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Surveillance Drone

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***Abstract* - This paper deals with the making of an autonomous nature of unmanned aerial vehicle to suit the purpose of rescue operation. It does so by easily approaching the areas where immediate help is required. With the added feature of live streaming, it takes video of such disastrous place. The video output is monitored in real time basis and the exact location of critical condition is made known. The use of drone not only facilitates the accessibility of places faster but provides us with a wide view of the area increasing the range of monitored area. Wave used image processing as well to be able to better detect the individual in need. Thus, the project can be summarized as an unmanned aerial vehicle that can be used in those areas where there is need of continuous monitoring and reaching of human is difficult and time consuming. This project is mainly focused on the use of drones as an automatic system that can reach on a mapped destination without the intervention of human beings after a planned mission is loaded in its microcontroller.**

Keywords: Radio transceivers, Wireless networks.

I. Introduction

A drone or unmanned aerial vehicle as the name suggests is a kind of vehicle that flies over in the sky but with no human inside. Though humans are not aboard this vehicle and on the ground due to its compact nature, the task of helping in the smooth flight is not a possibility without the support of humans. The flight could be planned before the take- off or is planned when the drone is in air. Drones are used widely in photography, in activities done in leisure, for entertainment purpose, or to record videos of games, and events which cover a relatively large area that does not fall in the range of human visibility. Its ability to fly high and provide large coverage is of utmost importance to mankind.

Drones are used for military tasks as well to gather intelligent information about the enemy, pre-attack to make better plans to take down the enemy with lower casualties. This technology is also of use in large zoos to keep an eye on the inhabiting animals. It is used in many fields to pick and drop material as well. For the design of such drones, it is very necessary to bear in mind the weight of the load that is to be transported during the selection of the component for the making of the drone. The drone finds its use in any and every kind of situation and place where the physical presence of human is uninvited or dangerous.

In the present context it is not uncommon to notice drones in the hands of a teenager as a plaything or in possession of a professional to make their task convenient and easy. A look on the outer form as well as in the features it is equipped with in the past decade suggests a massive and rapid development in the drone. Drone can perform the task that requires employment of a lot of time and manpower in a small time single handedly. From being fully controlled by humans with the help of a remote it has now become a self-controlled entity when it comes to flight missions.

II. Related Work

In this part of the paper, we will discuss the work done in the past in the field of development of drone. The first drone was made for the purpose of battle in the 1900s. The use of miniature to micro forms of aerial vehicle was also noticed then. Their development kick-started in that time and never looked back. Since then drones have been used in several fields to do several tasks.

This paragraph elaborates the use of drone in the field of GIS. It is used as a useful tool in this field to acquire the highly important and reliable data from the most remote places of the world. Many modifications have been made to make it suitable for gathering information for the collection of the information. Use of drones easily maps down a large area and is able to get quality real time imageries as well as other forms of data with the help of the equipped sensors.

Obstacle detection techniques were researched and integrated in the drone technology to simply provide them immunization to obstacles encountered mid-air while heading towards the target. Use of ultrasonic sensors, complex patterned algorithms such as potential field derivations as per the panel method etc. were done to make sure the drone did not collide with and avoided the obstacle properly. The employed algorithms were also made more precise with time.

With the spurious development in the drone efforts were made to make it less costly and multi- functional using lesser resources so that it could be easily available to the professionals who required its assistance. The drone was

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incorporated with dedicated microcontrollers having onboard sensors to detect the pressure, the position, etc. It could use receiver and transmitter pair to send back the raw data gathered by it.

III. Methodology

The methodology includes the overall tasks performed for the design and development of the proposed system. The methodology is further divided into Design and Workflow.

3.1 Design

The design of the system is divided into three parts i.e. User Control, Drone and Surveillance. The user control part includes the laptop (base station) and the transmitting radio telemetry device. The drone consists of flight controller, receiving radio telemetry, GPS module, electronic speed controllers, brushless motors and a lipo battery for the power supply. In the same way, the surveillance part includes the Raspberry pi 3B microcomputer, laptop, raspberry pi camera module and the ultra-sonic sensor.

The User control part is the transmission part of the system. The command is provided to the drone from the laptop via the transmitting telemetry device. Thus, from the ground station the flight of the drone can be controlled.

The drone is the main part of the system. The command delivered from the laptop is received by the receiving telemetry device and the command is processed by the flight controller and thus the action which is demanded by the command from the ground station (laptop).

The surveillance part performs the live streaming task. For the live video the raspberry pi is connected to the Wi-Fi and is provided with an IP address. The provided IP works as a wireless LAN. Then with the use of simple python code the HTML page is rendered for displaying the video from the pi camera.

The rendered page can be accessed from any devices connected in the same network as pi by using the IP and the provided port number. The Surveillance part also includes the ultrasonic sensor for detecting the obstacle in between the path of flight and hence for the avoidance of the obstacle.

