Drone Delivery System

SUBMITTED IN PARTIAL FULFILLMENT FOR THE REQUIREMENT OF THE AWARD OF DEGREE OF

BACHELOR OF TECHNOLOGY
IN
INFORMATION TECHNOLOGY

Submitted by

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KIET GROUP OF INSTITUTIONS, GHAZIABAD

Session 2022-23

DECLARATION

We declare that the work contained in this report is original and has been done by us under the guidance of our supervisor. The work has not been submitted to any other institute for any degree or diploma. I/we have followed the guidelines provided by the institute to prepare the report. We have conformed to the norms and guidelines given in the ethical code of conduct of the institute. Wherever we have used materials (data, theoretical analysis, figures, and text) from other sources, we have given due credit to them by citing them in the text of the report and giving their details in the references.

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CERTIFICATE

This is to certify that Project Report entitled "Drone Delivery System" which is submittedby Group G-54 (Priyanshu Gupta, Mayank Saxena, Shaumitra Sahu, Utkarsh Gupta, Mohit Singh) in partial fulfillment of the requirement for the award of degree B. Tech. in Department of Information Technology of Dr. A.P.J. Abdul Kalam Technical University, Lucknow is a record of the candidates own work carried out by them under my supervision. The matter embodied in this report is original and has not been submitted for the award of any otherdegree.

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Supervisor Name: Prof. Ruchin Gupta

Date: 14th May 2023

ACKNOWLEDGEMENT

It gives us a great sense of pleasure to present the report of the B. Tech Project undertaken during B. Tech. Final Year. We owe special debt of gratitude to Prof. Ruchin Gupta, Department of Information Technology, KIET, Ghaziabad, for his constant support and guidance throughout the course of our work. His sincerity, thoroughness and perseverance have been a constant source of inspiration for us. It is only his cognizant efforts that our endeavors have seen light of the day.

We also take the opportunity to acknowledge the contribution of Dr. Adesh Kumar Pandey, Head of the Department of Information Technology, KIET, Ghaziabad, for his full support and assistance during the development of the project. We also do not like to miss the opportunity to acknowledge the contribution of all the faculty membersof the department for their kind assistance and cooperation during the development of our project.

We also do not like to miss the opportunity to acknowledge the contribution of all faculty members, especially faculty/industry person/any person, of the department for their kind assistance and cooperation during the development of our project. Last but not the least, we acknowledge our friends for their contribution in the completion of the project.

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List of Figures

ABSTRACT

The main aim of this project is to deliver packages using a drone to improve delivery service and security. In recent years, e-commerce businesses have seen an increase in the daily volume of packages to be delivered, as well as an increase in the number of particularly demanding customer expectations. In this respect, the delivery mechanism became prohibitively expensive, particularly for the final kilometer. To stay competitive and meet the increased demand, businesses began to look for innovative autonomous delivery options for the last mile, such as autonomous unmanned aerial vehicles/drones, which are a promising alternative for the logistics industry. Following the success of drones in surveillance and remote sensing, drone delivery systems have begun to emerge as a new solution to reduce delivery costs and delivery time. In the coming years, autonomous drone sharing systems will be an unavoidable logistical solution, especially with the new laws and recommendations introduced by the Flight World Organization on how to organize the operations of these special unmanned airline systems. This paper provides a comprehensive literature survey on a set of relevant research issues and highlights the representative solutions and concepts that have been proposed thus far in the design and modelling of the logistics of drone delivery systems, with the purpose of discussing the respective performance levels reached by the various suggested approaches. Furthermore, the paper also investigates the central problems to be addressed and briefly discusses and outlines a series of interesting new research avenues of relevance for drone-based package delivery systems.

Keywords: autonomous drones; vehicle routing problem; drone-based package delivery system; drone charging station repositioning; drone routing optimization; e-commerce delivery; drone assignment; drone delivery modeling.

CONTENTS

CHAPTER 1

Introduction

A delivery drone is a type of unmanned aerial vehicle (UAV) used for distributing packages to consumers during the last mile delivery process several drone deliveries companies have started to gain traction in various transportation industries. What started as a passing fad has quickly turned into a legitimate enterprise.

Benefits of drone delivery are currently being tested but could include lower costs, higher operational efficiency, new revenue streams, instantaneous fulfillment, less congested roadways, fewer accidents and lower emissions. Since delivery drones are not yet an established solution, a few of the limitations being researched are package weight limitations, flight time and range constraints due to battery life, collision avoidance systems and how to handle unpredictable events such as weather or being hacked.

