

Design of an audio sensitive emergency copter

Ishwar Jha, Yash Bhatnagar, Priyal Pandya, Rishabh Maurya, Amit Mandal
student, student, student, student, student
Electronics and telecommunication,
Thakur college of engineering and technology, Mumbai, India

Abstract: With the world becoming a smaller place to live in, with each passing day, interdependence is increasing and this has given a whole new importance to the field of automation and aviation. This paper aims at simulating a prototype of an unmanned device which can be used for varied purposes. The challenges that are faced by the emergency services in their day to day functioning are multidimensional. Now a multi-copter that would be sound sensitive and could be used to control mob situations by transmitting data in the audio format in an increased area, would be a boon for these services. The declared UAV being an autopilot can be used to deliver food packets, blood packets, first-aid boxes etc. to inaccessible areas. The need of the project is such that in a nation where the ratio of police officers per 1000 citizens is 3.4 and has a dense population, the multi-copter would help in governing unruly areas, bring help and relief to the disaster struck regions where it becomes impossible for the security forces to reach.

IndexTerms - Sound Sensitive, Unmanned device, Automation

I. INTRODUCTION

In recent times the drone technology has seen a growth throughout the country, drones were used at various occasions for mostly surveillance purposes at Juhu, Mumbai during the ganpati visarjan and in Prayagraj, India during the Kumbh Mela. The emergency service drone focusses more on the delivery aspect of the varied applications of a multi-copter. The sound sensitivity provides it a unique capability of synthesizing voice, emergency sounds and being able to deliver information in an area through a speaker in it. Advantage of such a prototype is that it is a step towards complete automation and reduces a lot of human effort and the skills required to fly the drone is not needed because of the autopilot. On a broader perspective, Drone technology will grow very fast in future because it is less costly, also helps the researchers to think forward in terms of this technology, and the very important purpose is that because of this in emergency services it does not lead to any casualties of humans.

As we all know that there different means to integrate audio sensor with drones so here the authors will discuss about some of them.

The multi-copter is using Pixhawk 4 flight controller that works in an autopilot mode also in case of failure it can be controlled by the avionics radio control. Also the drone has an external GPS through which the live location of the drone can be tracked. The way point navigation of the drone is done using Q-Ground control software. In which the way points are set and the drone returns to the original position after covering all those areas. First the configuration of the drone has to be done through the software after which the software is ready to connect in the autopilot mode.

The voice recognition module is the important feature of this drone as till now the drones in the market are voice activated but not voice controlled. The drone would sense the alarming sounds such as ambulance, burglar alarm also the sounds which have been pre-recorded hello, on, off etc.

The voice through the surrounding would be sensed through the voice recognition module would be detected and the corresponding response would be transmitted to the Arduino, the Arduino would send the signal to pixhawk to work accordingly.

II. BACKGROUND

The need of drones and their types are increasing as the applications are numerous and the sector of applications are also increasing from normal household to medical applications to military services.

This project aims at simulating a prototype of an unmanned device which can be used for research purposes with its added features of Audio sensitive to alarming sounds, location analysis, GPS enabled and integrated with an app.

Through the camera feed it makes the user not just see but actually experience the places or terrains where it is surveilling. The location analysis has been specially added to record the position of the drone. Through its added features this project aims at creating a model that will be an important aid in the fields of research and surveillance and reduce human inconvenience. In India, Adoption of UAV is increasing and it is projected that the value of market and industry would be around US\$ 885.7 million, while the global market size will touch US\$ 21.47 billion by 2021.

For 3D digital mapping, an autonomous agency of the Government of India is responsible for management of a network of National Highways they used drones for Detailed Project Report (DPR) for road widening at Rae Bareli – Allahabad Highway. Using UAV technology, national Railway System in India have monitored the construction of its railway lines by 3D mapping of 3,360 Km. The entire corridor will be mapped using UAV technology.

The first typically used drone was a life-sized retooling of the Delaware Havilland DH82B "Queen Bee" plane, that was fitted out with a radio and servo-operated controls within the back seat. The plane may well be conventionally piloted from the front seat, but, generally, the plane flew remote-controlled and was shot at by artillery gunners in coaching. The term drone dates to the present initial use, a play on the "Queen Bee" word.

In late 2012, Chris Anderson, editor in chief of Wired magazine, retired to dedicate himself to his drones company, 3D artificial intelligence INC. the corporate, that started off specializing in amateur personal drones, currently markets its solutions to photography and film corporations, construction, utilities and telecommunication businesses, and public safety corporations, among others.

III. RESEARCH METHODOLOGY

Design

6 cell Lipo battery of 4200mah, with a capacity of 25.2 Volts provides the power to the drone. The carbon fibre frame with 680 dimension and an aerodynamic design supports the drone. The 380 kv motors with an rpm of 5120 provides enough thrust to the drone to be stable at a position above the ground. The propellers of carbon fibre material each of which are 13 inches long, manages to hold up the weight of the hexa-copter along with some extra load attached. The landing gears with two limbs provides the safety to the drone while landing even on a rough surface.

