International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 04 | April - 2023 Impact Factor: 8.176 ISSN: 2582-3930

Ambulance Drone-*Saving Life One Step Closer*

Shweta Prasad[1], Prof. Kitty Tripathi[2], Mansi Nigam[3]

[1,3]*Undergraduate Student of Electrical Engineering Department Babu Banarasi Das Northern India Institute of Technology Lucknow, Uttar Pradesh-226028, India*

[2]*Dept. of Electrical Engineering Babu Banarasi Das Northern India Institute of Technology Lucknow, Uttar Pradesh-226028 India*

[1]shwetaprasad806@gmail.com

[3]rianigam833@gmail.com

***Abstract*— Every day, countless lives are lost due to delayed ambulance services reaching the scene of an accident. In response, this project is developing a prototype for a drone ambulance system that can assist traditional ambulance services in saving human lives. By providing a faster and more efficient response, this technology has the potential to significantly reduce the number of fatalities caused by delayed emergency medical services. According to research done by the Centre for Science and Environment (CSE), the average speed does not surpass 30–40 km/h 92% of the time during peak traffic hours. A drone ambulance system prototype is being created to give patients fast medical attention in response to the urgency of emergency circumstances. The drone can get to the scene sooner than a regular ambulance since it is fitted with sensors that can assess several health metrics including temperature, heart rate, and heartbeat. The sensors can be used by on-site observers or nearby professionals to diagnose the patient's status under the direction of paramedics. In order for the ambulance and medical staff to be ready to meet the patient's needs, the drone will relay the information to them. [1]**

***Keywords*— drones, emergency, lifesaver, patients, survival variable sensors , peak hour**

I. INTRODUCTION

One of the major challenges faced by emergency medical services is the delay caused by traffic congestion, especially in urban areas. This delay can have serious consequences for patients, particularly those in critical condition. Drones, being able to fly over obstacles and traffic, offer a promising alternative for emergency medical services, and could potentially save lives by reducing response times. [2] Emergency response times can be greatly impacted by traffic congestion, especially in densely populated locations with high traffic volumes. Drones can offer a speedier and more efficient mode of transport than regular ambulances in these circumstances. Drones can quickly reach the patient's location and bring them to the hospital or other healthcare facilities by avoiding traffic, which shortens reaction times and can even save lives. [3]

The COVID-19 epidemic has brought attention to the necessity for technology-supported health services, as conventional methods of providing healthcare have been discontinued globally to maintain societal distance [4]. Drones are being looked at more and more as a viable option to improve the effectiveness and capacity of healthcare practitioners to offer healthcare to people, especially those in hard-to-reach locations. [5] With the goal to assess the potential of drones to address medical-related problems, several kinds of studies have been conducted globally. The continent of Sub-Saharan Africa is home to a significant number of drone-use pilot programmes that support national healthcare priorities and initiatives. In order to provide safe and effective treatment during times of crisis or health epidemics, understanding the potential of established and developing IoT technologies, such as drones, is becoming more and more crucial. [6] By providing a quicker way to get vital care to those who need it, the use of drones in emergency medical response can help save lives. The time it takes for medical personnel to arrive on the scene may be shortened by the use of drones, which may rapidly and effectively reach remote or difficult-to-access sites. [7] Every moment counts in a critical situation, and drones can help shorten the time gap between an incident and medical attention. Drones with sensors can also gather crucial information about patient health and activity levels, enabling medical experts to plan effective treatments even before they get on the scene. The use of this technology might alter the way emergency medical services are provided and enhance patient outcomes. [8]

Additionally, drones can also be fitted with a variety of sensors, cameras, and other technology, enabling them to carry out a variety of operations in contrast to simple delivery and navigation. For instance, chemical sensors can be used to find hazardous chemicals in emergency circumstances, while thermal imaging cameras can be used to locate missing people and identify heat signatures. Some drones are capable of analysing data and make judgements on their own because they have artificial intelligence built into them. Drones are useful tools for a range of sectors and purposes, including agricultural, environmental monitoring, and search and rescue operations, thanks to these cutting-edge features. The potential applications

for drones are essentially endless as technology advances and becomes more sophisticated. [9]