As e-commerce continues to grow and traditional forms of delivery are no longer the most efficient option, delivery companies are experimenting with the implementation of drones. Businesses such as USPS, Amazon and Google have undertaken drone experiments as a feasible alternative for growth. The current most popular use cases for delivery drones are time sensitive materials such as medicine and food or small items for same-day delivery. Below, we'll answer the common question, "What is drone delivery service?" We'll also explain how drone delivery systems work and highlight some of the companies that are already taking advantage of this new technology.

CHAPTER 2

Literature Review

When considering the Vehicle Routing Problem with Drones (VRPD), most of the literature has addressed hybrid delivery systems, which combine two delivery modes: the vehicle-based delivery system and the drone-based delivery mode. Most issues with last-mile delivery with drones suggest that the aerial vehicle is transported close to the destination of the package by ground vehicles. From here, while the drone is delivering a package, the van can serve other customers who are not reachable by drone. As a result, the drone will be able to continue serving all customers who are within its flight zone, increasing user-friendliness and making the schedule more flexible [8,17,18,19], in the first studies conducted in this direction.

However, the delivery problem is considered a stochastic problem and uses a large fleet of fully autonomous drones in the delivery system, thus making the modelling very challenging. Later, Jeon et al. [21] addressed the same routing problem by using MILP models and some heuristics based on the approach proposed by Murray and Chu. This proposed method involves reducing the number of empty flights in order to increase drone utilization; it is being tested on Jeju Island using localization and tracking data. Dorling et al. [8] addressed two multi-trip vehicle routing problems that incorporate battery and payload weights into the energy consumption calculations; the first problem deals with the cost issue of a delivery time constraint, and the second problem seeks to optimize the delivery time subject to a cost limit. Furthermore, the proposed algorithms seek to optimize the drone fleet size as well as the trips for the delivery of the package. The authors assumed that the operator has enough fully charged batteries to satisfy the drone energy requirements before the deliveries can start and that the operator deploys only one depot (charging station) in the area. In contrast, it would be very challenging and costly for a delivery company to deploy multiple depots and battery swapping stations, as well as manage battery swapping between trips to meet the daily demand. Wang et al. [22,23] addressed the vehicle routing problem with drones, where the fleet consists of multiple trucks equipped with multi-drones to minimize the completion time. Both vehicles can deliver the packages, and the trucks must wait for the drone after it has been deployed for a delivery. They proposed a routing strategy called “The Drone Vehicle Traffic Problem”, where the objective is to serve all customers within the shortest time duration. Moreover, a scheduling model was formulated to determine the time at which a battery begins/stops charging or begins/stops discharging. Sawadsitang et al. [30] developed a suppliers’ cooperation policy to share the total cost of a drone delivery service. This means that suppliers can serve their customers collaboratively and share their drones in order to serve as many customers as possible; when a drone drops a package at the desired destination, it can return to any supplier depot that is part of the cooperation system. The proposed optimization model considers the parcel assignment problem as mixed integer programming. In addition, they did not consider the battery range issue in their modeling. To the best of our knowledge, no short-term assignment strategies have been proposed to improve the efficiency of an autonomous drone-based delivery service in real time. For instance, in fast-food meal delivery services, customers need to be served quickly, especially during peak hours, which represents a challenge for scheduling the drone fleet.

According to the review of the most relevant and most recent papers on drone-based parcel delivery systems, many drone delivery problems have been addressed, indicating the importance of drones in resolving many logistical problems, particularly in the last mile, and transforming the future of package delivery. However, in order to launch a drone delivery system in an urban area, the level of urban aerospace must be capable of dealing with high delivery drone traffic densities. Doole et al. [48] proposed a method for estimating the traffic demand for a typical dense European city’s drone-based delivery system.

Furthermore, significant assumptions were included to simplify the modeling of this autonomous logistic mode in these research works. It is important to note that drone delivery performance is highly constrained by the battery range, payload, customer location, and weather conditions in which it is operating. These significantly influence the time delivery; thus, they must be included when modeling drone delivery systems.

CHAPTER 3

3.1 Code Editor & Hardware

3.1.1 Jupyter

The Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text. Uses include: data cleaning and transformation, numerical simulation, statistical modelling, data visualization, machine learning, and much more. Notebook documents contains the inputs and outputs of a interactive session as well as additional text that accompanies the code but is not meant for execution. In this way, notebook files can serve as a complete computational record of a session, interleaving executable code with explanatory text, mathematics, and rich representations of resulting objects. These documents are internally JSON files and are saved with the .ipynb extension. Since JSON is a plain text format, they can be version- controlled and shared with colleagues.