There are three ways to control this drone one via avionics manual tx-rx through which the command is signalled as per the joystick movements in it, second is the radio telemetry which sends the commands through predefined waypoints, and the third is through voice recognition module which commands the arduino to pass the info to the flight controller. The lipo voltage and battery monitor block tracks the voltage of the battery. It has a pre-set threshold voltage such that if the battery voltage decreases below the threshold, the buzzer in it beeps and signals to stop the flight as the battery needs to be charged. The Esc's and motors are connected to the flight controller through a power management board which passes commands to them as and when needed.

The Multi-Copter Frame

There are many types of frames and it is most important to put together a frame that is appropriate for your use. There are unit tons of Multicopter frame sorts and lots of area unit out there as blank frame kits or nearly able to Fly copters. Most skilled grade Multicopters are unit made of fiber glass and carbon fiber cut conduit and plate. Carbon fiber is extremely robust, but is also brittle and can shatter on impact, it is also hard to machine and to glue to. Fiberglass weighs a touch a lot of for equivalent strength however is a lot of shatter resistant and easier to machine and glue to.

Fiberglass or carbon fiber tube and sheet construction are unit terribly appropriate to use for creating your own copters. Many shopper grade Multicopters are unit created with injection shaped plastic elements and metallic element conduit. Some injection shaped elements may be terribly sturdy (the Iris's Zytel frame arms for instance), but others are cheap and break easily.

Square metallic element conduit frame arms are unit common, but they tend to bend or break with annoying frequency in normal mishaps. Except in specialized welded H or box frames aluminum tubing frame arms are sub optimal and will not be covered in depth here. Some of the newer, smaller, commercially made Quadcopters have monolithic injection molded plastic shells. On smaller copters these shells may be quite sturdy however they might be too fragile on larger ones albeit mould prices were even. A few Quadcopters have monolithic shells made of vacuum shaped laminated Kydex or different plastic sheet. Vacuum formed shells of laminated Kydex have proven very durable on small copters and are very good for waterproof uses. At least one vacuum shaped copter has been created with in-built blade guards the Safe Flight 4410 (unfortunately out of business). Hand laid fiberglass or carbon fiber is also popular on high end quadcopters. There are unit some terribly enticing, hard to get and not inexpensive hand laid fiberglass and carbon fiber shells made by "DeX". There are also a variety of fiberglass shells for civilian, commercial and military use including an amphibious one. Fiberglass shells tend to be expensive and may get damaged in use and can be difficult to repair. Each variety of construction has blessings and drawbacks and it's necessary| vital |important} to work out what's important for your desires. Prop to prop and prop to frame clearance limit the max diameter of your propeller blades. Allowing for various prop diameters will let you tune the copter for its current weight, batteries and function. Generally allow an additional half inch of clearance from prop tip to tip or to center frame to avoid asymmetrical prop wash vibration. A major design criteria is to size the frame appropriately for the largest propellers you might ever want to use. Generally larger mechanical device diameter equals higher potency associate degreed an X frame layout commonly permits the most important doable props. Of course the motor speed and power and frame strength have to be compelled to be matched to the mechanical device diameter and to total lifting capability.

Working Modes of Operation

The Innovation and development in technology is reaching and solving all the problems that human efforts lack in curing. In country like India where the nation always faces people getting stabbed, robbed also in medical fields as the roads are crowded the transport of medical kits takes time. This drone would target the inaccessible areas and during emergency to supply blood packets, food etc. The applications of drones are not limited hence they are used in various sector. This drone would target the inaccessible areas and during emergency to supply blood packets, food etc. This project aims at providing the ability to drones to minimize the crime rate. The ability and advancements are with respect to its audio sensitivity. The drones would sense the types of alarming sounds and differentiate them if harmful or harmless and accordingly transmitting the information to the information base. This drone uses Pixhawk 4 flight controller which works in autopilot mode. An external neo GPS is been used that would help in tracking the drone also the flight controller has its own GPS but it is very sensitive to weather conditions so its preferred to use an external GPS. The telemetry radio Tx and Rx has a range of 2kms which would help this drone to survey through a large radius. As the drone is autonomous there would be a ground station to control and navigate the surveillance so the software that we are using is Q-ground Control and Mission Planner the protocol used in communication between the ground station and the drone is through Mav-Link Protocol.

Geetech Voice Recognition Module

Voice recognition helps in establishing a connection between human and machines using the voice recognition module. It has a mic that extracts and analyses voice features of human delivered to a machine or computer. Voice recognition technique has a classification of types based on criteria's such as scope of the users, number of words used for recognition, naturalness of speaking. The voice recognition level should be more than 95%, then only the voice recognition is practically used.

There are three modes of operation are as follows: A. Via Telemetry B. Via Radio Controller C. Via Voice Controller for automated operation Now, let's discuss above mentioned mode in detail with practical experience that the authors had done while implementing this topic on our drone respectively.

