



OPEN CV BASED METAL DETECTOR IN WAR FIELD USING DRONE

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Abstract- *Metal Detection using drone in the war field, is designed to identify the type of explosives based on metal content. Lot of undetected landmine is the cause to large number of deaths and loss of limbs during and after the war. Landmines are one of the major threats for the soldiers during the world war. In order to save people from those explosive objects we designed our prototype. An advanced technology camera is used to relay the live feed of the warzone and Open CV detects the type of object or intruder in the Warfield .It is then processed, enhanced, analysed and displayed to the user in a format that is easily recognizable.*

Keywords: *Metal Detection, Drone, Open CV, Live Feed*

I. Introduction

The necessity for removal of landmines is imperative and is of acute importance. Millions of landmines are left untraced which leads to increased death rates every year. Manual techniques for removal of landmines is time consuming and is less efficient. This research paper helps us to detect landmines using the quadcopter to reduce the stressful effects on environments and human as well. Quadcopters are advantageous and safe over land robots as they avoid contact with land mines [1]. The quadcopter is driven by four rotors and 4 propellers. It comes in a set of CW and CCW. The four motors are driven in two different direction CW and CCW. Flying the drone across the war zone to detect landmine is much safer than the existing method and time consumption is less. Arduino Uno microcontroller is used to drive the quadcopter. When landmine is detected, user gets a notification of metal located. Open CV plays a major role in this concept, it targets the objects and intruders, shows them in the monitor [3]. Gyro MPU6050 is used to balance the drone. It has a fixed value so that it can balance the

quadcopter. The PID Values plays the major role in Quadcopter because it is used to control the drone. It has Yaw, Pitch and Roll. Pitch is known as nose down or up about an axis running from end to end. Yaw is known as nose left or right about an axis running up and down. Roll is known as rotation about x-axis running from left to right and these PID values must be set predefined to the Arduino. These axes are alternatively designated as longitudinal, lateral and vertical. These axes move along with the vehicle and they rotate relative to the Earth. The gyro sensor is very essential because it is used to balance and level the flying of quadcopter, along with the quadcopter. The gyro sensor is very essential because it is used to balance and level the flying of quadcopter.

II. Overview of drone

The Quadcopter can be designed under various frame size depending upon the application we use. In our prototype we used Q450 frame which is well sufficient for our model. The frame is made up of glass fiber and polyamide nylon. A great advantage of using this frame is that we can add any additional mounting brackets. The Q450 frame comes with two different coloured arms 2 white and 2 red. It helps us to know the right direction of flying the quadcopter. Tall landing skid gear quadcopter legs are used in order to land the quadcopter safely which is made up of plastic. The motors used are 1000Kv- A2212/13T Brushless DC Motor (BLDC), the connections are given in such a way that two opposite pair of BLDC motor rotate in counter clockwise (CCW) direction and the other two opposite pair of BLDC motor rotate in clockwise (CW) direction. Quadcopter will increase and decrease its height by increasing and decreasing the motor speed. It is controlled by the speed of the motor and the speed also depends on propellers spin. Generally it flies forward or backwards by increasing the speed of the backbone propellers or by increasing the speed of front side

propellers respectively, and flies right or left by increasing the right or left propellers speed respectively. The fact that two opposite pair of BLDC motors spin counter clock wise direction (CCW) and the other two pair of motorsspin clockwise direction (CW), are exactly able to adjust the speed of each individual motor. Signals from the transmitter is sent to flight controller which is converted into digital and then sent to ESC. This is the way they get communicated. The ESC reads the instructions andincreases or decreases the voltage sent to each individual motor. Electronic Speed Controller is known as ESC which can able to control the speed of the motor and according to which Quadcopter flies. ESC used is 30A. Propellers are differentiated into two types one for CW rotation and other for CCW rotation. The size of the propellers are 10*4.5" which is suitable for Q450 frame. The Q450 comes with power distribution board for direct soldering of the ESCs. This boycottsthe need for a messy multi-connectors keeping the electronics layout very tidy and safe. In this PCB connections ESC can be directly soldered and then connected with BLDC Motors. The battery used is LIPO (Lithium Polymer) 11.1V and has 2200mah. LIPO has three cell. Each has 3.7V and constant discharge of 44A and peak discharge (10 sec) of 66A. Input voltage various from 12 -18 V and output current is 1.1A. Fig1 shows the drone block diagram.

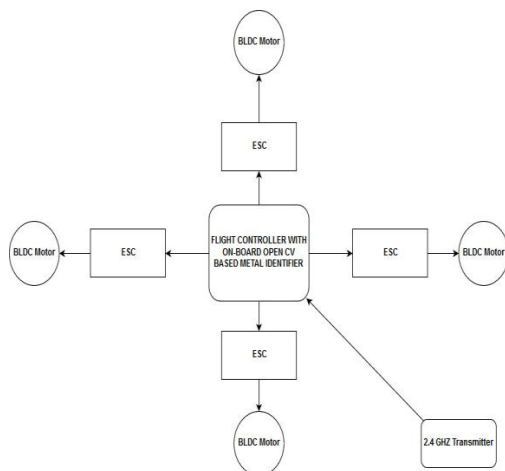


Fig1: Drone block diagram

This LIPO batteries can be recharged using suitable charger. Green led indicates it is fully charged, Red led indicates its charging, and red led (long time) indicates bad battery. LIPO battery can be placed in the PCB board. The Quadcopter is controlled by Flysky CT6B which has 6 channel transmitter.

