Journal of Engineering Sciences
Vol 12, Issue 07, July/2021
ISSN NO:0377-9254

ACCIDENT MONITORING SYSTEM USING DRONE

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Abstract— **UAV is defined as an aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expandable or recoverable, and can carry a lethal or nonlethal payload. It is controlled either autonomously by on-board computers or by remote control of a pilot on the ground. Its usage is currently limited by difficulties such as satellite communication and cost. A Drone has been built that can be operated by radio frequency controller and send live audio-visual feedback. The developed Drone control system has been simulated in MATLAB/Simulink. The simulation shows a very stable operation and control of the developed Drone. Microcontroller based drone control system has also been developed where a RF transmitter and receiver operating in the frequency of 2.4 GHz are used for remote operation for the Drone. Earlier, Drones were deployed for military applications such as spying on both domestic and international threats. The developed drone in this work can be used for a number of applications, such as policing, firefighting, monitoring flood effected areas, recording video footage from impassable areas and both military and non-military security work. In addition, using an Android mobile device incorporation with GPS has been used for live position tracking of Drone and real time audio-visual feedback from Drone.**

1. INTRODUCTION

Unmanned aerial vehicles (UAV) are more properly known as Drone. Basically, drone is a flying robot [1]. Working in combination with GPS, the flying machine may be remotely controlled or can fly autonomously by software controlled flight plans in their embedded systems. Drones are most often used in military services. However, it is also used for weather monitoring, firefighting, search and rescue, surveillance and traffic monitoring [2] etc. In recent years, the drone have come into attention for a number of commercial uses. In late 2013, Amazon announced a plan to use unmanned aerial vehicles for delivery in the nearby areas future [1]. It is known as Amazon Prime Air, it is estimated to deliver the orders within 30 minutes inside 10 miles of distance [1]. So it is clear that domestic usage of UAV has vast future possibility in different fields rather than military usage.

Drones for military use were started in the mid-1990s with the High-Altitude Endurance Unmanned Aerial Vehicle Advanced Concept Technology Demonstrator (HAE UAV ACTD) program managed by the Defense Advanced Research Projects Agency (DARPA) and Defense Airborne Reconnaissance Office (DARO) [3]. This ACTD placed the base for the improvement of the Global Hawk. The Global Hawk hovers at heights up to 65,000 feet and flying duration is up to 35 hours at speeds approaching 340 knots and it costs approximately 200 million dollars [4]. The wingspan is 116 feet and it can fly 13.8094 miles which is significant distance [4]. Motherland security and drug prohibition are the main needs Global Hawk was designed for [5]. Another very successful drone is the Predator which was also built in the mid-1990s but has since been improved with Hellfire missiles. “Named by Smithsonian’s Air & Space magazine as one of the top ten aircraft that changed the world, Predator is the most combat-proven Unmanned Aircraft System (UAS) in the world” [6]. The original version of the Predator, built by General Atomics, can fly at 25,000 feet for 40 hours at a maximum airspeed of 120 [6]

2. EXISTING SYSTEM

Many methodologies have been tried to improve real-world aircraft with vertical take-off and landing abilities. First, Nikola Tesla introduced a vertical take-off and landing vehicle concept in 1928. Advanced VTOL aircrafts uses a single engine with thrust vectoring. Thrust vectoring illustrates that the aircraft can send thrust from the engine in different directions, so that vertical and horizontal fight can be controlled by one engine [7]. The Harrier Jump Jet is one of the most famous and successful fixed-wing single-engine VTOL aircraft. In the 21st century, UAVs are becoming progressively conventional. Many of these have VTOL capability, especially the quad copter type. We were also interested by the requirements of DARPA’s UAV forge, while studying large and tiny UAVs competition which was posted

Vol 12, Issue 07, July/2021
ISSN NO:0377-9254

around the time we started our project.

