



## REVIEW ON PAYLOAD DELIVERY DRONE

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### ABSTRACT

Unmanned Aerial Vehicles (UAV) based delivery of goods could become a reality soon. At present drones can be used in a wide range of commercial applications, surveillance, video shooting, border security, etc. UAVs based payload delivery drones can be used to deliver goods from one point to other. The advantages of a Payload delivery Drone system are mainly related to an increased delivery speed, especially in urban cities with traffic, where it is difficult to make deliveries on time. This system also helps to reduce the overall carbon footprint. This Review paper Discuss various works done in this field.

**KEYWORDS:** Quadcopter, UAV, Payload Delivery Drone

### INTRODUCTION

Robotics and Artificial Intelligence are the future. One of the examples of Robotics and Artificial Intelligence systems are unmanned Aerial Vehicles. UAVs can be used for various purposes like monitoring, filming etc. One of the examples that we have discussed in this paper is Payload Delivery capabilities of Drone. Companies like Amazon are currently taking advantages of Prime Air, which is a fully autonomous delivery system designed to safely send packages to customers. UPS, Google, and other big companies are also experimenting with delivery drones. Using of such Payload Delivery Drones, reduces the delivery time, possible to reach difficult areas, increases the safety and efficiency of the transportation systems, it also helps to reduce overall

footprints on the environment. Our objective for this paper is to discuss various works done in the field of delivery using drones and find a solution to implement them in real world.

In section II, we have reviewed nine research papers in the field of the quadcopter. Section III 2 is the problem we have identified. In Section IV, we have proposed a solution to the problem identified. Section V and Section VI explains the objective and conclusion of the proposed system

### 1. LITERATURE REVIEW

1. Path planning of an autonomous quadcopter-based delivery system by Athira Krishnan R, Dr. V. R. Jisha and Gokulnath K[1], in the past few decades many plans, and techniques were made to make the



robot navigate the several path so that the time of execution will be minimum, and it will affect the system performance. In this paper they proposed the algorithm which is the combination of sampling based bidirectional RRT algorithm and improved Artificial potential field (APF) algorithm to achieve that goal. Using the proportional position and altitude controller quadcopter is made to traverse the path planned by algorithm. So, the quadcopter is made to plan a path effectively from source point to goal point to Minimum the execution time.[1]

2. Power measurement and modeling of quadcopters on horizontal flight by Kataro Maekawa, Shunsuke Negoro, Hiroyuki Tomiyama, and Ittetsu Taniguchi[2], now-a-days quadcopters are used widely for many purposes and have many promising applications. However, the flight time is very limited due to battery capacity. Therefore, effective power management is very necessary for utilizing power aware flight planning. This paper only focuses on horizontal flight. They developed lightweight voltage and current logger, it records the voltage between terminals and the current from the battery. These data are recorded continuously and given to flight log and power log which are energy modelling and further calculation are made. Also, analysis between the behavior and power consumption is important.[2]

3. Quadcopter flight dynamics by Mohd Khan[3], angular maneuvering scheme along with standard flight operations such as taking-off, landing and hovering is proposed for a quadcopter with flying capability. This is achieved but simultaneously controlling the speed of the four rotors for the quadcopter to attain the correct orientation. The total thrust is determined by using the input of altitude, pitch, and roll angles. According to required thrust, voltage supply is given to adjust RPM. To adjust thrust via voltage supply to give required RPM to perform standard flight operations and to position the quadcopter into certain angular orientation depending on the circumstances of the flight routine. The solution lays the foundation for further use in control the quadcopter. [3]

4. Crowd Monitoring and Payload Delivery Drone using Quadcopter based UAV System by K.V.V.M ani Sai Kumar, M d Sohail, and Dr. Usha Rani. Nelakuditi[4], quadcopters can be used for crowd monitoring and payload delivery drone. The paper discusses the design and implementation of a quadcopter for delivery and surveillance operation using a camera. A quadcopter is an unmanned aerial vehicle (UAV) that has four rotors, and it is capable of vertical take-off and landing at a point. In this paper, a quadcopter having a payload delivery of 500 grams along with a camera is designed using APM 2.5 as a pre-programmed flight controller. It mentioned all the specifications of the components

used for constructing a quadcopter and provides the design calculation.[4]

5. Designing and Implementation of a Multi-purpose Quadcopter by Nadia Nowshin, Hossain, Md. Ahsanul Kabir, Anne, Sumaiya Jannat, and Kafa, Kaniz Fatema[5], the UAV based ting Assistance System for Quadcopter with Deep Reinforcement Lear quadcopters for human welfare have become a major topic of research. The paper explains the design of a microcontroller-based quadcopter that can detect metal and spray fire extinguisher. For the fire extinguisher a flame sensor, a two-channel relay, a DC motor, a bottle, and a hand-made plastic board propeller and to detect metal NE555 Timer IC, two 2.2 $\mu$ F capacitors, a 10 $\mu$ F capacitor, a 47K resistor, a coil made of 26-30 AWG copper wire with 140- 150 turns, and a speaker is used. Arduino UNO is used as a flight controller and MPU 6050 gyro provides stability and navigational information.[5]

