International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

AUTONOMOUS DRONE ROBOT

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Abstract- *Quadcopter is a type of Unmanned Aerial vehicle (UAV), used in many applications to monitor and to collect data in the region where manned flight is difficult. Quadcopter consists of onboard sensors, flight controller and front camera which helps it to navigate independently. This paper describes automatic Object detection and tracking of selected object. This paper will give a brief idea about hardware setup of quadcopter, algorithms used for object tracking, and software required for this task.*

Keywords – Quadcopter, Object tracking, flight controller, Raspberry Pi.

1. INTRODUCTION:

The rapid advances in research, technology and development in robotics have made inexpensive and light weight drones, with many sensors and actuators. Many challenges have been overcome by these robots, and object tracking is one of the main challenge. This paper shows the way to build inexpensive drone for tracking. The idea is to sense and detect objects in video stream captured by the front camera and the selected object is tracked. Then the exact position of the selected object is then used to navigate the drone. Originally UAV's were used in military, in the missions where the task cannot carried out manned flights. Ex. Drone attack. Further development in drones used in aerial photography, shipping and delivery, racing etc.

3. METHODOLOGY

3.1 BASICS:-

1. UAV Quadcopter :- An UAV quadcopter is also called as a drone having a four rotors. These four rotors are used for boosting the movement upword. Quadcopter can be in the simplest form or in the most complicated form depending on the electronic system is used.

2. Flight Control :- An UAV has four motors allocated on the each arm of the frame, as shown in the below figure. In the figure the circles are the motors moving and the arrows are the directions of the motor. First and the third motor rotates in the clockwise direction and the second and the fourth motor rotates in the anticlockwise direction.

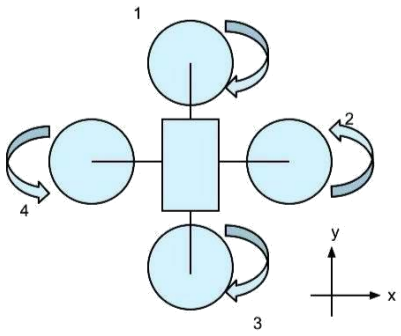

Fig. 3.1: Quadcopter: - Motor rotation

The vertical forces on the rotors of the quadcopter as starts getting over the gravitational force, the quadcopter uplifts itself from the altitude. Figure 3.2 shows the upwords motion of the quadcopter.

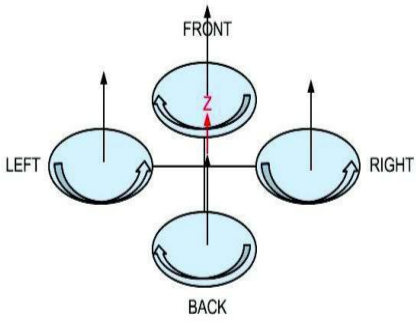

Figure 3.2: Quadcopter **:-** Vertical thrust movement.

Pitch is the term used to describe the up and the down motion of the drone along the erect direction. The vertical thrust producing here can be calculated by the drift of the left and the right motors; hence only changed term is pitch angle acceleration. While explaining the flight of the drone another aerial movement come into the picture is Roll; Roll is nothing but the motion of the drone along the all possible directions.

3. Quadcopter modeling: The UAV has the simple mechanism. As we have seen the flight of the drone, the vertical and the horizontal direction or the lift is achived

by the change in the trust of the drone. The frame of the quadrotor has the horizontal mechanism so that it can become simple to achieve the final lift.

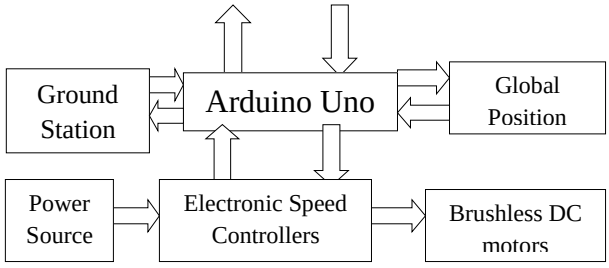

Figure 3.3 : block diagram

The block diagram designed in the figure (3.3) clarifies the flight control system of the drone. An Arduino Uno is the heart of the flight control system. It manages all the sensors, that are accelerometer, gyrometer, and barometer, with the power source and electronic speed controller of the brushless dc motors. The calibration between the motors and the power supply is managed by the arduino. The exchange of the information from the sensors to the CPU i.e. raspberry pi is done by the arduino. The overall architecture of the drone is depended on the communication between the arduino which controls the flight control and the raspberry pi which is the CPU of the drone.

