

# “AEROPATH”

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**Abstract-** Natural disasters are sure to leave communities in dire need of medical assistance, and many disasters render these efforts impossible due to destroyed infrastructure, hazardous conditions, and other logistical delays. This may be disastrous because any delay in offering lifesaving or life-sustaining care multiplies the effect on livelihood and health. The Aeropath is an unmanned, drone-based system meant to bridge this very important supply gap by ensuring timely and reliable delivery of lifesaving medical supplies in emergencies. It deploys two types of drones: a Quadcopter for autonomous disaster zone surveying to make damage assessments and build 3D maps, and a VTOL aircraft to supply medical supplies to prioritized locations as quickly as possible. Central to the operation of Aeropath is a Base Station that coordinates all tasks-processing SOS signals, managing inventory, and planning optimized delivery routes based on live data from the mapping done by the Quadcopter. Then, this layout enables the use of Aeropath independently of human involvement and bypasses conventional infrastructure challenges. Automation and real-time decision-making as implemented by Aeropath would enable speed and accuracy in disaster response, ensuring that no stranded person has to wait for medical aid. This paper discusses the current design and operational frameworks of Aeropath and how it can improve disaster resilience by providing an autonomous, efficient solution whenever each second counts.

**Key Words:** Autonomous drones, disaster response, real-time mapping, robotic systems, medical supply, delivery, telemetry, Quadcopter, VTOL.

## 1. INTRODUCTION

Various factors such as "damaged infrastructure, adverse weather conditions, and logistic barriers invariably come into play in the course of delivering emergency medical supplies during disasters." One can imagine how such delays often result in worse living conditions for the affected people-a fact that underlines that such urgent needs require quick and sure solutions. The Aeropath addresses this challenge through an autonomous, drone-based system designed to deliver lifesaving medical aid precisely and efficiently in the worst conditions. Aeropath integrates two different kinds of drones: a Quadcopter for autonomous surveying in disaster zones and assessment of damages; a VTOL aircraft for fast supply delivery. The drones are controlled through a centralized Base Station

that manages all aspects of mission planning, from the processing of SOS signals to route optimization of delivery. Operating on real-time mapping and central coordination, it reduces human interference to a minimum; hence, the promptness of response in case of emergencies and supplies are given to the precise locations they are most wanted in. Aeropath is a revolutionary disaster response through its integrated frameworks, affording scalability and efficiency in surmounting the logistical hurdles conventionally faced by traditional emergency response methods. The following proposed project aims at redefining emergency logistics, setting new marks of speed, precision, and reliability in disaster preparedness. The system mainly consists of following frameworks:

### 1}Quadcopter and Lidar Farmwork

### 2}Vending Machine Framework Integrated with Base

#### Base Station

### 3}VTOL Framework

#### 1.1 Quadcopter and Lidar Farmwork – Q.L.F

The Quadcopter autonomously surveys disaster zones, creating 3D maps using Lidar technology, assisting in route planning for efficient delivery by the VTOL

#### 1.2 Vending Machine Framework Integrated with Base Station – V.M.I.B.S.

The Base Station coordinates inventory and drone dispatch. It uses a robotic arm to load supplies into the VTOL, ensuring climate-controlled storage for temperature-sensitive items

#### 1.3 VTOL Framework – V.F.

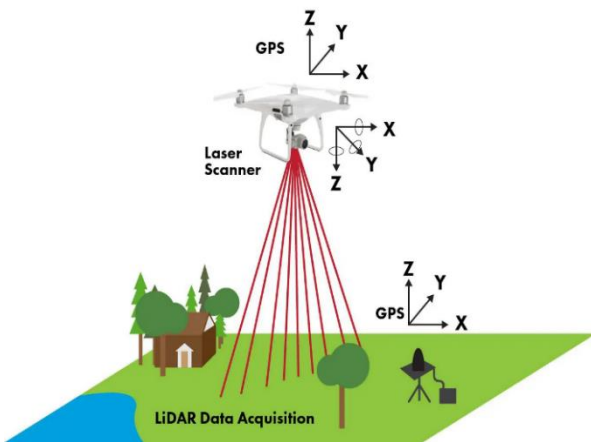
The VTOL delivers medical supplies based on optimal routes planned from Quadcopter data. Equipped with advanced navigation, it ensures accurate delivery to targeted locations quickly.

## 2. WORKING ON THE FRAMEWORKS

The working of all the frameworks has been explained below.

### 2.1 Quadcopter and Lidar Farmwork – “Q.L.F”

It automatically launches at the receipt of an SOS signal to begin damage assessments and mapping with Lidar. These enable the system to generate detailed 3D maps that outline critical zones needing attention. In real time, the Quadcopter streams the data back to the base station, where agencies such as the NDRF may monitor it. This live feedback creates dynamic changes in the path of the drone, if necessary, to ensure good area coverage. Data gathered evolves route planning for the VTOL aircraft by way of supporting its navigation efforts and prioritizing deliveries. Overall, the Quadcopter’s mapping capabilities play a key role in reducing delivery times by providing accurate, up-to-date information, which aids in the quick deployment of supplies.