In addition to measuring the victim's health indicators, it is utilised to fly to emergency situations. We employ heartbeat sensors, which provide a precise reading of the victim's heart rate. The patient's current body condition is assessed using a temperature sensor. If the condition is more serious, the doctor can notify the hospital well in advance so that they are prepared for the next stage in the patient's life-saving treatment. By analysing the patient's health parameters, the doctor in the ambulance can arrive prepared. [10] The use of drones for emergency response and medical delivery, which can send real-time patient data and carry supplies to remote or disaster-prone places. Given that it offers a more effective way to deliver healthcare, this technology can be especially helpful in underdeveloped nations or regions with weak infrastructure. [11] The drones are also ideally suited for emergency scenarios where conventional routes of transportation could be impractical due to their portability. Overall, the use of this technology in life-threatening situations has the potential to save a great number of lives by delivering quicker and more efficient medical care.

II. THEORETICAL BACKGROUND

The International Civil Aviation Organisation (ICAO) is a specialised division of the United Nations that creates and upholds guidelines and standards for sustainable, safe, and effective aviation. The ICAO definitions of a drone, an unmanned aircraft system, a remotely piloted aircraft system, and a remotely piloted aircraft are extensively recognised and utilised in the global aviation industry and regulatory frameworks. As these phrases have varied significance for the legal and practical facets of unmanned aviation, it is crucial to distinguish between them. [12] Drone use in medicine offers enormous potential to enhance healthcare delivery, particularly in difficult-to-reach places, disaster areas, and emergency situations. Drones can transport diagnostic samples, supply medical supplies, and offer telemedicine services to isolated regions. In order to provide prompt and life-saving interventions, they can also be utilised to swiftly convey medical professionals and equipment to emergency scenes and disaster locations. Drones are only just beginning to be used in medical, therefore there are still many obstacles to overcome, including legal frameworks, safety and security concerns, and public acceptance. However, there are enormous potential advantages of drone technology in healthcare, so it's critical to keep researching and creating cutting-edge solutions to enhance patient outcomes and access to care [13]

a) Use of Drone with IOT in Medicine

The Internet of Things (IoT) has the potential to revolutionize healthcare by enabling the continuous and remote monitoring of patients with chronic conditions, such as diabetes, hypertension, and heart disease. [3]-[7] IoT devices can collect real-time data on a patient's vital signs, activity levels, medication adherence, and other relevant parameters, which can then be transmitted to healthcare providers for analysis and intervention. This data can be used to identify trends, detect early warning signs of complications, and provide personalized treatment plans, which can ultimately improve patient outcomes and reduce healthcare costs. IoT devices can also assist patients in better managing their diseases by giving them feedback and reminders in real-time, simplifying communication with healthcare professionals, and encouraging self-care and lifestyle modifications. The rapid adoption of IoT in healthcare, however, also brings with it a number of difficulties, including interoperability, regulatory compliance, and data security and privacy. These issues must be addressed by healthcare professionals and governments in order to harness the promise of IoT for bettering healthcare outcomes [14]

III. INTERPRETATION AND ANALYSIS OF DATA

The data provided in this section demonstrates how Zipline Drone deliveries for medical supply chain management were implemented successfully in Rwanda. The country's difficult geography and subpar transportation infrastructure made the adoption inevitable. Drone delivery was found to be a more practical choice, particularly for emergency healthcare attendance, when compared to terrestrial transportation in terms of cost-effectiveness. In Rwanda's healthcare logistics management supply chain, Zipline drone deliveries have grown to be a significant component of commercial medical delivery. [15] The Zipline Company started operating in two supply centres in Muhanga in the middle of 2016, Rwanda's use of drones officially got underway.[16] The most economically feasible method of delivering medical supplies in Rwanda is via Internet of Things drone delivery because to the country's mountainous geography and subpar road system. Drones have been found to be more cost-effective than terrestrial transportation for delivering medical supplies, particularly in emergency healthcare scenarios. The lacklustre status of the nation's public transit system has led to Zipline Drone delivery becoming the favoured choice [17].