3.1.2 Raspberry Pi

Raspberry Pi is a series of small single-board computers (SBCs) developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom.[14] The Raspberry Pi project originally leaned towards the promotion of teaching basic computer science in schools.[15][16][17] The original model became more popular than anticipated,[18] selling outside its target market for uses such as robotics. It is widely used in many areas, such as for weather monitoring,[19] because of its low cost, modularity, and open design. It is typically used by computer and electronic hobbyists, due to its adoption of the HDMI and USB standards.

3.2 Hardware

3.2.1 Frame

Fig.1 Frame

A frame/chassis of drone is the main structure that holds all the parts of drone together.

3.2.2 Motors

Fig 2. 4x Brushless Motors

Brushless motor with specifications of 1000KV with 13000-15000 rpm.

3.2.3 Propellers

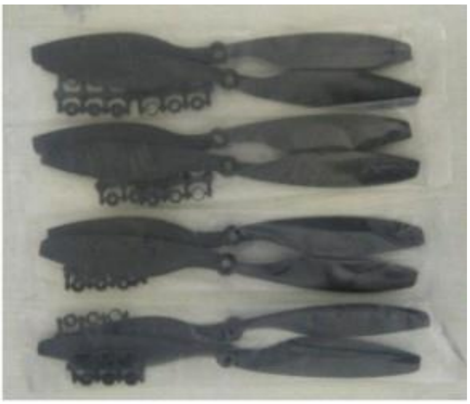

Fig 3. 4x Propellers

3.2.4 ESC

Fig.4 ESCs*4

Electronic speed controllers (ESCs) are devices that allow drone flight controllers to control and adjust the speed of the aircraft’s electric motors.

3.2.5 Flight Controller

Fig 5. Flight Controller KK 2.1.5

KK2.1.5 is a flight controller; the flight controller is also called the brain of the drone because with this all the operation of the drone is controlled. KK2.1.5 has ATMEL mega 664PA IC inbuilt inside it. It is an 8-bit AVR RISC based microcontroller with 64k of memory. It has inbuilt accelerometer and gyroscope, 6050 MPU and auto level function. It has eight motor outputs at the right side of the board; we connect ESC here. It has 5 control inputs; these inputs are connected through a receiver. It also has one LCD display in the middle, it will work as a user interface for the drone. Its operating voltage is 1.8V to 5.5V and its input voltage is 4.8-6.0 V.

3.2.6 Batteries

Fig. 6 Battery

3.2.7 Assembled

Fig.7   Main Drone System with Raspberry Pi as Controller

- Hardware and Building Phase: Assemble the F450 quadrotor frame and the printed battery casing in the middle (make sure to add the M2.5*5mm spacers).

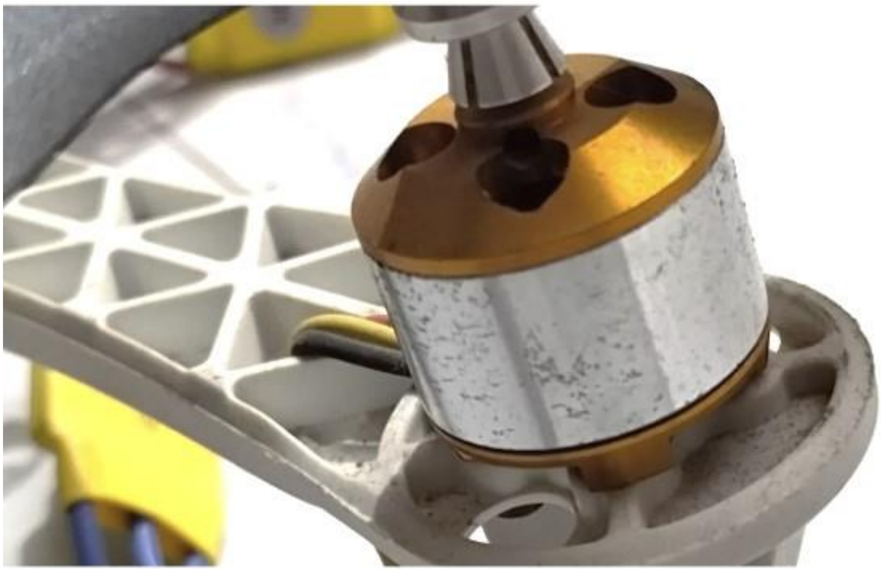

Fig 8. Motor attaching to the frame

- Attach the motors to the frame.

