unit conventions to evolving drone applications, regulatory requirements, and industry practices.

Overview of commonly used units in drone specifications and measurements, including:

- Distance: meters (m), kilometers (km), feet (ft)
- Altitude: meters above ground level (AGL), feet above ground level (AGL)
- Speed: meters per second (m/s), kilometers per hour (km/h), miles per hour (mph)
- Weight: kilograms (kg), pounds (lbs.)
- Battery capacity: milliampere-hours (mAh)
- Power: watts (W), kilowatts (kW)
- Time: seconds (s), minutes (min), hours (h)

B. Equations

- Definition of equations and their significance in modeling, analysis, and design in drone technology.
- Role of equations in describing physical phenomena, flight dynamics, sensor measurements, and control algorithms.
- Impact of mathematical modeling and simulation on the development, testing, and optimization of drone systems.
- Historical development of mathematical principles and equations in aviation and aerospace engineering.
- Adaptation of classical mechanics, fluid dynamics, and control theory to drone-specific applications.
- Integration of sensor equations, navigation algorithms, and control laws into drone systems.

Overview of commonly used equations in drone technology, including:

- Kinematic equations for position, velocity, and acceleration.
- Dynamics equations for flight stability, control, and maneuverability.
- Sensor equations for GPS, IMU, altimeter, and camera measurements.
- Control equations for PID controllers, path planning, and trajectory optimization.
- Power and energy equations for battery life estimation and payload capacity.
- Signal processing equations for data filtering, fusion, and analysis.
- Challenges associated with the complexity and nonlinearity of equations in drone systems.
- Importance of accurate modeling, parameter estimation, and validation for reliable system behavior.
- Considerations for computational efficiency, numerical stability, and real-time implementation of equations in drone control and navigation.
- Role of simulation tools and software platforms in modeling and analyzing drone systems.
- Importance of experimental validation, flight testing, and data collection for verifying equation-based models and algorithms.
- Integration of simulation and validation processes into the drone development lifecycle.
- Emerging mathematical techniques, optimization algorithms, and machine learning approaches for drone systems.
- Potential impact of advancements in computational power, sensor technology, and autonomy on equation-based modeling and control.
- Considerations for addressing uncertainties, environmental factors, and dynamic interactions in equation-based drone systems.

C. Some Common Mistakes

- Introduction to the prevalence and significance of common mistakes in drone operation and maintenance.
- Overview of the structure of the literature review
- Failure to adhere to local, national, and international regulations governing drone operations.
- Misinterpretation of airspace restrictions, flight altitude limits, and prohibited areas.
- Inadequate knowledge of privacy laws, data protection regulations, and liability considerations.
- Inadequate training and certification of drone pilots, operators, and maintenance personnel.
- Lack of proficiency in flight maneuvers, emergency procedures, and troubleshooting techniques.
- Overreliance on automated flight modes without proficiency in manual control and situational awareness.
- Neglecting pre-flight checks, equipment inspections, and battery condition assessments.
- Failure to conduct thorough risk assessments, including weather conditions, airspace congestion, and environmental hazards.
- Inadequate contingency planning for emergencies, equipment failures, and loss of communication.

- Neglecting routine maintenance tasks, such as propeller inspection, motor calibration, and firmware updates.
- Failure to monitor battery health, storage conditions, and charging practices.
- Lack of proper storage, transportation, and protection of drones and accessories.

- Errors in sensor calibration, data synchronization, and georeferencing during data collection.
- Inadequate data processing techniques, leading to inaccuracies, artifacts, and incomplete analysis.
- Misinterpretation of data outputs, resulting in flawed decision-making and ineffective utilization of drone-collected data.
- Engaging in risky flight maneuvers, such as flying beyond visual line of sight (BVLOS) or overpopulated areas.
- Ignoring safety guidelines, airspace restrictions, and flight limitations imposed by drone specifications.
- Overestimation of pilot skills and capabilities, leading to accidents, collisions, and property damage.
- Failure to maintain accurate flight logs, maintenance records, and incident reports.
- Lack of transparency in reporting accidents, near misses, and safety incidents to relevant authorities.
- Insufficient documentation of flight operations, data collection methodologies, and data analysis procedures.
- Poor communication between drone operators, stakeholders, and regulatory agencies.
- Inadequate coordination with other airspace users, such as manned aircraft, airports, and emergency services.