The UAV forge contest us basically to design and build a micro-UAV that can take off vertically, go to the destination and surveillance the area for three hours. We know transporting and resupplying troops is a great challenge in war field. To meet this challenge DARPA initiated a program in 2010 demonstrating four person vertical takeoff and landing vehicle Twin tilting ducted fans would deliver effective flying and landing abilities in a compact structure. It is capable of rapid change to high-speed travel voyage. However, this project is under development now. Our project has similarities with this Lockheed Martin's research and the flying methodology is partially similar to their machine.

3. PROPOSED SYSTEM

As has been already stated in the abstract, this thesis is turning around an unmanned flying vehicle called drone. The aim of this thesis is to find an appropriate mathematical model for such a machine and develop a complete control architecture which will allow the drone to fly. Using this features then we develop our UAV, for observation and scouting missions for civilian or even military personnel. An UAV (Unmanned Aerial Vehicle) with precise payloads can hover straight above the fire zone to record video of the fire line, as well as thermal images that are then geo-tagged and communicated in real time to mobile command centers using the planning and monitoring system for firefighting [10].

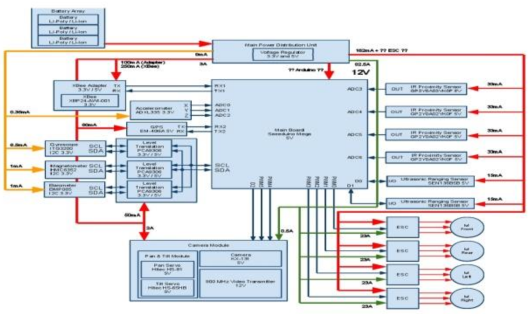

Figure-1: Block diagram and internal connections

From the experience of the last few years, we have seen that many garments factories and markets burned in Bangladesh. So if we surveillance the affected area by UAV, then we can get a proper direction and make decision from where to extinguish fire. At the same time we can send a UAV close to the fire to see whether any human being exists inside the building or not. On the other hand, flood visits our country almost every year. So we can also surveillance flood effected area and we can send primary help to them like dry food, water or first aid kit. However, surveillance can be done using helicopter but it consumes huge amount of fuel thus it is costly. In addition, as the size of the helicopter is bigger it cannot hover into a narrow space and if any accidents happens then a lot of money will be destroyed as well. In contrast electric powered drone consumes very low power and cost both plus it can hover into tiny spaces as it is small in size. So it is more efficient and environment friendly.

The software for the android device has been developed using an open source web application which is originally provided by Google and maintained by Massachusetts Institute of Technology (MIT) known as MIT App Inventor. On December 6, 2013 MIT released App Inventor 2 and this web application has been used to develop the app for the embedded system. A person with very basic knowledge of programming can develop any android app through this tool. This is very simple yet effective method to improve any application for android. No substantial software installation is needed for this and this can be completed just over web browser with a Google account. Byusing MIT app inventor we have developed an Android application for lipath tracking. We have named it "Path Tracker". The basic function of this application is, it records GPS coordinates and the current address of the location and sends it to the MySQL web server via PHP. For displaying data using Google Map API v3 it draw a red line through the each points it has travelled. In addition, it records data to when it starts it journey and stops and on the basis of this data it displays the average speed and distance

4. HARDWARE DESCRIPTION

a) Raspberry Pi

The Raspberry Pi is manufactured in three board configurations through licensed manufacturing deals with Newark element 14(Premier Farnell), RS Components and Ego man. These companies sell the Raspberry Pi online. Ego man produces a version for distribution solely in China and Taiwan, which can be distinguished from other Pi's by their red coloring and lack of FCC/CE marks. The hardware is the same across all manufacturers.

The Raspberry Pi has a Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZF-S 700 MHz processor, Video Core IV GPU and was originally shipped with 256 megabytes of RAM, later upgraded (Model B &

Vol 12, Issue 07, July/2021
ISSN NO:0377-9254

Model B+) to 512 MB. It does not include a built-in hard disk or solid-state drive, but it uses an SD card for booting and persistent storage, with the Model B+ using a MicroSD.

