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DESIGN AND DEVELOPMENT OF MICRO CONTROLLER DRONE FOR CIVIL APPLICATIONS

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Abstract:

This paper describes the current legal framework and regulations applied to industrial drone's flights established by different countries as a set point on drones and Earlier, Drones were deployed for military applications such as spying on both domestic and international threats. design and applications. Drone 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. 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.

Keywords: Drone, Microcontroller,

1.0 INTRODUCTION:

Drones including unmanned air vehicles (UAVs) and micro air vehicles (MAVs), have been used for a variety of civilian and military applications and missions. These unmanned flying systems are able to carry different sensors based on the type of their missions, such as acoustic, visual, chemical, and biological sensors. To enhance the performance and efficiency of drones, researchers have focused on the design optimization of drones that has resulted in the development and fabrication of various types of aerial vehicles with diverse capabilities. The use of aerial vehicles for industrial applications goes back to the 19th century. In 1860, balloons were used to take pictures for remote sensing purposes In 1903, pigeons carrying a breast-mounted aerial camera were used for photography Around the beginnings of World War I, aerial torpedoes, which are known as the origin of drones, were developed In recent years, attention to research and development of unmanned aerial vehicles has been growing by academic and industry communities worldwide Depending on the defined mission, drones are generally classified widely based upon their configurations Drones can be grouped into nine categories, such as fixed-wing, flapping wing, rotary-wing, tilt-rotor, ducted fan, helicopter, ornithopter, and unconventional types As the evolution of drone technology continues, its battery capacity and the range of the fight increase, therefore also increasing the range and scope of tasks

drones can be assigned to perform. Statistics of accidents during the operation of an Unmanned Aerial Vehicle (UAV) exhibits a significantly higher accident rate compared to piloted aircrafts' Tis poses severe limitations on the possible adoption of unmanned systems particularly in the civilian air space.

LIMITATIONS:

Firstly, the power issues got priority Out drone can fly up to 25-30 minutes with fully charged battery. However, we can overcome such issues by using more powerful batteries and motors but that will increase the cost approximately 52% of the overall cost. Secondly, highest roll angle of the aircraft is 45º. If more than 45º rotation occurs then it lost control. Thirdly, since our radio controller's range is approximately 1 km so we cannot operate this vehicle beyond this range.

PROBLEM OF THE STATEMENT:

In addition to the military practices of the drones, we were concerned in evaluating applications in the industrial, commercial and as well as government sector. In addition, new markets and uses will emerge if small drones are very available drone manufacturers are also looking for an upgrade civilian uses for remote sensing drones to spread their markets and this includes the use of drones for surveillance where it's needed. Drones will no doubt make possible the dramatic change in the surveillance state with the convergence of other technologies it may even make possible machine recognition of faces, behaviors, and the monitoring of individual conversations. In the absence of government clearness, civil society has lead substantial research on drone strikes.

OBJECTIVES:

- The objects of this paper to design and development of micro controller drone
- To Uses the feature then we develop our UAV, for observation and scouting missions for civilian or even military application of drone technology

2.0 LITERATURE REVIEW

Javier Irizarry Masoud [1] In this study, a small-scale aerial drone was used as a tool for exploring potential benefits to safety managers within the construction jobsite. This drone is an aerial drone that can be piloted remotely using a smart phone, tablet device or a computer. Since the drone is equipped with video cameras, it can provide safety managers with fast access to images as well as real time videos from a range of locations around the jobsite. An expert analysis as well as a user participation analysis were performed on said drone to determine the features of an ideal safety inspection drone

Gordana Ostojić Stevan [2] a development of a quadcopter system and potential application in which it can be implemented. Quadcopter structure model, basic components with block diagram, hovering stability, dimensions, and description of basic movements will be represented and discussed

Pei-Hsiang Chung [3] In their study the design, manufacturing, and flight testing of an electric-powered experimental flying wing unmanned aerial vehicle (UAV). The design process starts with defining the performance requirements including the stall speed, maximal speed, cruise altitude, absolute ceiling, and turn radius and speed.