II. Using The Template

Unmanned Aerial Vehicles (UAVs), commonly referred to as drones, have become integral tools in various industries, from aerial photography and filmmaking to agriculture and infrastructure inspection. However, along with their increasing popularity comes the prevalence of common mistakes in their operation and maintenance. This literature review aims to explore and analyse these mistakes, shedding light on their causes, impacts, and potential mitigation strategies.

One of the most prevalent mistakes in drone operation is the disregard for regulations and compliance. Many operators overlook or misunderstand local, national, and international regulations governing drone use, leading to inadvertent violations of airspace restrictions, privacy laws, and safety protocols. Failure to comply with regulations not only poses legal risks but also compromises safety and public trust in drone technology.

Inadequate training and experience among drone pilots and operators contribute significantly to operational errors and accidents. Many individuals lack proper training in flight manoeuvres, emergency procedures, and troubleshooting techniques, leading to mishaps and equipment damage. Moreover, the overreliance on automated flight modes without proficiency in manual control exacerbates the problem, highlighting the importance of comprehensive training programs for drone operators.

Another common mistake is the neglect of pre-flight planning and risk assessment. Failure to conduct thorough pre-flight checks, equipment inspections, and risk assessments increases the likelihood of accidents and incidents during drone operations. Inadequate contingency planning for emergencies, equipment failures, and adverse weather conditions further compounds the risks associated with drone flights.

Maintaining drones in optimal condition is essential for safe and reliable operation, yet many operators overlook routine maintenance tasks and proper care practices. Neglecting tasks such as propeller inspection, motor calibration, and battery maintenance can lead to equipment malfunctions and premature wear. Additionally, improper storage, transportation, and protection of drones and accessories increase the risk of damage and performance degradation.

Inaccurate data collection and analysis are common pitfalls in drone operations, undermining the reliability and effectiveness of drone-collected data. Errors in sensor calibration, data synchronization, and georeferencing during data collection introduce inaccuracies and artifacts into the dataset. Furthermore, misinterpretation of data outputs can result in flawed decision-making and ineffective utilization of drone-collected data for analysis and decision-making.

Engaging in risky flight practices and manoeuvres is another prevalent mistake among drone operators. Flying beyond visual line of sight (BVLOS), overpopulated areas, or in adverse weather conditions increases the risk of accidents, collisions, and property damage. Ignoring safety guidelines and airspace restrictions imposed by drone specifications and regulatory requirements jeopardizes not only the safety of drone operations but also public safety and privacy.

Maintaining accurate documentation and reporting of drone operations is crucial for accountability, compliance, and incident investigation. However, many operators fail to keep comprehensive flight logs, maintenance records, and incident reports. Inadequate documentation and reporting hinder the ability to track operational history, analyse trends, and address safety concerns effectively.

Effective communication and collaboration are essential for safe and efficient drone operations, yet they are often lacking among stakeholders. Poor communication between drone operators, regulatory agencies, and other airspace users can lead to misunderstandings, conflicts, and coordination issues. Furthermore, the failure to share information, best practices, and lessons learned within the drone community hampers collective learning and improvement efforts.

In conclusion, common mistakes in drone operation and maintenance pose significant risks to safety, compliance, and effectiveness. Addressing these mistakes requires a multifaceted approach, including improved education and training, enhanced regulatory compliance, and the adoption of best practices in pre-flight planning, maintenance, and data management. By identifying, understanding, and mitigating common mistakes, stakeholders can promote safer, more efficient, and more responsible drone operations across various industries.