The Foundation provides Debian and Arch Linux ARM distributions for download. Tools are available for Python as the main programming language, with support for BBC BASIC (via the RISC OS image or the Brandy Basic clone for Linux), C, Java and Perl.

Figure-2: Raspberry Pi

b) Multi Rotor

The KK2.1.5 Multi-Rotor control board also uses signals from radio system via a receiver and passes these signals together with stabilization signals to the Atmega324PA IC via the aileron; elevator; throttle and rudder user demand inputs. Once processed, this data is sent to the ESCs which adjusts the rotational speed of each motor to control flight orientation (up, down, backwards,Forwards, left , right ,yaw).

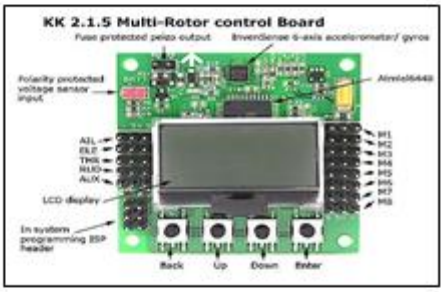

Figure-3: Multi rotor connections

c) ESC (Electronic Speed Controller)

An electronic speed controller or ESC is a device installed to a remote controlled electrical model to vary its motor's speed and direction. It needs to plug into the receiver's throttle control channel.

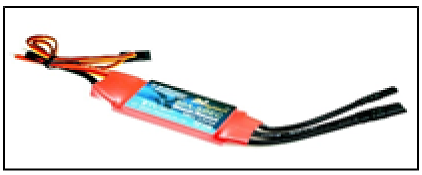

Figure-4: Electronic Speed Controller

d) Servo motor

For tilting the motors we have used small servo motors. In this experiment we have mounted two Futaba S-140 servo motor to tilt the brushless motors to a certain angle. This servomotor is can rotate up to 180º. So we can rotate each brushless motor up to 45º from normal as the brushless motors needs to be at 90º for vertical takeoff or lane.

Figure-5: Servo Motor

e) LIPO Battery

As the brushless motor we have used in this experiment needs high amount of current so we have used 3300mAh 11.1V 3 cell Li-Po (Lithium Polymer) battery. It can provide approximately 3A current constantly.

Figure-6: Li-Po Battery

f) Landing gear

Real-time information is a key challenge for engineering and construction companies. UAVs can assist project managers by providing a picture of the entire project and keeping them informed about day-to-day progress. They are then able to take informed decisions quickly and anticipate planning delays.

Figure-7: Landing gear

Figure-8: Live location tracking software

.5. SOFTWARE DESCRIPTION

a) Software Development

An Android mobile device has been installed in our Drone's payload system for live video stream, live position tracking and real time voice communication. By the aid of two android software we have manipulated audio video transmission and GPS position tracking system.

b) Live location tracking

The software for the android device has been developed using an open source web application which is originally provided by Google and maintained by Massachusetts Institute of Technology (MIT) known as MIT App Inventor.

c) Live location tracking software architecture

By using MIT app inventor we have developed an Android application for live path tracking. We have named it "Path Tracker". The basic function of this application is, it records GPS coordinates and the current address of the location and sends it to the MySQL web server via PHP. For displaying data using Google Map API v3 it draw a red line through the each points it has travelled. In addition, it records data to when it starts it journey and stops and on the basis of this data it displays the average speed and distance.

On the other hand, this data can be also accessed by computer from any place as all the data stored in the server. For the test purpose we have built a website in a free hosting server which can be accessed from both mobile and computer.

The proportional, integral controller action shows the better performance of controlling the roll, pitch and yaw of developed Drone. For live GPS tracking and live video footage feedback is also demonstrated. Demonstration shows the successful operation of Drone tracking and video footage transmission from Drone.