The wing loading and associated power loading are obtained based on the defined performance requirements

3.0 DESIGN AND DEVELOPMENT OF MICRO CONTROLLER DRONE

Drones are Unmanned Aerial Vehicles (UAVs) that would operate under remote/autonomous control without any pilot onboard. This operation relies mostly on human involvement. The very first application of this device was within military missions and now they have their permanent position in the military arsenal Drone use 2 sets of identical fixed pitched propellers two clockwise (CW) and 2 counter-clockwise (CCW). These use variation of RPM to control lift and torque. Control of vehicle motion is achieved by altering the rotation rate of one or more rotor discs, thereby changing its torque load and thrust/lift characteristics. The front and the rear propellers rotate counter clockwise, while the left and the right ones turn clockwise. This configuration of opposite pairs directions re-moves the need for a tail rotor (needed instead in the standard helicopter structure)

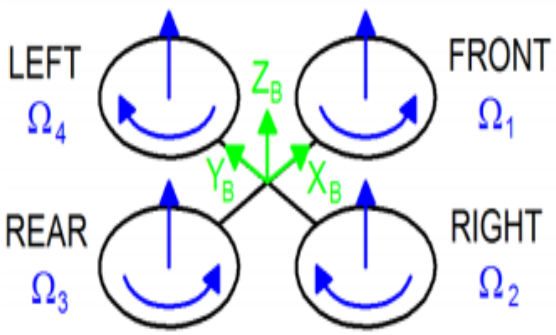

Figure: 3.1 The quadcopter structure model in hovering condition

In Figure a fixed-body B-frame of quadcopter is shown (XB, YB, ZB). Also, the angular speed of the propellers is represented. In addition to the name of the velocity variable, for each propeller, two arrows are drawn: the curved one represents the direction of rotation, the other one represents the velocity. This last vector always points upwards hence it doesn't follow the right-hand rule (for clockwise rotation) because it also models a vertical thrust and it would be confusing to have two speed vectors pointing upwards and the other two pointing downwards. All four propellers rotate at the same speed which is represented as Ω [rad s-1] to counterbalance the acceleration due to gravity

KK2.1.5 Multi-Rotor micro control board:

In this paper we have used kk2.1.5 Multi-Rotor micro control board to control the drone. This KK2.1 Multi-Rotor controller controls the flight of multi-rotor. Its purpose is to stabilize the aircraft during flight and to do this, it takes signals from on-board gyroscopes (roll, pitch and yaw) and passes these signals to the Atmega324PA processor, which processes signals according the users designated firmware and passes the control signals to the mounted ESCs (Electronic Speed Controllers) and the mixture of these signals commands the ESCs to make fine adjustments to the motors rotational speeds which stabilizes the craft

- Size: 50mm x 50mm x 12mm
- IC: Atmega644 PA

- Signal from Receiver: 1520us

Figure: 3.2 KK2.1.5 Multi-Rotor micro control board

Radio communication:

There are many high range radio transmitter and receiver in the market which are expensive. However, as it is prototype and to minimize the cost, we used 2.4 GHz Fly Sky 6 channel transmitter and receiver module. It covers almost 970 meter to 1 kilometre with average obstacle.

Figure: 3.3 Fly Sky 6 channel radio transmitter and receiver

Technical Specifications:

- Radio: 2.4 GHz
- Length: 7.4 in (188mm)
- Height: 3.8 in (96.5mm)
- Width/Diameter: 11.6 in (294.6mm)
- Weight: 498.9 g (17.6oz)

By the aid of this device we can control the flight system of our drone

4.0 APPLICATION OF DRONE TECHNOLOGY:

The applications of drones were firstly discovered in 20th century for military purpose. The vigorously booming development of drone technology in early 21st century however, has twisted the application of drones, from military to personal hobby such as filming and selfie. Nowadays, drones have a variety of functions and features which makes our life easier and widen our vision, some of the functions embrace creating planning and topographic maps, taking photos and creating a record, flying in a standard pattern and clear airspace, flying over hazards and covering large amounts of land. Although drones are very beneficial to us in nowadays life, they have deficiencies which will generate less accurate results that are insufficient and discontented. Drones are not appropriate for tasks with a huge amount of ground cover. [4] A drone will capture the top part of the area which are tress instead of the ground area when it is used to create a topographic map of a heavily forested area. A drone is not recommended in projects which require high levels of accuracy, for instance, construction engineering design. These deficiencies might be the future studies for drone as due to the advancement of technology. Application of the drone we have developed has covered a vast area of usage. We can use it in different surveillance purpose. Main applications of this flying machine are given below:

- Firefighting
- Traffic control & surveillance
- Emergency first aid delivery
- Product delivery
- Military surveillance

DRONE TECHNOLOGY:

The concept of a drone agent to support a clean environment by persuading the pedestrians in various ways to remove waste from the environment will be continued to be progressed. This includes more careful design of drone prompts or

alerts and using vision recognition capabilities of drones to categorize and classify waste so as to promote a clean environment and the enhance social interaction with technology Net-Drone, which is a platform which can widen the application of drones by enabling multiple drones to accomplish missions that cannot be achieve with only a drone will be evaluated and investigated for further applications and possibilities [5]

WORKING DRONE:

it is built and designed based on the weight and size that would provide stability, accessibility and speed during flight. Drone is controlled by ground-controlled system. Initially with the help of e-signals to the Flight Controller which consists of receiver and simultaneously collects data from GPS module. Flight Controller is placed on the X frame on which all components are assembled. From the ground station we can operate and guide the drone.

