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DRONE AMBULANCE MEDICAL SYSTEMS

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ABSTRACT

By accelerating emergency medical response times, particularly in populated or isolated places, drones hold the potential to completely transform the healthcare industry. In addition to providing real-time video and data transmissions to doctors who can deliver medical samples and samples using drones, drone ambulances can quickly deliver medical supplies, defibrillators, and other life-saving equipment to patients. This reduces the time and associated costs associated with using traditional methods. But before drones and ambulatory medical systems become commonplace, a number of obstacles must be removed. Among these difficulties are: Safety: Drones need to be able to function safely in a range of settings, such as populated places, mountainous terrain, and inclement weather. Rules: Currently, there are a lot of laws governing drone operations, which might make it challenging to get the permissions required to operate both ambulances and drones. Public Acceptance: The security and privacy of drones used for medical purposes are issues that the public is concerned about. Notwithstanding these difficulties, drone ambulance and medical systems have a lot of potential advantages. These initiatives have the power to lower healthcare expenses, save lives, and enhance patient outcomes.

Keywords: Data Transmission, Real-Time Video, Medical Precedent, Model, Protection, Regulation, Public Acceptability, Defibrillators, Drones, Ambulances, Medical Systems, Healthcare, Emergency Response, Remote Locations, Crowded Surroundings, And Medical Equipment.

I. INTRODUCTION

Today's rapid autos and poor road conditions can make a traffic collision highly deadly. There are a lot of fatalities associated with traffic accidents. People pass away as a result of delayed access to medical care. It can be because there is a lot of traffic or a big region to cover quickly. Accidents can take many different forms; along the coast, attacks by sharks, jellyfish, or snake bites account for a significant number of fatalities. If the patient takes medication or an antidote within ten minutes of the poisoning, they can recover from any poisoning attack All of these issues can be resolved with the use of a drone or hexacopter. Hexacopters are aircraft that fly without human operators. Six brushless DC motors with propellers attached make up a hexacopter. The hexacopter is powered by a 4000mAh battery on average. he hexacopter is equipped with a dropping mechanism and a servo motor that enables it to select and drop the necessary medical assistance to the desired place. Because a hexacopter can easily carry a load of up to 2 kg and has six BLDC motors that create higher thrust, it is employed for this purpose. The medical box that the drone will deliver will arrive at the emergency site more quickly than an ambulance and be able to measure health parameters in real time. The measurement of temperature sensor, ECG, and heartbeat sensor are the various parameters [1]. The current drone ambulance can only target one parameter at a time in a medical emergency. Cardiopulmonary resuscitation (CPR) and an automated external defibrillator (AED) are both compatible with the current drone [2]. Individuals with respiratory conditions have access to oxygen.

Once more, though, the present system only looks at one parameter. The hexacopter prototype that is suggested in this research has a dropping mechanism that is connected to a servo motor and allows it to drop the medication package at the emergency site. The medication box can be modified based on the patient's needs, allowing it to target numerous emergency crisis criteria rather than just one. General emergency supplies like an ECG sensor, a temperature sensor, and heartbeat sensors can be kept in the medical box. Loads up to 2 kg can be carried by the hexacopter. The client's current values are available to the doctor. In order to prepare for the next procedure, the doctors might communicate with the hospital if the patient is seriously ill.

This system leverages drones equipped with medical kits and communication devices, allowing for the rapid deployment of first aid resources to accident sites, remote areas, or any location where traditional ambulances may struggle to reach promptly. By integrating IoT for real-time monitoring, drones can transmit vital patient data to emergency teams, enabling them to prepare for further treatment upon the patient's arrival at a healthcare facility. The goal of this project is to minimize emergency response times, enhance accessibility to critical care, and potentially increase survival rates in life-threatening scenarios. Through this approach, the

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Drone Ambulance and Medical Systems concept aims to transform emergency healthcare, illustrating how technology can address limitations in current systems and contribute to more resilient and responsive medical services.

Drones, or unmanned aerial vehicles (UAVs), are increasingly recognized for their versatility, speed, and ability to navigate complex terrains. This project builds on these capabilities by equipping drones with essential medical kits, real-time communication systems, and navigation technology, transforming them into autonomous, mobile medical responders. When an emergency call is made, these drones can be dispatched immediately to the specified location, equipped to deliver essential first aid supplies — including automated external defibrillators (AEDs), epinephrine injectors, and oxygen packs — to aid patients in critical need.

This innovative solution presents a unique model for integrating drones into healthcare systems, particularly in areas where access to emergency services is limited by factors such as distance or insufficient infrastructure. By providing immediate, first-line medical assistance, drones can reduce dependency on traditional ambulance services in congested areas and offer a critical lifeline in remote or underserved regions. This approach not only enhances emergency care accessibility but also complements existing medical systems, potentially bridging gaps in response times and saving lives.

