e-Yantra Ideas Competition 2019-2020

Project Name:
Compact, Intelligent and Higher Flight-time System for Efficient Aerial Transportation

INTRODUCTION/ MOTIVATION

Congestion is the main cause behind the delayed delivery services of food,packages, and medical, gradually causing serious environmental issues due to emission of pollutant gases from increased number of vehicles. As of in an article in Times of India,a survey taken by global consultancy firm Congestion in Delhi, Mumbai, and Bangalore costs the economy of 1.47 lakh crore a year. [1]. In India all types of vehicles use similar roads leading to earlier destruction of roads, hence, it becomes more dangerous in rainy seasons as rainwater gets accumulated in the ditches. This scenario overall affects the transportation services, most important here is the delivery of emergency medical services like blood, organs, drugs where congestion proves fatal to it. The objective is to introduce a dynamic Aerial system which is highly portable, autonomous, and intelligent also having higher endurance flight-time for long duration operations. This aerial system would be able to carry out delivery operations using pre-planned paths including obstacle avoidance, precision landing system using image processing for landing and delivering food/medical/packages instead of dropping them at complicated areas. This system would be used in rescue missions, like floods in kedarnath, kerala, Kolhapur for locating victims. .

MARKET RESEARCH/LITERATURE REVIEW

Current delivery services opted are manual resulting unnecessary human errors in delayed services, recent development of aerial vehicles for delivery services has showed alternate way to carry out the delivery operations overcoming the hurdle of congestion. Zomato in collaboration with Eagel tech recently had a food delivery using over 5 km of distance in 10 minutes. [2]. They have used a drone with autonomous capability with pre-planned flight path for delivery drop point, this system is autonomous but not intelligent with its flight characteristics and the accuracy of dropping the package is limited on to free space dropping areas, it doesn't use precision lading system for landing at congested areas. As in an articlet The times of India drone flies blood from remote village to Uttarakhand covering 36 km of distance, this system doesn't use any vision based system and obstacle manipulation making system inefficient. [3]

SYSTEM DEVELOPMENT

0.1 Hardware requirement

The main hardware used in this project is as follows:

1. raspberry pi

2. arduino

3. pixhawk flight controller

4. brushless motors, carbon fiber sheets / tubes ,silicone wires (14AWG)

5. 3d printed parts for the drone

6. 2.4Ghz transmitter and receiver

7. custom telemetry module

8. Lipo batteries

9. Camera for image processing

0.2 Software Requirement

1. ROS

2. Python Environment

3. Mission planner

4. Arduino IDE

5. Solidworks

6. ANSYS

7. OPEN CV

IMPLEMENTATION

This aerial system could be used for many purposes, like delivering food autonomously, any package /medicinal drugs, providing help in disaster prone locations, surveillance of larger forest areas. Considering delivering food using the drone, a system is designed where the houses/buildings or any place will be registered with unique code which is generated on a landing pad in a QR code format visible to drone from a particular height. When the order from the customer is generated the food delivering company updates the path of the customer39;s location to the drone, which will be that unique code on the building, or house that is registered with the company. The food package is attached to the drone (weight carrying capacity of our drone is 2.5 kg) and after getting updated with the delivery point the drone takes off,the way points are achieved with the help of GPS and the live tracking of the drone could be done at the customers side on mobile application. When the drone arrives near the delivery point the where the landing pad with the unique QR code will be presented. Drone will be enabled with the obstruction detection sensors in-order to detect unusual obstacles act according to the logic developed. Here precision ails to provide precise coordinates, so the vision based system would scan the QR code and adjust itself to maintain the same axis and land on the landing with QR code printed on it and leave the package there once the person is verified by entering the one time password to the drone by the customer. Once package is delivered the drone accurately move towards the hoe position. In this delivery the flight controller and the raspberry pi plays a very vital role,normal autonomous flights can be achieved by only using the PIXHAWK flight controller but to make the system more efficient and accurate ROS (robotic operating system) is used to program the raspberry.OPEN CV is used for 3D visualization for scanning the QR codes and acting according to it.LIDAR is also an option for 3d mapping the environment and avoiding the unusual obstacles. For high precision more than one GPS can be used but this system gradually increases the cost and also does not have more precision that vision based systems only for accurate landing.