The design diagram of the proposed system is diagrammatically shown below:

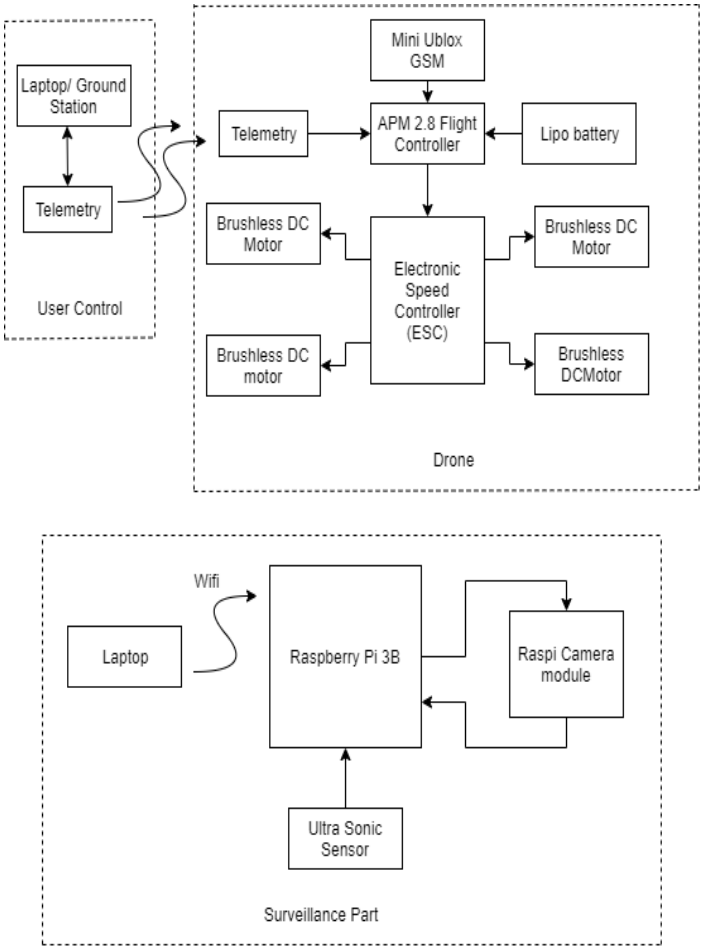

Figure 1: Design Diagram

3.2 Workflow

The workflow describes the working of the proposed system in a systematic way. In other words the workflow explains the tasks performed chronologically for the achievement of the specific mission.

The workflow can be elaborated by the flowchart. The flowchart is also divided into two parts i.e. forward and backward. The forward chart describes the operation of the system from the ground to the destination and the backward chart describes the operation of the system from the destination point back to the ground station.

The operation of the system in both the cases is similar with a small difference. The flowchart for the forward path of the proposed system is shown below:

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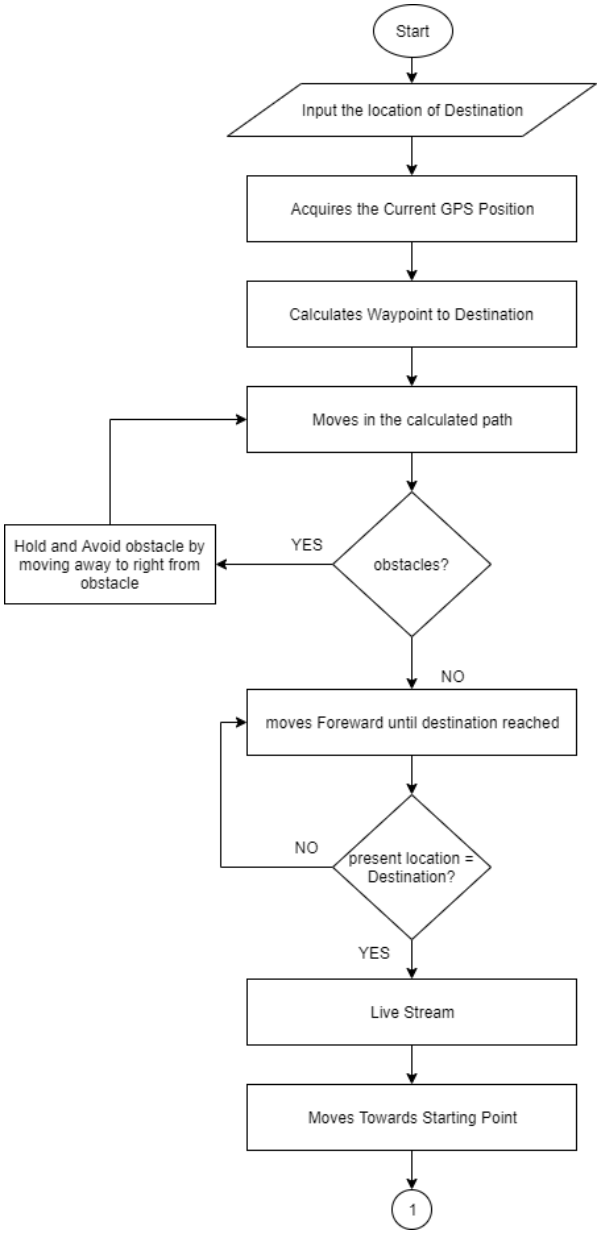

Figure 2: Flowchart of Forward Workflow

The forward flowchart describes the working of the system in the forward. As seen from the above diagram, first the destination is taken as the input by the flight controller via the radio telemetry. Then the GPS acquires the current location of the system. Then, based on the firmware and program installed on the flight controller, the waypoint to the destination is calculated.