II. OBJECTIVE OF DAMS

The primary objective of the **Drone Ambulance and Medical Systems** project is to develop an autonomous, drone-based emergency response system that can deliver life-saving medical aid quickly and efficiently in critical situations. Specifically, the project aims to:

1. **Reduce Emergency Response Times**: Provide rapid response to medical emergencies by bypassing traditional traffic and geographic barriers, particularly in congested urban areas and remote locations.
2. **Increase Accessibility to Critical Care**: Ensure that essential medical aid reaches patients in rural, underserved, or hard-to-reach areas, where conventional ambulances may struggle to arrive promptly.
3. **Provide Preliminary Medical Assistance**: Equip drones with first aid supplies, such as automated external defibrillators (AEDs), EpiPens, oxygen supplies, and basic medical kits, allowing bystanders or first responders to administer initial treatment before an ambulance arrives.
4. **Enhance Remote Monitoring and Diagnosis**: Utilize IoT sensors on the drone to monitor patient vitals and transmit this data to emergency medical teams in real time, enabling doctors and paramedics to prepare for treatment in advance.
5. **Enable Real-Time Communication with Medical Professionals**: Equip drones with video and audio systems that allow medical professionals to guide individuals on-site in providing care, thus improving the effectiveness of initial emergency responses.
6. **Support in Time-Critical Medical Scenarios**: Address specific medical emergencies, such as cardiac arrests, allergic reactions, or severe injuries, where prompt medical intervention is crucial to improve survival chances.
7. **Improve Overall Emergency Care Efficiency**: Complement traditional ambulance services by handling certain emergency cases, thus optimizing healthcare resources and response times across the board.
8. **Extend Reach to Geographically Challenged Areas**: Provide emergency care access in remote, rural, and underserved regions, where conventional ambulances may be delayed due to distance, difficult terrain, or lack of infrastructure. Drones can overcome these barriers, bringing essential care to areas previously beyond the reach of rapid medical services.
9. **Optimize Use of First-Line Medical Resources**: Equip drones with automated medical kits designed to administer immediate care. These include defibrillators, basic wound care supplies, oxygen support, and medications for allergic reactions or pain relief, empowering individuals at the scene to provide critical initial care under the guidance of medical professionals.
10. **Integrate IoT for Enhanced Patient Assessment and Pre-Hospital Care**: Use IoT-enabled sensors on drones to gather vital health data such as heart rate, oxygen levels, and blood pressure. This data can be instantly relayed to hospitals and emergency responders, allowing for remote assessment and better-prepared hospital teams upon the patient's arrival.
11. **Facilitate Real-Time Remote Guidance from Medical Professionals**: Through two-way audio and video capabilities, enable healthcare providers to observe and direct bystanders or first responders in real-time,

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thus maximizing the chances of successful intervention. This allows for immediate, expert advice in cases where professional medical personnel are not yet on the scene.

III. METHODOLOGIES

Introducing a Drone Ambulance Proof of Concept with an IoT-Based Health Monitoring technology, the suggested technology offers a revolutionary approach to emergency medical care. Unlike the current ground-based ambulance system, this creative approach makes use of unmanned aerial vehicles' (UAVs') capabilities to transform the way medical crises are responded to. Due to its quick deployment design, the drone ambulance may arrive at the scene of an emergency with amazing speed and agility, avoiding geographical barriers and traffic jams that frequently impede conventional ambulances. In addition, the device has sophisticated health monitoring functionalities, such as a pulse detecting module and body temperature sensor, enabling instantaneous patient state evaluation. Healthcare professionals may remotely monitor and analyze the gathered health data on the Thing Speak IoT cloud platform, facilitating proactive medical treatments and well-informed decision-making.

By automatically recharging the drone while not in use, a wireless charging system provides continuous operation, minimizing downtime and increasing overall efficiency. The operating procedure is further streamlined by an image processing-based QR code identification technique that precisely identifies predefined landing spots, such hospitals or emergency rooms. The voltage level display gives vital information about the drone's battery condition, allowing for prompt maintenance and replacement as necessary. The goal of the proposed system is to show that employing drone ambulances to improve emergency medical care is feasible, especially when patient outcomes depend on prompt response times. This technology has the power to completely change how emergency healthcare is provided, enhancing accessibility, monitoring capabilities, and overall response effectiveness in a variety of settings, including distant and crowded metropolitan places. The proof of concept's successful execution might herald in a new age of emergency medical care, one in which technology is essential to saving lives.