Image Processing :The problem with the GPS when landing at the given landing coordinates is that it doesn't have precision so when landing at some complex location this may prove fatal,hence vision system proves much efficient as it is able to analyze the environment and the landing pad where it has to be landed, the image data base is already

created and know the system like,when the drone is above the building it tries to search for the landing pad and when it detects the landing pad analysis is done to decode the QR code printed on it once it recognizes it,the drone slowly starts to descend maintaining the axis of the center of the landing pad with it. simultaneously is checks for any obstacles in its path to avoid collision.

FLOW CHART
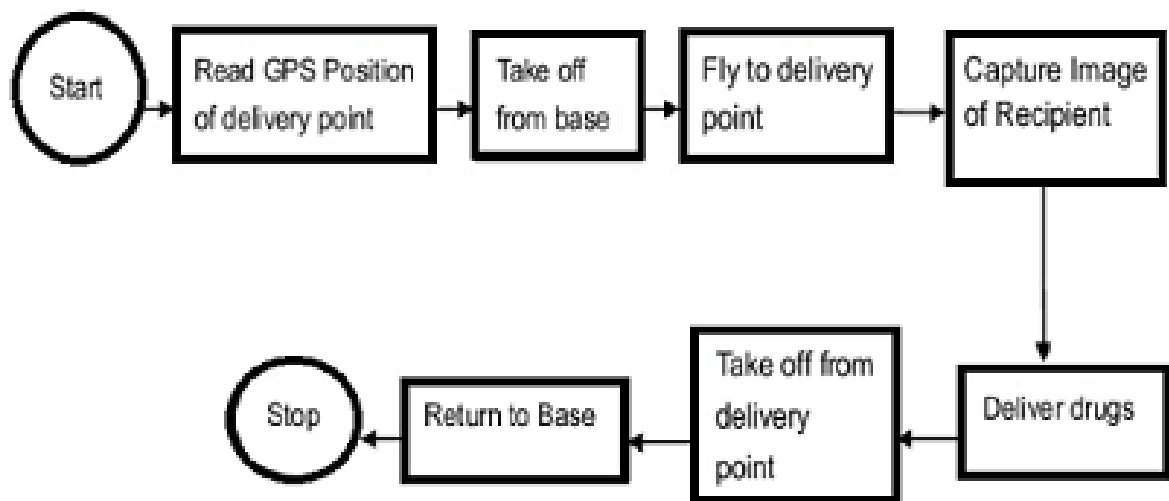
Figure 2:Autonomous Delivery

The drone is designed to function for the operational time between 45-60 minutes depending upon the payload and environmental conditions like winds. Rescue teams can easily deploy this drone and control it manually as it is highly portable due to its Foldable structure and can so surveillance operations to save the people in the affected areas similarly it can be used as platform for aerial mobility.

FEASIBILITY

The process of delivering food and medicinal packages is manual, and which increases the conflict between time and congestion although the delivery services are being carried well-but there an intense requirement of such aerial system which could cope up with the conflict between the time and congestion in delivering the packages safely and fast. The incident at kedarnath where many people lost their lives not due to floods but due to delay rescue operations as there were no efficient systems to search and locate the lost victims, this incident highly focuses on development of such aerial platform which could sustain in such conditions and carry out rescue operations, the victims lost their lives mainly due to lack of medical services at that situations. Fire rampage at the amazon forest in Brazil took place in 2019 was unknown for about a week, so here such aerial platforms can be deployed manually or autonomously for surveillance purpose and immediate action can be taken.This systems would completely make better use of clean energy.

References

[1] https://timesofindia.indiatimes.com/india/traffc-congestion-costs-four-major-indian-cities-rs-1-5-lakh-crore-a-year/articleshow/63918040.cms

[2] https://www.thehindubusinessline.com/info-tech/zomato-success- tests-food-delivery-via-drone/article27889844.ece

[3] https://timesofindia.indiatimes.com/city/dehradun/in-possible-health-game-changer-drone-flies-blood-sample-from-remote-village-to-district-hospital-in-ukhands-tehri/articleshow/69695848.cms

[4] https://timesofindia.indiatimes.com/india/Uttarakhand-5000-feared-killed-19000-still-stranded/articleshow/20731541.cms

[5] https://www.bbc.com/news/world-latin-america-49971563