Figure: 3.4 Working drone module

It contains four important quadcopter controls namely Throttle, Pitch, Yaw, Roll. Roll turns your quadcopter left or right. This is done by thrusting the right stick on your transmitter to the left or vice versa. Pitch is where you push the right-hand stick on the transmitter backward or forward. Yaw seems a little confusing at the start. Basically, it twists the quadcopter clockwise or counter clock wise. The propellers on the quadcopter gets enough power for getting airborne due to throttle During the flight, you have the throttle occupied constantly. For by estimating the distinction in temperature between the sky and the ground the drone in the air, throttle is the control needed. Push the throttle (left stick) up very slowly, just to get the propellers going. Then stop. Repeat this again and again until you're comfortable with the throttle's sensitivity. Slowly push the throttle ground. Then pull the throttle back down to zero and let the quadcopter land.

Flight Test:

The experimental flying wing UAV consists of a propulsion system, flight control and navigation system, battery pack, main and secondary structural modules, control surface actuators, and a ground control station. The propulsion system consists of an AXi 4130/20 kv305 electric brushless motor and a 15.5 × 12 four-blade propellers. Pixhawk 4 (PX4), a low-cost autopilot software, is used as the flight control and navigation system PX4 has an IMU module (gyroscopes and accelerometers), magnetometer (compass), barometer, GPS module, power system, and various interfaces (e.g., PWM, general-purpose serial ports, I2C, SPI buses, CAN Buses, R/C input). It can handle all flight control and navigation requirements of the experimental flying wing UAV. PX4 has a weight of 15.5 g, dimensions of 44 × 84 × 12 mm, and operating temperature of −40 ◦C to 85 ◦C. The battery pack is 1.6 kg, and then the total weight of the experimental flying wing UAV is 8.62 kg. The total weight of the actual UAV exceeds the original design weight of 6.5 kg. If the payload is

not loaded, the cruising speed increases to 20.3 m/s, and this requires a power of 77 W.

Figure: 4.1 flying test of the drone

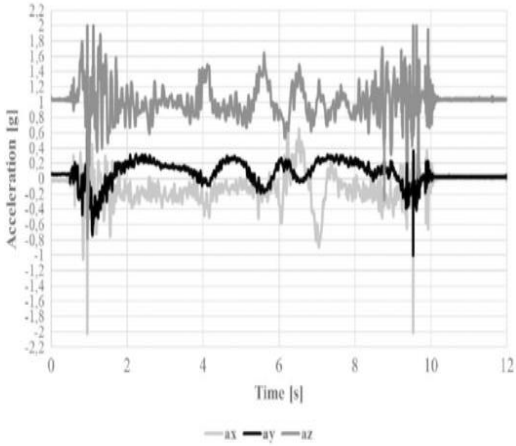

Figure: 4.2 Acquired linear acceleration during a small flight test of the drone module.

Hardware implementation:

We have used aluminium bar instead of carbon fibre bar to minimise cost. A plastic made landing gear is used to land the machine softly and spread the landing force over the body.

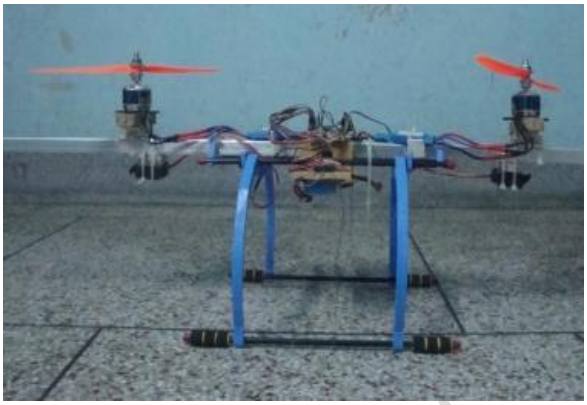

Figure:4.3 micro controller drone

motors are mounted on the top of the aluminum bar and a servo motor is placed underneath of each brushless motor. Middle part of the body contains all the payloads (ESC, Controller, RF receiver, battery and mobile device)

Conclusion:

In this paper 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. 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. The condition can frequently be treated with a defibrillator, yet time is a basic factor. As an outcome, survival rates are low. Ongoing improvements in automaton innovation have made regular citizen rambles modest, simple to work, and solid. The primary spotlight is on binding together the necessities of crisis reaction with the

guidelines and guidelines required to work the Drones securely

Recommendations:

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 rotors 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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