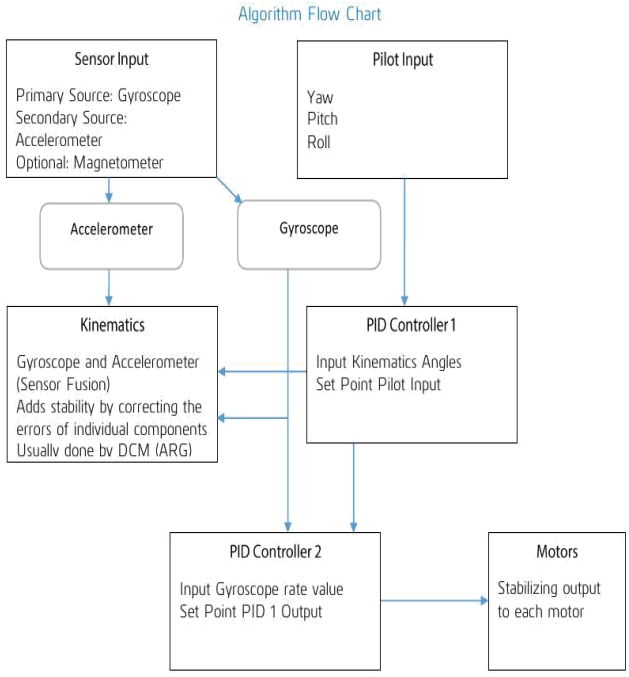

Figure 3.4 : overall flowchart of drone

Control system is the huge part of the evolution and expansion of the modern technology. A proportional–integral–derivative controller (PID controller) is an instrumental mechanism used to control the kinematic motion and the stabilization of the flight of drone. This controller evaluates an "error" and compares it with the desired result. We have used two PID controllers to stabilize the motion.

HARDWARE:

3.2.1. Drone Mechanism: The drone mechanism consists of following components.

- drone frame
- propellers
- motors
- ESC

3.2.2. Raspberry Pi: The Raspberry Pi is also called as the mini-computer on a single chip. Various generations of Raspberry Pi's have been released. The models of the RPi contains the broadband system on chip i.e. SOC and the CPU and GPU unit. It runs using the Raspbian software.

3.2.3. Transmitter and Receiver: The communication system of the drone involve mainly two elements i.e. transmitter can be held in hand and the receiver is situated inside the drone. The input information can be given to the tramsitter, it reads the input and passes it to the receiver. Receiver receives the signal and passes it to the flight control system of the drone.

3.2.4. Arduino Uno: A microcontroller board based on the microchip ATmega380p is nothing but the Arduino Uno. It has the input and output pins and is programmable using the arduino IDE. The boaed also has the mini version which is called as the arduino nano. It can be connected to the various sensors, because it is good in maintaining the communications. The information exchange as the input and the output is easier with the arduino IDE.

3.2 SOFTWARE :

3.3.1. Open CV:

Highly optimized library having the programming functions for the real time applications of the computer vision is nothing but the Open CV. The various algorithms in this platform are can be used for the face recognition, human computer interaction, mobile robotics etc. It supports the areas like the artificial neural networks and deep learning. The source has the function to use the various programming languages like C++, java, python, java script etc.

3.3.2. Tensor-Flow :

A free and open source library having the various function of programming for the machine learning platform is TensorFlow. The computation is expressed in terms of the dataflow graphs. It provides the AI programmable feature for the training and the running the model. It is an automated image capturing software which automatically works using the machine learning or the deep learning platform. The use of the TensorFlow is only for the machine learning and the deep learning applications which are automated. This software also can be used on the mobile phones with the flexibility. TensorFlow is designed in the java programming language but can be used for various languages like C++ or python.

3.3.3. Raspberry Pi OS (Raspbian):

The set of basic program and utilities is nothing but the operating system. To operate the RPi a software is used with Debian base is called the Raspberry Pi OS or the Raspbian. It can operate the entire RPi family which is on the single board. It can be used for the programming in various languages like python, C++, java and more or for the general use as it comes pre-installed. The operating system contains and has the distributed Linux platform. Raspbian buster and Raspbian stretch are the types of this operating system.

3.3.4.ARDUINO ENVIRONMENT (ARDUINO-IDE):

The environment which can be used as the text editor, writing and the debugging the programs. Arduino hardware boards run on this software. It can be used to write and upload the program to the Arduino boards. It set ups the communication with the hardware so that the giving the input information becomes much easier. Programs which are compiled from the languages like C and C++ can be run on this software. Arduino environment creates the well communication between the arduino and sensors.

4. APPLICATIONS:

- It has applications in civil constructions.
- Inspection of solar farms.
- Early plant disease detection.
- In efficient conversation and management of mangrove ecosystem.
- Geographic coordinates and data processing.
- Public safety.

5. RESULT & CONCLUSION:

An authentic and veritable perspective is been explained to recognise and find the object or target using the quadcopter with the camera. Algorithms and flowcharts presented in the paper gives the explaination of the architecture designed. The architecture explained is with considering the issues occurs during the environmental changes or the technical issues. The project aims to design and make the UAV for the servielence use and as tracking device. The aim for the future work is to apply the various techniques of the machine learning and deep learning with computer vision to get the cooperative and stable output.

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