The Rwandan medical supply chain has been significantly impacted by Zipline's IoT drone delivery system, as demonstrated by this. The system has provided over 20,000 blood supplies and travelled over 1,000,000 kilometres. In addition, the fact that Zipline drones are being used to carry 65% of the blood in Rwanda shows how this technology is becoming more widely used in the medical field. Particularly in places with poor access to medical infrastructure and supplies, this

could enhance healthcare results and save lives. [18] The total number of hospital centres in Rwanda as of 2018 was 480, serving a population of 12.3 million people, spread across the five regions. The Eastern region had nine hospital canter's, Kigali City had eight hospital centres (including Military and Police Hospitals), the Western region had twelve hospital canter's, the Northern region had seven hospital centres, and the Southern region had twelve hospital centres [19].

***Table 1**. Zipline IoT Drone Medical distribution centres in Rwanda*

Country	**Delivery Centre**	**Location**	**Year**
Rwanda	Central district of the country	Muhanga	2016
Rwanda	Central district of the country	Kayonza	2018

b) Drones in Agriculture

Drones are used in agriculture for a variety of functions, including crop planting, disease detection, monitoring irrigation and water quantity, yield estimation, and deficit monitoring, in addition to delivering medical supplies. This is accomplished by utilising remote sensing technology, which makes it possible to gather information on numerous agricultural characteristics. The advantages of deploying drones for agriculture, such as enhanced effectiveness, lower costs, and better crop yields, are highlighted by Norasma et al. (2019).[20] Farmers may get up-to-the-minute information on the health of their crops by employing drones, which gives them the knowledge they need to manage their crops effectively. This could result in a more environmentally friendly and sustainable agricultural system by increasing crop yields, lowering water use, and using less pesticides and fertilisers.

c) Others

As a result of their adaptability and affordability, drones are used in a wide range of industries. From crisis management to healthcare, building to waste management, and even commercial photography, utility inspection, urban planning, wildlife conservation, geographic mapping, weather forecasting, mining, and law enforcement. Numerous uses of drones are currently being pursued. UAV use is also present in commercial photography and real-time monitoring of traffic flow on roads. UAVs are an excellent tool for a variety of applications because they can access difficult-to-reach places, deliver high-resolution data, and carry out operations with minimal risk to humans.

***Table 2**. Drone classification based on type, mechanism, application*

Type	**Applications of Drones**		
	Description	**Mechanism**	**Application**
Nano	Easily movable	Multi-rotor	Recreation
Micro	Operated at low altitudes.	Fixed body	Military spying task
Mini	Maintain line of sight between the ground and aircraft	Multi-rotor	Photography and cinematography
Small	Operated at low medium altitudes and longer loiter capabilities	Multi-rotor	Transferring goods and military services.
Tactical	Operated at high altitudes provide tracking and monitoring.	Fixed wing	Armed investigation target acquisition

IV. CONCLUSIONS

In the context of healthcare, drones are being used more and more frequently for a variety of tasks, such as illness surveillance, epidemiological research, and the observation of disaster sites and places with biological risks. Furthermore, they are employed in remote areas for telemedicine-based diagnosis, therapy, and mentoring. Drones have the potential to develop into reliable platforms for shipping medical goods like laboratory samples, medications, vaccines, emergency medical equipment, and patient transportation. Governments have put drone technology on the national agenda as they begin to recognise its potential. More study is required in fields including safety, business expansion, raising public knowledge, and engagement if we are to improve this technology.