A. Authors and Affiliations

- Analysis of authorship trends in drone research, including the number of authors per paper, collaboration networks, and interdisciplinary collaborations.
- Exploration of factors influencing authorship patterns, such as research funding, institutional affiliations, and geographical distribution.
- Identification of prolific authors and research groups contributing significantly to the advancement of drone technology.
- Examination of the types of affiliations represented in drone research, including academic institutions, research organizations, government agencies, and industry partners.
- Analysis of the distribution of affiliations across different regions and countries, highlighting hubs of drone research and innovation.
- Investigation of the role of affiliations in driving research agendas, funding priorities, and technology transfer in the drone industry.
- Exploration of collaboration networks among authors and affiliations in drone research, including co-authorship networks, joint publications, and research consortia.
- Identification of key partnerships and collaborations driving interdisciplinary research and technology integration in the drone ecosystem.
- Assessment of the impact of collaboration on research output, citation impact, and knowledge dissemination in the field of drone technology.

A. Identify the Headings

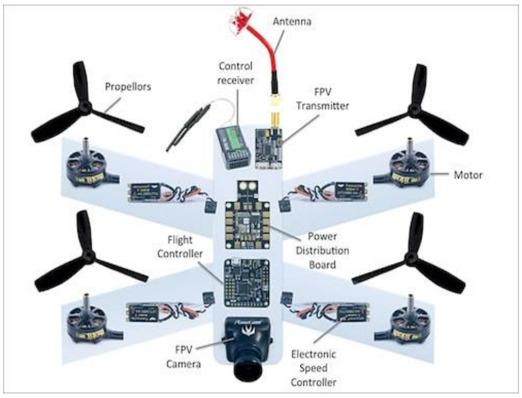
1. Introduction
2. Authorship Patterns in Drone Research
3. Affiliation Types and Distribution
4. Collaboration Networks and Partnerships
5. Emerging Trends and Future Directions
6. Conclusion

B. Figures and Tables

TABLE I
COMPARISON BETWEEN DRONES AND BLIMPS
CHARACTERISTICS

Characteristics	***Drones***	***Blimps***
Duration of flight	Between 20 and 30 minutes	Up to 8 hours
Reached heights	Maximum of 120 m	Maximum of 120 m without authorities' permission
Cost	400€ to 20.000€ (from online research)	$5.000 to$10.000 (from literature)
Permission	Depending on the weight, they can fly or not over people up to a minimum distance of 150 m	Requires permission from aviation authorities for heights above 120 m and in no-fly zones
Required operator	Pilot with license	Trained pilot.
Max speed	72 km/h	140 km/h
Risks	Collision with storage tools and humans	Minimal wounds during the phases of deployment and retrieval due to rope burns
Storage	Nominal requirements	Storage room

FIG NO. 1 DRONE DESIGN STRUCTURE



Conclusion

This paper proposed a UAV-based smart healthcare system for COVID-19 monitoring, sanitization, social distancing, data analysis, and statistics generation for the control room. Our framework gathers data by either through wearable sensors, movement sensors deployed in the targeted areas, or through thermal image processing. The data is processed through a multilayered architecture for analysis and decision-making. In multilayered architecture, edge computing controls the proposed drones' collision- resistant strategies. Whereas, fog and cloud computing techniques build commuters and patient profiles before making decisions. The proposed approach is demonstrated with implementation and simulation. In an implementation, it is observed that a large distance can be covered within a short period and the proposed drone-based healthcare system is effective for COVID-19 operations in Delhi/NCR regions. In the simulation, the proposed approach is tested for indoor and outdoor activities. Results show that a distance of 1200 kilometres can be covered in 2293 to 18 900 min with a variation of 3–30 drones. In an indoor activity, thermal image-based patient identification is found to be very effective for COVID-19 pandemic.

The simulation studies (Case-2 to Case-6) in the proposed drone-based smart healthcare system have limitations such as it considers the movement of drones in an ideal scenario. In the real-scenario, environmental conditions affects its movement and can change the statistics of its usage. Further, it is assumed that the drone used for indoor imaging and sanitization is compatible with its operations. In the real-scenario, a compact-drone is required for similar operations. Thus, compact-drone design aspects should be considered to analyse the real-facts.