6. Navigating Assistance System for Quadcopter with Deep Reinforcement Learning by Tung Cheng Wu, Shau-Yin Tseng, Chin Feng Lai, Chia Yu Ho, and Ying Hsun Lai[6], the paper explains the deep reinforcement learning method for quadcopter to bypass the obstacle on the flying path. The quadcopter navigation function is based on calculating the coordination point and find the shortest straight path and the collision avoidance function is implemented using the deep Qnetwork model. Also, the deep Q-network will help the quadcopter fly up and down to bypass the obstacle. For the experiment, the training environment in Unreal Engine with AirSim plugin is used, and the resulting model can avoid 86% of object obstacles in the strange path.[6]

7. Quadcopter Obstacle Avoidance and Path Planning Using Flood Fill Method by Sushrut Ranade, and P. V. Manivannan[7], unmanned aerial vehicles (UAVs) require advanced path planning to reach the destination point and obstacle avoidance algorithms for navigation. In this paper, the Flood fill method (FFM) was used for navigating an autonomous quadcopter in a simulated environment to complete the task. FFM method is then compared with the traditional potential field method (PFM) in term of parameter such as avoiding random obstacles for variable starting and destination positions, the time required to complete the journey, task and the optimum path selection. FFM works computationally faster than PFM [7]

8. Autonomous Quadcopter for Product Home Delivery by Md R Haque, M Muhammad2, D Swarnaker3, and M Arifuzzaman[8], in this paper we learned about trade-off between maximizing profit and maximizing client's satisfaction in the content of drone service. A simulation study was done to compare drone with different strategies. We have compared some possible drone strategies and



identified common factors that may affect the decision-making process of quadcopter according to their strategies. Future will involve working with multiple drones and different drone strategies as there are project developing air traffic management system and will increase drone's reliability, efficiency, and profitability. [8]

9. On-Drone Decision Making for Service Delivery: Concept and Simulation by Majed Alwateer, and Seng W. Loke[9], in this paper we learned about trade-off between maximizing profit and maximizing client's satisfaction in the content of drone service. A simulation study was done to compare different drone serving strategies. We have considered some possible drone strategies and identified common factors that may affect the decision-making process. Future will involve working with multiple drones and different drone strategies as there are project developing air

traffic management system and will increase drone's reliability, efficiency, and profitability.[9]

## 2. PROBLEM IDENTIFIED

Due to rise in demand for commercial deliveries within cities, companies are facing problem to home delivery because of heavy traffic in road transport. Drones will solve the problem by exploring the transport opportunities in vertical dimension above the road. Drones will be able to reach places which are difficult to reach. For years, companies such as Amazon and Google have been working hard at developing a safe and practical way of utilizing the potential of unmanned aerial vehicles to improve upon their current network of delivery services.

Sr. No.	Title of the paper	Year of publication	Authors	Methodology	advantage
1	Path planning of an autonomous quadcopter-based delivery system	2018	Athira Krishnan R, Dr. V. R. Jisha and Gokulnath K	<ol style="list-style-type: none"> <li>1. Bidirectional RRT is efficient in finding a path between start and goal</li> <li>2. APF uses repulsive force toward obstacle and attractive force toward goal</li> <li>3. Position control reduces the error in position</li> <li>4. Altitude control is used to maintain reference altitude reference</li> </ol>	<ol style="list-style-type: none"> <li>1. Faster than normal map</li> <li>2. Execution time is less</li> </ol>
2	Power measurement and modeling of quadcopters on horizontal	2017	Kataro Maekawa, Shunsuke Negoro, Hiroyuki Tomiyama	<ol style="list-style-type: none"> <li>1. They developed light weight voltage and current logger</li> <li>2. The logger is inserted between battery and quadcopter to record the voltage between battery terminals and the current from battery</li> <li>3. During the horizontal flight, the force nerated by four rotors can be broke down into component</li> </ol>	<ol style="list-style-type: none"> <li>1. Logger will help us to keep record of voltage and current</li> <li>2. Use battery efficiently</li> </ol>
3	Quadcopter flight dynamics	2014	Mohd Khan	<ol style="list-style-type: none"> <li>1.The propeller speed is adjusted to</li> </ol>	<ol style="list-style-type: none"> <li>1. Easy to use as mostly autonomous</li> </ol>