IV. BODY DIAGRAM OF THE DRONE

Prioritizing the drone's purpose should be the primary consideration when building it. The weight of the drone is important to know because it will be picking up and dropping medical supplies. It was necessary to determine how much weight the drone could pick up now that its weight was established. That's how the motor's size is determined. About two kilograms makes up the drone's weight, and since it must lift another two kilograms of weight, the motors must bear a combined four kilogram burden. On paper, the drone should be able to fly if its engines are able to generate double its own weight, or 8 kg of load. However, in practice this is not feasible, thus the drone's motors must provide three times the thrust of the drone's 12 kg weight. A drone alone will thereafter be able to fly. Since the thrust needed is greater than for a typical drone, six BLDC motors are used in place of four. The drone is referred to as a hexacopter because it has six BLDC motors. It is made up of an independent mechanism that maintains the drone's stability. Features like height control, fall back, posture hold, and battery safety are included. It has a dropping mechanism that is connected to the medical aid's picking and dropping servo motor. It also features a gyroscope F is the force that the drone's motors provide in opposition to gravity to cause it to ascend above the surface of the earth [4].

The force exerted by the drone's motor 1 (m1) is known as T1.

The force exerted by the motors m2, m3 and m4 is denoted as T2, T3 and T4.

IF (no movement) T1+T2+T3+T4 = mg

IF (Drone Rises) T1+T2+T3+T4 > mg

IF (drone descends) T1+T2+T3+T4 < mg

COMPUTATION OF THE UAV

L = ρ + γ 2. A. CL.

A. Material used in the construction

- Frame made of aluminum
- Landing Structure and Hub for Quadcopters
- Medical Kit
- Microcontroller
- LCD Panel

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- Thermostat
- Sensor for Pulse Detection
- Cordless Telephone
- Lead-acid battery
- Transformer (9V)
- Power Cord
- Driver of a motor vehicle
- DC Motor at 1000 RPM
- Propellors

B. Motors

A hexacopter typically uses two types of motors: brushless and brushed. Six brushless DC motors (BLDC) are employed in this hexacopter, one on each arm of the frame [5]. There is less movement in brushless motors and outperform brushed motors in terms of stability. Thus, it facilitates the drone's easy flight. While designing the motor arrangement, the location of the motors and which should be turned clockwise and counterclockwise should be the primary considerations. The motors are arranged clockwise and counterclockwise on the side of the hexacopter designated as its front. The hexacopter's motors M1, M3 are counterclockwise, while the motors M4 and M2 are clockwise.

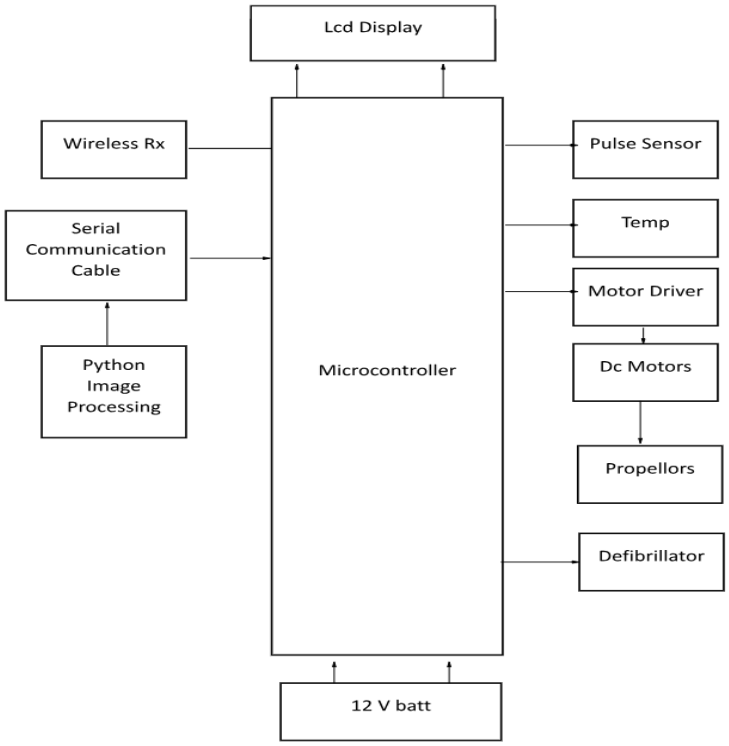
C. Controllers for Electronic Speed

An ESC is required for hexacopters that use brushless motors since they require three out-of-phase voltage inputs. The Electronic Speed Controller needs to be first given a direct current input voltage in order to automatically generate three out-of-phase voltages. These voltages must then be connected to the motor in order for it to start spinning. The ESC is wired to the motors with three wires and to the batteries with the other two cables. Every motor has an electronic speed controller (ESC), which monitors and adjusts the motor's speed based on various conditions. The ESC is also used to rotate the motor in both clockwise and counterclockwise directions [6].