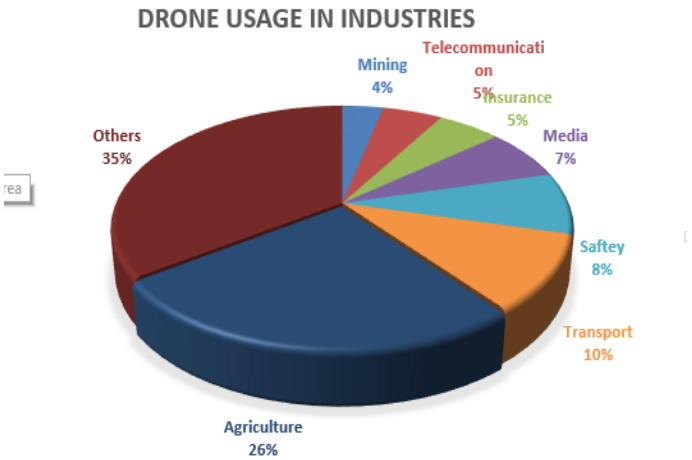

***Figure 1.** Pie Chart of drone usage in industries*

REFERENCES

[1] https://www.researchgate.net/publication/325686036_Medical_Drone_-_A_Life_Saver_in_Emergency_Situations
[2] DESIGN OF DRONE AMBULANCE Vangara Vamsi Krishna[1], Shivang Shastri[2], Shubhra Kulshrestha[3], Mrs. A. Mariajossy[4] SRM Institute of Science and Technology, Kattankulathur
[3] https://www.academia.edu/36679485/Drone_Ambulance_Support_System
[4] Zhang, C., Kovacs, J.M., 2012. The application of small unmanned aerial systems for precision agriculture: a review. Precis. Agric. 13 (6), 693–712.
[5] A. Josephin Arockia Dhivya, Dr. J. Premkumar, "Quadcopter based technology for an emergency healthcare," 2017 3rd International Conference on Biosignals, images and instrumentation (ICBSII), 16-18 March 2017.
[6] Rosser, J.C.; Vignesh, V.; Terwilliger, B.A.; Parker, B.C. Surgical and Medical Applications of Drones: A Comprehensive Review. JSLS J. Soc. Laparoendosc. Surg. 2018, 22, e2018.00018. Available online: http://www.ncbi.nlm.nih.gov/pubmed/30356360 (accessed on 25 February 2020). [CrossRef] [PubMed]
[7] Molfenter, T., Boyle, M., Holloway, D., Zwick, J.: Trends in telemedicine use in addiction treatment. Addict. Sci. Clin. Pract. 10(1), 14 (2015).
[8] https://www.researchgate.net/publication/325686036_Medical_Drone_-_A_Life_Saver_in_Emergency_Situations
[9] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6174005/
[10] https://www.scirp.org/(S(lz5mqp453edsnp55rrgjct55))/reference/referencespapers.aspx?referenceid=2710421
[11] Ayamga, M., Tekinerdogan, B., Kassahun, A., Rambaldi, G., 2020. Developing a policy framework for adoption and management of drones for agriculture in Africa. Technol. Anal. Strateg. Manag. 1–18. https://doi.org/10.1080/ 09537325.2020.1858047.
[12] ICAO, Doc. 2015. 10019, "Manual on Remotely Piloted Aircraft Systems (RPAS)" 2015. http://store.icao.int/products/manual-on-remotely-piloted-aircraft-systems-rpas-doc-10019.ICAO. 2011. Cir '328 AN/190', Unmanned Aircraft Systems (UAS) Circular.
[13] www.prnewswire.com/news-releases/osteopathic-emergency
[14] van Veelen, M.J., Kaufmann, M., Brugger, H., Strapazzon, G., 2020. Drone delivery of AED's and personal protective equipment in the era of SARS-CoV-2. Resuscitation 152, 1–2.
[15] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7198402/K. Kuru, "Planning the future of smart cities with swarms of fully autonomous unmanned aerial vehicles using a novel framework," IEEE Access, vol. 9, pp. 6571-6595, 2021.
[16] E. Ackerman and M. Koziol, "The blood is here: Zipline'smedical delivery drones are changing the game in Rwanda," IEEE Spectrum, vol. 56, pp. 24-31, 2019
[17] https://www.mdpi.com/2413-8851/2/1/22 A. K. Richmond, D. Malcomb, and K. Ringler, "Household vulnerability mapping in Africa's Rift Valley," Applied Geography, vol. 63, pp. 380-395, 2015.
[18] U. O. Matthew, J. S. Kazaure, O. Amaonwu, U. A. Adamu, I. M. Hassan, A. A. Kazaure, et al., "Role of Internet of Health Things (IoHTs) and Innovative Internet of 5G Medical Robotic Things (IIo-5GMRTs) and COVID-19 Global Health Risk Management and Logistics Planning," in Intelligent DataAnalysis for COVID-19 Pandemic, ed: Springer, 2021, pp. 27-53
[19] S. Pierre, "Determinants of Effective Development Aid In Africa: Examining the Impact of International Assistance in Rwanda," Howard University, 2015
[20] https://pubmed.ncbi.nlm.nih.gov/30980745/ Ling, G., Draghic, N., 2019. Aerial drones for blood delivery. Transfusion 59 (S2), 1608–1611