III. MultiWii

MultiWii is a software used to control a RC quadcopter and it is an open source software. It is used to check the pitch, roll and yaw value of the quadcopter. MultiWii is s GUI Based software used to control multi rotor flying platform. This software is suitable for multiple hardware boards and sensors. There are many versions of software available in MultiWii, such as MultiWii 2.4, 2.3, 2.2, 2.1, 2.0, 1.9, 1.8, and 1.7. In our prototype we used MultiWii version 2.3 which is used to calibrate the quadcopter and also used the check the workings of gyro. The quadcopter is programmed in Arduino IDE software, the file is saved and then the program is uploaded to the Arduino board. Once the uploading process is over, In the MultiWii software we have to set the Baud Rate value and we can change the initial value for throttle, pitch, roll and yaw. Fig 2 shows the MultiWii configuration. While Accelerometer Calibration process place the quadcopter on the ground surface, output values of roll, pitch and yaw are plotted. V201 indicates the version of Multiwii software used. Save option is used to save the configuration of a file and Load option is used to load the configuration. Port com is used to select the desire port in which Arduino is connected. PID Settings set the Altitude and Global PID values. Expo setting sets the expo and rate setting of roll/pitch and throttle values. Calibration allows us to set Magnetometer and Accelerometer Calibration from GCS. Read/Write option allows us to read/write from the board.

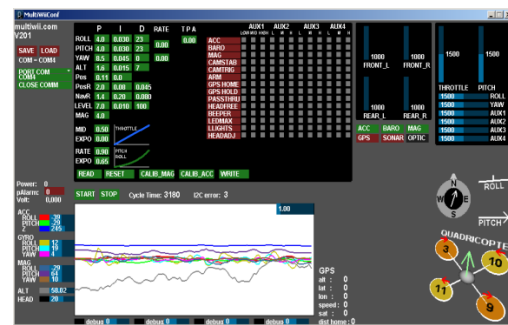


Fig 2: MultiWii Configuration

IV. Configuration of drone

Initially quadcopter must be calibrated and then configured by setting the suitable PID values, so that quadcopter flies perfectly. PID stands for Proportional, Integral, and Derivative. It is a major part of flight controller software which reads the data from transmitter and calculates how fast the motors should spin in order to retain the speed of the quadcopter. The goal of the PID controller is to correct the gyro values, the difference between a

gyro sensor measurement and the desired rotation speed. The error can be reduced by adjusting the control inputs, which is the speed of the motors. Before setting the PID values for yaw, pitch and roll we need to follow trial and error method. Studied the designing and controlling of the Quadcopter[5]. We need to find the exact value which suits for the quadcopter. PID values plays a major role in the quadcopter.

A. setup

Quadcopter is controlled by Flysky CT6B which is a six channel RC transmitter. It consists of throttle, roll, pitch and yaw. Throttle is for taking off and landing the quadcopter. Roll is used to move the quadcopter in left and right direction. Pitch is used for forward and backward direction of the quadcopter. Yaw is used for 180° rotation. Before using the transmitter we need to configure it so that it works perfectly.

B. ESC Calibration

ESC is known as Electronic Speed Controller which can able to control the speed of the motor and according to which quadcopter flies. ESC needs to be calibrated so that they function with the minimum and maximum ppm values that the flight controller will send. Before calibrating ESCs, we need to ensure that the quadcopter has no propellers on it and the APM is not connected.

C. Flight test

The final process in the configuration is flight test. After the setup and ESC calibration the quadcopter can be tested in the open ground. If there is any problem in the flight test then the PID values are changed until the quadcopter flies stable

V. Metal Detection

Detection of land mine has been an upcoming challenge for the last couple of years, as there are lots of mines still undetected and still functioning causing cause to large number of deaths and loss of limbs. Have explained the different techniques of land mine detection [4]. There are various methods involved in detection of landmines such as:

- 1) Biological Method
- 2) Electromagnetics Method
- 3) Metal detector Technologies
- 4) Mechanical Method
- 5) Acoustic Method

Countries like India are training rats to detect landmine buried underground but the main

disadvantage is that it takes more time to train the rats. Once the training is completed the rats are put through a rigorous test. The other way to find landmine is RC car. Metal detector follows magnetic field concept. When current flows through the inductance coil, it creates a magnetic flux around the coil [2]. When metal detector is placed above any metal object, the magnetic flux will penetrate inside the metal and in turn creates electric current which flows around the metal and it produce sound from the buzzer. Metal detector is shown in Fig3.