D. Motor Propellers

In each frame of this hexacopter, six plastic propellers are employed, and they are screwed to the frame arm. The propeller has a pitch of 4.5. The distance the propellers travel in a single rotation is known as pitch.

DIAGRAM



Block Diagram For Drone System

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V. FUTURE SCOPE

The **Drone Ambulance and Medical Systems** project has a promising future, with potential expansions and enhancements that could significantly impact healthcare and emergency response services globally. As technology advances, the system can be adapted and upgraded to meet emerging healthcare needs. Here are some areas where the project can grow and evolve:

1. **Enhanced AI for Autonomous Medical Decision-Making**: Incorporate artificial intelligence (AI) to enable drones to make real-time decisions based on patient data. With AI, drones could potentially assess patient conditions on-site, automatically deliver appropriate medical interventions, and provide dynamic guidance to bystanders based on the severity of the patient's condition.
2. **Integration of Advanced Diagnostic Tools**: Future versions of the drone could carry portable diagnostic equipment, such as ultrasound devices, ECG monitors, or blood analyzers, allowing for on-site diagnostics. This would enable real-time analysis of critical metrics and further support remote medical teams in making informed treatment decisions before the patient arrives at a medical facility.
3. **Expansion into Rural and Underserved Communities**: In many rural and underserved areas, access to emergency healthcare remains limited. The drone ambulance system could become a primary emergency response tool in these regions, effectively bridging the healthcare gap by providing essential services where infrastructure is lacking.
4. **Use in Disaster and Crisis Response**: In natural disasters, pandemics, or other large-scale emergencies, drones can serve as the initial wave of response, bringing aid to areas inaccessible by traditional means. The system could be adapted to deliver bulk medical supplies, food, and water, or even act as communication hubs when infrastructure is down.
5. **Fleet Integration with Traditional Ambulance Services**: In the future, drone ambulances could work as part of a coordinated fleet with traditional ambulances, allowing healthcare providers to allocate resources more efficiently. For example, drones could handle minor injuries or deliver initial aid while ambulances respond to more critical cases, optimizing response times across all emergencies.
6. **Development of Modular and Specialized Drone Models**: The system could evolve to include specialized drones for various emergency scenarios, such as trauma care, pediatric emergencies, or even mental health crises. Modular designs would allow drones to carry specific kits and tools, making the system adaptable for different medical needs.
7. **Improvement in Drone Payload and Range**: As drone technology advances, improvements in payload capacity and battery life will enable drones to carry more equipment over greater distances, making them more effective in rural and expansive areas.
8. **Smart City and IoT Ecosystem Integration**: The system could become part of a larger smart city infrastructure, integrating with traffic systems, emergency dispatch centres and IoT networks. This would enable quicker response times, automated dispatching, and seamless coordination with other public services, making emergency responses faster and more efficient.
9. **Remote and Preventive Healthcare Delivery**: Beyond emergency response, drones could be adapted for preventive care in remote areas, delivering medications, vaccines, and essential healthcare supplies to individuals with chronic conditions or those requiring routine medical care in hard-to-reach locations.
10. **Enhanced Data Collection and Analysis for Public Health**: The project could contribute to public health initiatives by collecting and analysing anonymized patient data from various emergencies. This information could be used to identify patterns in healthcare needs, optimize resource allocation, and improve preparedness for future healthcare challenges.
11. **Global Implementation and Scalability**: With proven effectiveness, the system could be expanded to different countries, customized to fit each region's unique healthcare and regulatory needs. The drone ambulance model could become a template for global emergency response innovation, adaptable to diverse environments and healthcare systems.
12. **Collaborations with Healthcare and Technology Companies**: Partnerships with medical device manufacturers, tech companies, and emergency response organizations could drive the development of more advanced drone capabilities, bringing innovations in both healthcare and UAV technology.

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13.Enhanced Safety Features and Regulations: As the project expands, enhancing safety features like collision avoidance, real-time weather adaptation, and advanced navigation systems will be crucial. Additionally, the system will require regulatory development to ensure safe drone operations in populated areas and compliance with medical standards.

VI. CONCLUSION

In summary, These days traffic accidents occur often, and the death rate from not receiving medical attention is very high. When an unfortunate incident occurs, such as a drowning in the ocean or an animal attack, and rescue operations take some time, this drone can be very helpful in providing initial medical assistance. This is because it uses an aerial route, which reduces the time it takes to cover the distance and allows medical assistance to be given immediately. The primary feature of this project is its ability to accept any kind of medical gadget that the patient may need. Drones could previously only be utilized to deliver a particular kind of healthcare. Thus, the medical business will find great use for this drone going forward. It makes use of a very basic pick-and-drop concept, which keeps the drone's cost down and makes it quite affordable. In India, where there are poor road conditions that make it difficult for ambulances to arrive on time, a drone that uses an aerial path can save time and potentially save lives.

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