References

1. Li L., Zhang Q., Wang X., Zhang J., Wang T., Gao T.L., Duan W., fai Tsoi K.K., Wang F.Y. Characterizing the propagation of situational information in social media during COVID-19 epidemic: A case study on Weibo. IEEE Trans. Compute. Soc. Syst. 2020;7(2):556–562. [Google Scholar]
2. Hopkins Skua N. Ent Uk; 2020. Loss of Sense of Smell As Marker of COVID-19 Infection; pp. 19–20. [Google Scholar]
3. Wu J.T., Leung K., Leung G.M. Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study. Lancet. 2019;395(10225):689–697. [PMC free article] [PubMed] [Google Scholar]
4. Dragonfly selected to globally integrate breakthrough health diagnosis technology immediately onto autonomous camera's and specialized drones to combat coronavirus (covid19) and future health emergencies. [Online]. Available: https://apnews.com/Globe%20Newswire/dc013 44350423d7d64c99eb be8fb7548.
5. Drones and the coronavirus: How drones are helping containment efforts. [Online]. Available: https://uavcoach.com/drones-coronavirus/.
6. Lum M.J., Rosen J., King H., Friedman D.C., Donlin G., Sankaranarayanan G., Harnett B., Huffman L., Doarn C., Broderick T., Hannaford B. Telesurgery via unmanned aerial vehicle (UAV) with a field deployable surgical robot. Stud. Health Technol. Inform. 2007;125:313–315. [PubMed] [Google Scholar]
7. D. CΩ AÂamara, Cavalry to the rescue: Drones fleet to help rescuers operations over disasters scenarios, 2014 IEEE Conference on Antenna Measurements and Applications, CAMA 2014, (2014), pp. 1–4.
8. Kim S.J., Lim G.J., Cho J., Cote M.J. Drone-aided healthcare services for patients with chronic diseases in rural areas. J. Intel. Robot. Syst., Theory Appl. 2017;88(1):163–180. [Google Scholar]
9. Graboyes R.F., Skorup B. Medical drones in the United States and a survey of technical and policy challenges. SSRN Electron. J. 2020 [Google Scholar]
10. C.F. Peng, J.W. Hsieh, S.W. Leu, C.H. Chuang, Drone-based vacant parking space detection, Proceedings - 32nd IEEE International Conference on Advanced Information Networking and Applications Workshops, WAINA 2018, vol. 2018- January, (2018) pp. 618–622.
11. Pirbhulal S., Wu W., Li G., Sangaiah A.K. Medical information security for wearable body sensor networks in smart healthcare. IEEE Consum. Electron.Mag. 2019;8(5):37–41. [Google Scholar]
12. Ullah H., Gopalakrishnan Nair N., Moore A., Nugent C., Muschamp P., CuevasM. 5G Communication: An overview of vehicle-to-everything drones, and health care use cases. IEEE Access. 2019;7:37251–37268. [Google Scholar]
13. R.W. Jones, G. Despotou, Unmanned aerial systems and healthcare: Possibilities and challenges, in: 2019 14th IEEE Conference on

Industrial Electronics and Applications (ICIEA), 2019, pp. 189–194.