Fig 3: Metal Detector

VI OpenCV

Open Source Computer Vision (OpenCV) is a machine learning software which accelerates the use of machine view in commercial products and consists of common infrastructure for open source computer vision applications. OpenCV can be coded in various software languages and it supports OS (operating systems) like Windows, Mac OS. It has more than 2500 optimized algorithm [3]. These algorithms can be used to detect, classify human actions in videos, recognize faces, identify objects, track camera movements and even track moving objects. In this project OpenCV is used for object detection and let us know the type of object. Fig4 shows OpenCV detection process in the monitor screen.

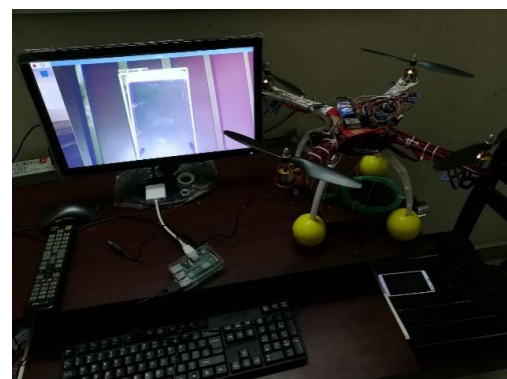


Fig 4: OpenCV detection process

VI. Working Model

There are many research paper dealing with landmine detection. In this research paper we are using metal detector to detect the buried landmines using a Quadcopter. Quadcopter is driven by 4 motors each rotor has 1000kv, Here we have use the 1000kv motors because it will be suitable for aerial view military surveillance. The speed of the motor is controlled by electronic speed controller (ESC), the data is send to ESC through Arduino board, and the source of data is received from transmitter [5].

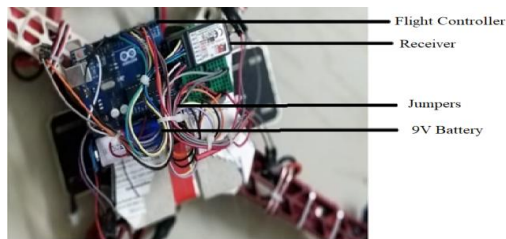


Fig 5: Quadcopter top view

We use Fly Sky CT6B Transmitter and Receiver. It uses PPM signal to send the data. There are four different channels throttle, yaw, pitch and roll. Fly Sky CT6B can be configured using T6Config. The height of quadcopter is controlled by the transmitter up and down. Quadcopter can be moved in 360 degree direction. When the quadcopter flies above the landmine, a signal is generated and sent to the user. Fig5 and Fig6 diagram indicates the model of quadcopter. Live surveillance of the area is given by web camera. OpenCV plays a major role in this concept, it detects the type of object or intruder in the Warfield. It is then process, enhance, analyse and display to the user in a format that is easily recognizable.

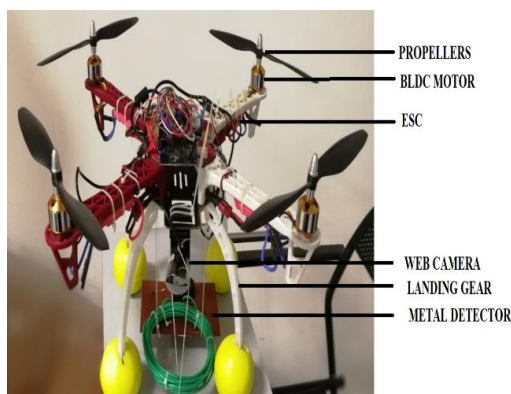


Fig 6: Quadcopter side view

VII. Future work

The current prototype has an ability to detect the metal up to the range of 15cm from the ground level. A few changes has to be done in future to

enhance the range of metal detection. which can be performed by increasing the distance traversed by the electromagnetic waves and the radius of the coil has to be made bigger than the current model, which makes the Quadcopter to hover at larger distance from the ground level. Future work includes determining the landmine location by GPS (Global Positioning System) module. It should be programmed in such a way that, if any mine is detected then the longitude and latitude of the land mine has to be sent to user via text message. In order to mark the land mine area, a spray has to be attached in the quadcopter, if mine is detected then the spray is sprayed in that area. Increase in the weight can be compensated by incorporating a few design changes.

VIII. Conclusion

Landmines are one of the major threat for mankind since the world war. Detecting the mine without causing any harmful to the mankind is the major advantage of our prototype. There are still many inefficient methods are functioning to detect the mine, but efficient method has not been found. Identifying the mine using a rat or by other resource has always been a threat. Such kind of threat can be overcome by the help of surveillance Quadcopter. Using an RC car or land robot for detection may sometimes end up in blowing the mine, which is an expensive affair [1]. Our prototype can overcome all those disadvantages. It does not cause any threat to human life because the quadcopter will be controlled at a distance of a kilometre away from the mine. After thorough validation, the results can be seen in the user display, which is a safe determining process.

IX. Reference

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