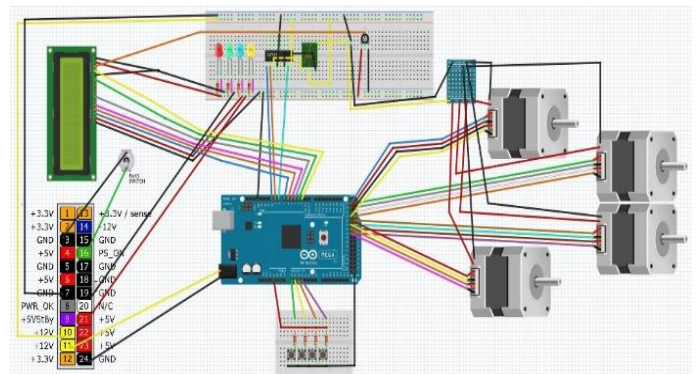


**Fig -1:** Block-Diagram for **Quadcopter and lidar Framework**

### 2.2 Vending Machine Framework Integrated with Base Station – “V.M.I.B.S.”

The Vending Machine Framework shall include an autonomous inventory management system and integrate seamlessly with the VTOL aircraft through a central Base Station control system. The required medications are identified at the Base Station from the survey data received from the Quadcopter and instruct the vending machine to dispense them. This would be done using a robotic arm that picks up selected items carefully and places them inside the VTOL aircraft for precise and secured placement without human interference. The Base Station serves as the control hub, integrating all communication and RF telemetry functions: processing real-time data from the Quadcopter and other sources, planning optimal routes for the VTOL, and also transmit the live data collected from

quadcopters, and VTOL with disaster response agencies like the NDRF. Moreover, the Base Station monitors the drones’ status, ensuring they are fully charged and ready for immediate deployment. It also maintains a climate-controlled environment within the vending machine to store temperature-sensitive supplies, guaranteeing their efficacy during delivery. Integration of automated dispensing for centralized control with efficient communication makes the Vending Machine Framework a crucial component within Aeropath-SR in ensuring speedy and reliable delivery during emergencies.



**Fig -2:** Block-Diagram for **Vending Machine Framework**

### 2.3 VTOL Framework – V.F.

VTOL is the main vehicle to efficiently, accurately deliver medical supplies. From the data gathered by the Quadcopter and then processed by the Base Station, VTOL will be sent detailed, optimized flight paths that minimize travel time, and supplies reach their destinations in no time. The aircraft carries up to 5 kilograms of supplies, covering a range of 50 kilometers with up to 2 hours of operational capacity at a cruising speed of 80 km/h. The aircraft is equipped with advanced navigation systems, including OpenCV technology, which allows it to identify individuals in need and navigate through challenging terrain, even in areas with obstructed visibility. The VTOL framework also includes a robust payload management system, where medications are securely loaded using a robotic arm to ensure safe and organized transport. This careful attention to payload handling, combined with the precise navigation capabilities, makes the VTOL an integral part of Aeropath’s autonomous delivery network, providing reliable and swift support during critical emergencies.

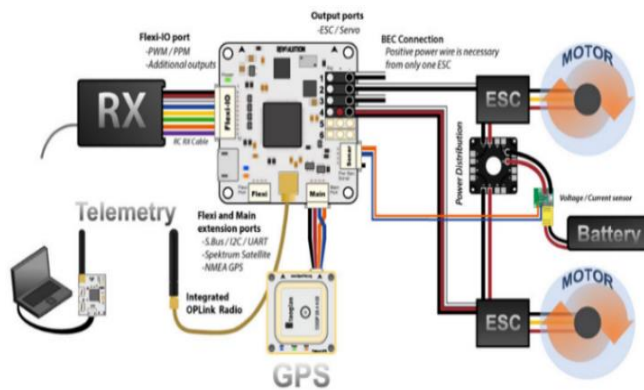


Fig -3: Block-Diagram for VTOL system

PROTOTYPE MODEL-



**3. CONCLUSIONS**

Aeropath presents a significant advancement in autonomous disaster management technology, integrating multiple autonomous frameworks to streamline the delivery of life-saving medical supplies. By combining real-time 3D mapping, centralized control, and precise navigation, Aeropath minimizes human intervention and reduces response times, addressing the critical need for rapid action during emergencies. Future enhancements will focus on expanding operational range, improving real-time analytics, and further integrating AI for dynamic disaster response, aiming to set a new standard in emergency logistics.

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**REFERENCES**

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- [2] **"Autonomous Drones for Disaster Risk Reduction"** - Discusses how AI-powered drones improve efficiency in emergency situations by offering real-time reconnaissance and supply delivery.
- [3] **"Drones4Good Initiative: Supporting Disaster Relief"** - Covers the use of imaging technology in drones to assess damage and locate survivors, helping in efficient medical deliveries.