Thus, the system starts moving towards the calculated path. The system checks about the presence of obstacle in between the path. If the obstacle is encountered then it will hold and avoid the obstacle by moving right to it. After avoiding the obstacle it checks whether the destination is reached or not.

If it is reached then it will start live streaming for some times determined by the program and if not it continue moving towards the destination. After completion of the live streaming the system moves towards the starting point in the similar way.

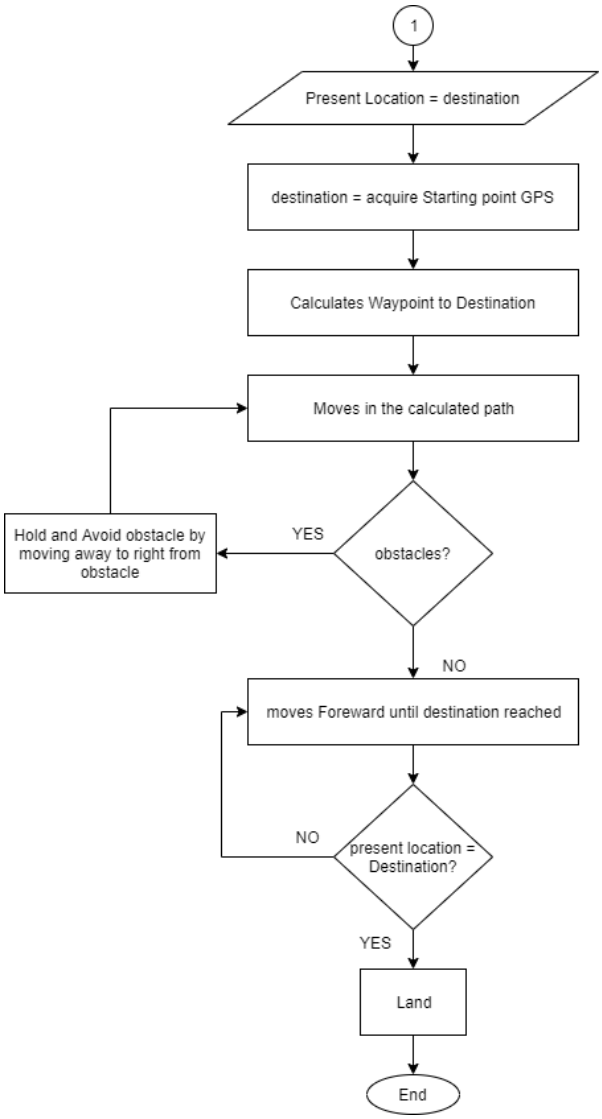

Figure 3: Flowchart of backward Workflow

The flowchart of the system moving in the backward path or returning back to the start position is illustrated bellow. The only difference in the flowchart is the exchange of the value of present location and destination. Then the system operates in the similar manner as in the forward path.

IV. Result Analysis

The final outcome of the project is a prototype drone that flies to the desired location and live surveillance the real time video. The outcome of the project can be seen in the pictures below:

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Figure 4: Flying Drone

After many practices and research we were able to make fly our drone autonomously and this picture was taken during our quadcopter flying.

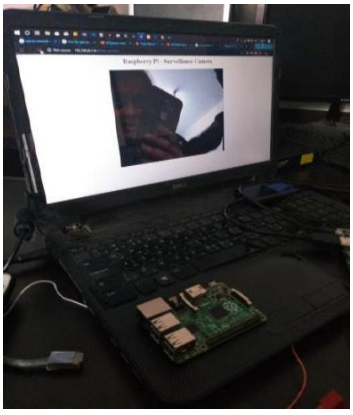

Figure 5: Surveillance using Raspberry pi

Surveillance is main part of our project. We have used raspberry pi for our surveillance. The pi camera takes the video and sends it to the raspberry pi for processing.

Before integrating the system with the final circuit, it was first simulated using Mission Planner simulation software. The several simulations done using the software are shown in the figures below:

Figure 6: Mapping of waypoint

After the simulation done by mission planner. In the Google map shown by the mission planner all the waypoint which we desired for our drone to fly autonomously were mapped.

After mapping of waypoint the drone will follow that waypoint and will move towards destination following such waypoint.

Figure 7: Telemetry log during flight

During flight these are the telemetry log which is seen on the screen of mission planner. In mission planner all the data related to flight are shown during flight. Like values of roll, yaw, pitch, altitude of our quadcopter, gps signal, number of active satellites during flight. Fail safe modes, etc

V. Conclusion

In this project a drone of autonomous nature was created. The drone uses an apm which controls most of the other hardware used in the drone. The drone also makes use of mounted raspberry pi for the live streaming part. The mission planner software is used to perform and monitor the flight of the drone. Hence, making the drone with the capability to perform the very many desired functions we begin with, we have succeeded in fulfilling our goal of completing the major project.

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