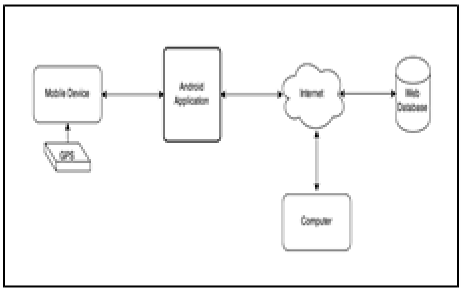

Figure-9: Flow diagram of live location tracking software

d) Live location tracking website architecture

In this experiment, we have built a very simple yet effective website to upload, download and display necessary data. We have used MySQL database to store data and PHP program to upload, download, calculate and display data. In addition, we have used HTML and jQuery to make a interactive display.

At the beginning, "index.php" file takes mobile number of the user and sends a get request to the database by "list.php". Finally, "analytics.php" file reads data from the database and calculates average distance by the aid of Google Map Api and we divide that distance value by the duration of flight and get the speed per hour. Aerial monitoring provides data for 3D object creation and area's orthophotographic map. The data can be continuously updated and stored as an online map for interactive viewing of objects. This provides a better control over the work progress and the

Vol 12, Issue 07, July/2021
ISSN NO:0377-9254

ability to provide investors and clients with the most recent visual information. This also equips and provides the ease to the government agencies to detect illegal construction detection.

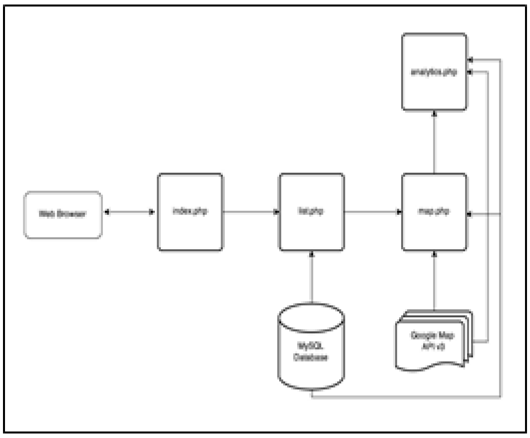

Figure-10: Flow diagram of live location tracking website

6. RESULT

we designed a structure for the airspace and provided strategies for utilizing that structure in the airspace. Our design makes it possible to provide generic services that can be used by many applications. To effectively tackle the problem of ‘‘how to enable drones to perform tasks’’, we divided the overall required functionality of the architecture into logical layers. The main sub-problem was the airspace navigation and coordination for various applications as addressed in the first three layers of IOD. We addressed other common services that are needed by applications such as location aware communication in an extensible service layer. In IOD architecture, we describe the features that are required to be implemented in each of these layers by IOD systems.. Finally, we discussed the differences and future works that can benefit from the solutions from the vast existing literature on these three subjects.

CONCLUSION

Aim of this project was to develop a Drone which can be used in several surveillance purposes and deliver light weight products. For controlling the Drone, 2.4 GHz radio frequency transmitter, receiver, microcontroller, electronic speed controller, brushless DC motor and servo motor have been used. MATLAB /Simulink has been used to developed the Drone roll, yaw and pitch control system simulation. The proportional, integral controller action shows the better performance of controlling the roll, pitch and yaw of developed Drone. For live GPS tracking and live video footage feedback is also demonstrated. Demonstration shows the successful operation of Drone tracking and video footage transmission from Drone.

FUTURE SCOPE

This work could be improved by including the precise mechanical instruments made of carbon fiber. In addition, to have a more precise PID parameters, new methods of PID tuning (the use of genetic algorithms) could be employed for optimal values. Yaw mechanism for tilting rooters can be more improved and well controlled by using gear mechanism. On the other hand, to increase the flight duration 5 cell 5000 mAh Li-Po batteries can be used and it is highly recommended that a vibration absorber needs to be attached to remove vibration effects and get a stable flight.

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