14. Islam A., Young Shin S. A blockchain-based secure healthcare scheme with the assistance of unmanned aerial vehicle in Internet of Things. Comput. Electr. Eng. 2020;84:106627. [Google Scholar]
15. Sethuraman S.C., Vijayakumar V., Walczak S. Cyber attacks on healthcare devices using unmanned aerial vehicles. J Med Syst. 2020;44(1) [PubMed] [Google Scholar]
16. Tuli S., Tuli S., Tuli R., Gill S.S. Elsevier; 2020. Predicting the Growth and Trend of COVID-19 Pandemic using Machine Learning and Cloud Computing Internet of Things, vol. 11. [CrossRef] [Google Scholar]
17. Corona combat drone: Indian robotics solution launches corona combat drone to fight covid-19, government news, et government. [Online]. Available: https://government.economictimes.indiatimes.com/news/technology/i ndianrobotics-solution-launches-corona-combat-drone-to-fightcovid-19/75077517.
18. Drone technology: A new ally in the fight against COVID- https://www.mdlinx.com/internal-medicine/article/6767(Accessed 15 April 2020) Dr one Association of Kerala: Latest News & Videos, Photos about Drone Association of Kerala | The EconomicTimes.https://economictimes.indiatimes.com/topic/Drone-Association-of- Kerala (Accessed 15 April 2020).
19. Covid-19 lockdown: Authorities rely on drone eye to maintain vigil - The Economic Times.https://economictimes.indiatimes.com/news/politics-and-nation/covid-19- lockdown-authorities-rely-on-drone-eye-to-maintain-
20. Chiang M., Zhang T. Fog and iot: An overview of research opportunities. IEEE Internet Things J. 2016;3(6):854–864. [Google Scholar]
21. Wickramasinghe N., F T., Bodendorf R. Springer International Publishing; 2020. Delivering Superior Health and Wellness Management with Iot and Analytics. [Google Scholar]
22. Palossi D., Loquercio A., Conti F., Flamand E., Scaramuzza D., Benini L. A 64- mW DNN-based visual navigation engine for autonomous nano-drones. IEEE Internet Things J. 2019;6(5):8357–8371. [Google Scholar]
23. Hossein Motlagh N., Taleb T., Arouk O. Low-altitude unmanned aerial vehicles- based Internet of Things Services: Comprehensive survey and future perspectives. IEEE Internet Things J. 2016;3(6):899–922. [Google Scholar]
24. Pereira A.A., Espada J.P., Crespo R.G., Aguilar S.R. Platform for controlling and getting data from network connected drones in indoor environments. Future Gener. Comput. Syst. 2019;92:656–662. [Google Scholar]
25. Mohammad A., Al-Ali A., Mohamed A., Khattab T., Erbad A. RF-Based drone detection and identification using deep learning approaches: An initiative towards a large open source drone database. Future Gener. Comput. Syst. 2019;100:86– [Google Scholar]
26. Li Y., Lu H., Nakayama Y., Kim H., Serikawa S. Automatic road detection system for an air–land amphibious car drone. Future Gener. Comput. Syst. 2018;85:51–
27. Benedetti M.D., D'Urso F., Fortino G., Messina F., Pappalardo G., Santoro C. A fault-tolerant self-organizing flocking approach for UAV aerial survey. J. Netw. Comput. Appl. 2017;96:14–30. [Google Scholar]
28. Pace P., Aloi G., Caliciuri G., Fortino G. A mission-oriented coordination framework for teams of mobile aerial and terrestrial smart objects. Mob. Netw. Appl. 2016;21(4):708–725.
29. Whaiduzzaman M., Hossain M., Shovon A.R., Roy S., Laszka A., Buyya R., Barros A. A Privacy-Preserving Mobile and Fog Computing Framework To Trace and Prevent COVID-19 Community Transmission. 2020. arXiv preprint arXiv:2006.13364. [PubMed] [Google Scholar]
30. Gubbi J., Buyya R., Marusic S., Palaniswami M. Internet of things (IoT): A vision, architectural elements, and future directions. Future Gener. Comput. Syst. 2013;(7):1645–1660. [Google Scholar]
31. Lee K., Park J. Application of geospatial information of neighborhood park for healthcare of local residents. J. Med. Imaging and Health Inform. 2017;7(06):674– 679. [Google Scholar]
32. Ullah S., Kim K.I., Kim K.H., Imran M., Khan P., Tovar E., Ali F. UAV-Enabled healthcarearchitecture: Issues and challenges. Future Gener. Comput. Syst. 2019;97:425–432. doi: 10.1016/j.future.2019.01.028. [Online]. Available: [CrossRef] [Google Scholar]
33. Skorup B., Haaland C. How drones can help fight the coronavirus. SSRN Electron.