Fig 9. ESC being connected through Banana Connectors

- Solder the banana connectors to the ESCs and motors wires. Solder the ESCs and the power module to the PDB. Note: Make sure not to use the 5V output of the PDB.

CHAPTER 4

4.1 Methodology

STEP 1: Making of the Frame

The primary task is to form a frame. For this purpose, you'll use different materials, like metal, plastic, or wood. These materials will differ supported by how sturdy you plan the drone to be.

STEP 2: Propellers, Electronic Speed Controllers and Motors

- The ESCs (Electronic Speed Controllers), the motors, and therefore the propellers are among the foremost important elements of a functional drone.
- Put the motor within the appropriate place and fix it to the frame using the screws and a screwdriver.
- After mounting the motors, you furthermore may need to mount the speed controllers. How will you be doing this? It is recommended to attach the speed controllers on the bottom side of the wings of the frame.
- Now attach the propellors to the motor, and keep the direction of the propellor for the right movement
- Clockwise or Counter-Clockwise.
- The wings of the drone are now ready. Now solder the ESC inputs to the Power Distribution Board.

STEP 3: Flight Controller

- Every flying drone must have an impact system. This electronic system allows a drone to be stable within the air while flying and processes all the shifts and changes in direction and therefore the wind
- Now, fix the flight controller to the frame at a center position for good stability.

STEP 4: External GPS

Now, Attach the external GPS to the frame and make sure that external GPS is not very near to the flight controller because it causes interference because of the magnetometer in the flight controller.

STEP 5: Connection to the Flight Controller

Now connect the ESC to the flight controller output port, GPS to the GPS port and Power module to the PM port of the flight controller.

STEP 6: Radio Receiver

Now, connect channel no. 1-5 to the input of the flight controller. The Channel 1-4 is for Pitch, Roll, Throttle & Yaw. Channel 5 is for flight modes like Stabilize, Position holds etc.
The construction of Drone is now complete. All we need is to upload the latest firmware available for the Quadcopter drone by using the Mission Planner software.
And, after uploading the firmware, we need to calibrate the GPS and each ESC so that it starts

at the same time with the same frequency.

CHAPTER 5

5.1 Result

The drone's mission is to fly over mountains or wilderness and spot humans or irregular objects and then process that to see if that person needs help. This ideally would be done using an expensive infrared camera. However, due to the high costs of infrared cameras, instead the infrared detection is being resembled by detecting all non-green objects using a normal Pi camera. ssh into the Raspberry Pi First of all we need to install OpenCV on the Raspberry Pi. The following guide provided by py image search is one of the best available on the internet. Download the code into the Raspberry Pi from GitHub through this following link: http://bit.ly/GitHub-UoBDASAR. To download the code onto the Raspberry Pi, we can download the file onto your computer and then transfer it to the Raspberry Pi.

CHAPTER 6

Future Scope

A project for delivering packages using drones and machine learning which provides more security and better it was the new concept of Dronmakehich can make a change in the field of technology. In the future, these drones can help in receiving & retrieving information from customers. Not only that in the future, but these drones can also help in receiving the weather information too. In the future, we can also develop this project more and more securely like authorizing the person by Bio-Metric or by Face Recognition etc.

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ANNEXURE 1

Title of Paper: Drone Delivery System

Name of Scopus Conference: ICICAT 2023

Date of Submission: 26/04/2023

Date of acceptance: Pending

Date of Publication: Pending.

Name of Scopus Conference: ICICAT 2023

Microsoft CMT <email@msr-cmt.org>

to me

Hello,

The following submission has been created.

Track Name: Track-4 (special Session)

Paper ID: 825

Paper Title: Face Mask Detection using Haar-Like Features

Abstract:
The objective of the “Face Mask Detection” project is to create a simple, fast, and effective model that can identify whether people in videos are covering their faces with masks or not. The COVID-19 pandemic has increased the need for such technology, as wearing face masks has been shown to reduce the spread of the virus. “Face mask detection” uses the Haar Cascade method to detect faces in video. This model has numerous applications, including monitoring compliance with the face mask mandates in public places, identifying potential COVID-19 hotspots, and enhancing safety in public places.

Created on: Wed, 26 Apr 2023 09:01:12 GMT

Last Modified: Wed, 26 Apr 2023 09:01:12 GMT

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ANNEXURE 2

A. Research Paper

B. Plagiarism Report

ORIGINALITY REPORT

17%	16%	11%	8%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

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