A. Via Telemetry

The 3DR Radio telemetry system is a replacement for X-Bee radios. They offer low price, long range and superior performance than X-Bee radios. It's available in 433 MHz and 915 MHz depending on the country and in the following configurations: Ground and Air radio modules. Air Radio Module is used for UAV Drones. Ground Radio Module is used to connect to a computer or display digital data on an equipment on the ground. When two modules are connected wirelessly, we can use the ground station software's (Mission Planner/ Q-Ground control) to adjust and upgrade the parameters.

Autonomous Flight Mission: The waypoints of the Drone are set manually in the Ground station software and are fed into the flight controller via telemetry radios. The procedure of setting the waypoints, selecting the flight mode, feeding it to the controller are referred to as a mission and once the mission is uploaded the return to launch flight mode can be used so that the drone returns to its original launch position after completing the mission. Below figure 1 shows the interpretation of above process.

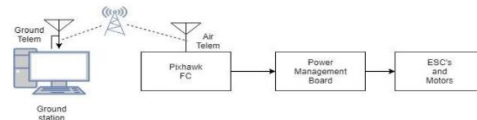


Figure 1

B. Via Radio Controller

A radio control system consists of two elements, the transmitter through which the drone can be controlled and the receiver that is connected to the flight controller. The transmitter simply reads the stick you operate and that sends it accordingly to the receiver. Once the receiver has this information it passes it on to your drone flight controller which makes the drone fly accordingly. A radio has many channels of which four separate channels are for each direction on the sticks along and some extra ones for any auxiliary switches it may have Avionics RCB6i receiver that is used by us has as bus through which the channels can be further extended for controlling the flight modes GPS etc. Below figure 2 shows the interpretation of above process.

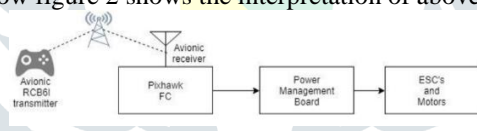


Figure 2

C. Via Voice Recognition Module

Voice recognition and implementation in drones has been universally achieved through Bluetooth modules. We decided to do it directly through voice recognition modules. However, the integration of voice modules with the drone is a challenge. The flight controllers aren't designed to support voice commands directly so the way of integration is through Arduino board.

The voice recognition modules have been designed to listen to Arduino programs and flight controllers are also quite compatible with Arduino but it is not that simple as the Arduino can only be connected as an output device. So, the voice command as input to the flight controller wouldn't be possible. So, we decided not to connect the Arduino directly to the flight controller but via radio receiver. Now as the radio receiver understands the value of its transmitter, we can program the Arduino to pass the voice commands same as it would be from the transmitter. Below figure 3 shows the interpretation of above process.

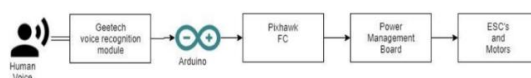


Figure 3

IV. RESULTS AND DISCUSSION

The emergency service drone on consuming 80% of the battery, can achieve a flight time of 20 minutes, keeping a safety limit of 5% without any payload. These observations were made in ideal conditions, and the drone was kept at a stable altitude for all the flight tests.

NOTE: Battery capacity = 4200mAH

When a payload of 500gm is added the flight time at a stable altitude is approximately 15 minutes while when the payload is increased to 1000gm the flight time achieved is 13 minutes. The audio sensor worked as a switch to arm and disarm the drone of flight but during the flight tests had range.

NOTE: Payload of 1.5 kg can be lifted but at the cost of the flight time. Telemetry range = 2 km which was not put to test due to the risks involved.

In this section of the document we will be discussing the verification and testing of each hardware and software components. All problems will be described in detail and the solutions we made to solve these problems. In this section we will also discuss this overall results of the project and what we could have done to improve upon this project. Future work for this project will also be mentioned in this section of the documents. Currently we have completed the assembly of the drone in which we have connected all the 6 motors to the model. Motor 1, 3 and 5 will rotate in clockwise direction and motor 2, 4 and 6 will rotate in anti-clockwise direction.

Ground station connection is completed using telemetry. We have used 2 telemetry, one for the transmitting purpose and the for receiving purpose. Live GPS tracking is now possible from the ground station through multiple ways. Here, 2 GPS device has been used, 1st is the in-built GPS device which is in the Pixhawk. The range of in-built GPS device is very low, so we can not access the drone from long distance, therefore, an external GPS device is also used which has no range constraints as long as the hexa-copter is connected to the ground station. Pixhawk 4 flight controller supports fully autonomous flight mode and way points can be set making it fully autonomous. Geetech voice recognition module has been integrated with Arduino that can be used for voice-controlled action of the drone once the prototype is ready

V. ACKNOWLEDGMENT

The preferred spelling of the word "acknowledgment" in America is without an "e" after the "g". Avoid the stilted expression, "One of us (R.B.G.) thanks..."

Instead, try "R.B.G. thanks". Put applicable sponsor acknowledgments here; DONOT place them on the first page of your paper or as a footnote.

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