				<p>gain or lose altitude. This feature is used for taking-off or landing-off</p> <p>2. Another controller is used to increase speed, slow down or turn by adjusting the speed of the certain propeller</p> <p>3. To control thrust by giving required RPM</p>	2. Less human efforts
4	Crowd Monitoring and Payload Delivery Drone using Quadcopter based UAV System	2018	K.VV.M ani Sai Kumar, M d Sohail, Dr. Usha Rani. Nelakuditi	<p>1. APM 2.5 is used as pre-programmed flight controller</p> <p>2. In this design 1400kv and propellers are about 1045</p> <p>3. A quadcopter having a payload delivery of 500 grams along with a camera is designed.</p>	<p>1. The quadcopter can be used to deliver a payload.</p> <p>2. The quadcopter can be used for surveillance purpose and crowd monitoring</p>
5	Designing and Implementation of a Multi-purpose Quadcopter	2018	Nadia Nowshin, Hossain, Md. Ahsanul Kabir, Anne, Sumaiya Jannat, Kafa, Kaniz Fatema	<p>1. For the fire extinguisher a flame sensor, a two-channel relay, a DC motor, a bottle, and a hand-made plastic board propeller is used.</p> <p>2. To detect metal NE555 Timer IC, two 2.2<math>\mu</math>F capacitors, a 10<math>\mu</math>F capacitor, a 47K resistor, a coil made of 26-30 AWG copper wire with 140-150 turns, and a speaker is used.</p> <p>3. Arduino UNO is used as a flight controller and MPU 6050 gyro provides stability and navigational information.</p>	<p>1. The quadcopter can be used as either a metal detector or a fire extinguisher.</p> <p>2. It is a low-cost system and provides accessibility to low-income households.</p> <p>3.It can be easily upgraded</p>
6	Navigating Assistance System for Quadcopter with Deep Reinforcement Learning	2018	Tung Cheng Wu, Shau-Yin Tseng, Chin Feng Lai, Chia Yu Ho, Ying Hsun Lai	<p>1. Two function to control quadcopter - navigating function and collision avoidance function</p> <p>2. Navigation</p>	1. The quadcopter will autonomously fly from one point to other without any collision

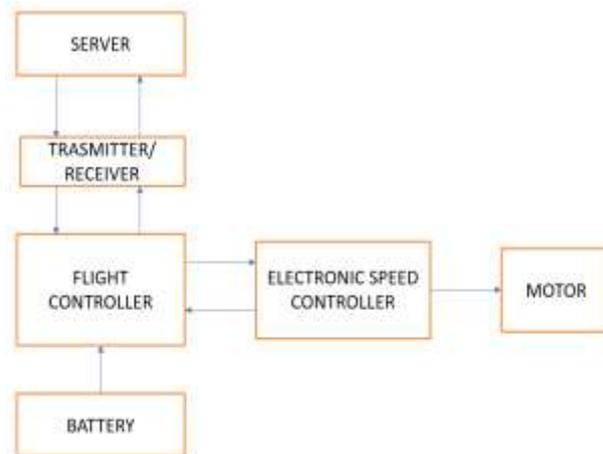


				function is based on calculating the coordination point and find the shortest straight path 3. collision avoidance function is implemented using the deep Q-network model.	
7	Quadcopter Obstacle Avoidance and Path Planning Using Flood Fill Method	2019	Sushrut Ranade, P. V. Manivannan	1. PFM is used for ground agent path planning while FFM is used for maze solving ground robot. 2. In PFM obstacle exert imaginary repulsive force while the target exerts an attractive force on quadcopter	1. FFM takes less time for deciding a path and tracing it as compared to PFM 2. Effectiveness of FFM was more than PFM Avoided all obstacle successfully
8	Autonomous Quadcopter for Product Home Delivery	2014	Md R Haque, M Muhammad <sup>2</sup> , D Swarnaker <sup>3</sup> , M Arifuzzaman	1. Customer will buy product and online company will send confirmation sms 2. Loading will be done of parcel and oordinates will be provided to quadcopter 3. Quadcopter will use google map to reach the destination 4. After reaching the destination and confirmation it will drop the parcel	1. Faster transport 2.Reduce of cost fuel 3. Less human labour 4. Time saving
9	On-Drone Decision Making For Service Delivery: Concept And Simulation	2019	Majed Alwateer, Seng W. Loke	1. Drone receive request directly from clients or indirectly through a proxy (i.e. its station center) 2. The drone must then decide whether it can take up a job upon receiving the request 3. Drone will perform the request	1. Autonomous activity 2. Save human efforts 3. More revenue

### 3. PROPOSED SYSTEM

Due to rise in demand for commercial deliveries within cities, companies are facing

problem to home delivery because of heavy traffic in road transport.



Use of drone will enable faster transport of goods which will ensure timely delivery. It will also reduce the fuel cost of vehicles and human labour and thus will help in reducing the overall carbon footprint. In this proposed system a quadcopter-based UAV (unmanned Aerial Vehicle) is used. This system represents quadcopter-based UAV as a low weight and low-cost autonomous

flight capable Unmanned Aerial Vehicle for delivering parcel ordered by online from one place to another. This UAV by following Google map can locate and navigate to the destination. This system demonstrates the capability of the UAV to delivered parcel ordered by online and coming back to the starting place.



Figure 1. Architecture of a quadcopter

#### 4. OBJECTIVES

1. To reduce the overall time taken to deliver products to the consumer
2. To reduce overall cost involved in delivery
3. To increase efficiency
4. To reduce carbon footprint in the environment.

#### 5. CONCLUSIONS

This paper discusses on the topic of using unmanned arial vehicles as payload delivery drones for transporting goods for one place to other. It takes note on various works done over past years and proposes a system that can be used by the commercial industries for delivering goods to the consumer with efficiently, less energy consumption, reduced time and less carbon footprint thus, making this system an environmentally friendly.

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