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DESIGN AND OPTIMAL CONTROL OF DRONE USING TWIN ROTOR TECHNOLOGY

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***Abstract*-Design of unmanned aerial vehicles(drone) with an innovative customization in control features which increases the battery life of the drone so that it can stay on the field for longer period of time. Actual use of twin rotor in drones increases the flying speed as it can be used for surveillance purpose. This customization overcomes the use of the conventional methods of quad copter, helicopter and gliders which requires more energy for flying and has less control.**

Key words—electronicspeed controller;BLDC Motor; Servo motor.

I. INTRODUCTION

A Drone or Quad copter is a Vehicle which has large potential for performing tasks that are dangerous or very costly for humans. Examples are the inspection of high structures, humanitarian purposes or search-and-rescue missions. One specific type of Drone is becoming increasingly more popular lately: the quad copter. When the quad copter is visiting the large events or parties, the professional quad copters can be seen that are used to capture video for promotional or surveillance purposes. Recreational use is increasing as well: for less than 50 Euros a small remote controlled quad copter can be bought to fly around in your living room or garden. In these situations the quad copter is usually in free flight. For example, a group of Drone would be able to efficiently and autonomously search a missing person in a large area by sharing data between. Or, the combined load capacity of a group of quad copters can be used to distribute medicine in remote areas. This bachelor thesis focuses on the use of a commercially available quad copter platform. Drone, to perform a task that requires physical collaboration and communication: moving a mass. In this way a clear interaction between the quad copters and their surroundings is present. As preliminary step towards the vision of collaborating aerial robots the choice was made to execute this task in an indoor scenario where position feedback is present. Starting off with position control, added controller logic can be implemented to counter the forces imposed by a mass associated to the quad copter.

II. EXISTING SYSTEM

While the existing system of drones, helicopters, airplane have the problem of staying in the sky for a long time of flight due to the use of more number of drive for operation. It leads to increasesthe power consumption, less controllability of position, reduced battery lifetime, Needs gyro sensors for stability of flight.

III. PROPOSED SYSTEM

We have given a new idea to design and control of drone system using the twin rotor technology as shown in Fig. 1. Here we have use only two BLDC motor for the creation of thrust to lift the drone in the sky. In addition we have two servo motors which are highly energy efficient for the control of the flaps of the drone. It make less power consumption, use of only Two BLDC motors for propulsion, the radio system works in the range of 2.4 to 2.4835GHz, more controllability, throttle of the BLDC Motor can be controlled by using electronic speed controller.

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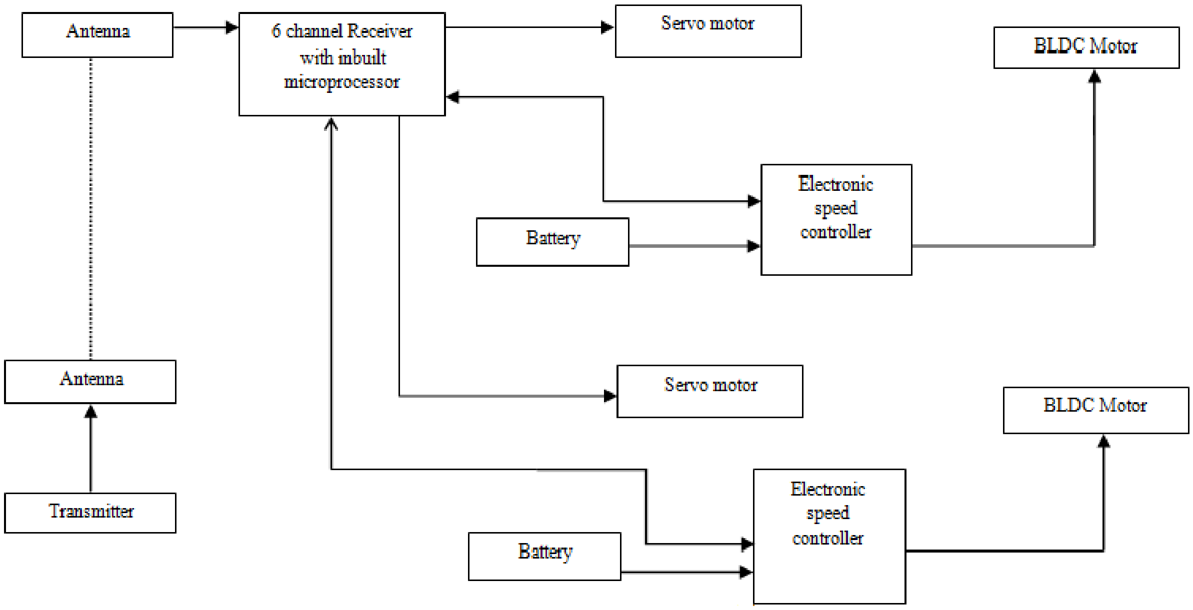

Fig. 1

IV. HARDWARE DESCRIPTION

A. Servomotor:

A servomotor is a rotating actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration is shown in Fig. 2.

It consists of a suitable motor joined to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

Fig. 2

A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is some signal, either analogue or digital, representing the position commanded for the output shaft.

B. Transmitter & Receiver:

AFHDS stand for "Automatic Frequency Hopping Digital System". This highly sophisticated radio transmission system will assurance you a long range, jamming free and extended battery lifeexperience.The main menu is divided into two main sections, System and Functions.

The system menu allows you to setup the transmitter and to supervise the 20 models. The Function menu is used to setup each model separately. Use this function to select the active model among the 20 available models. Doing so, you can setup and save all required parameters to fly 20 different models and switch instantly between them. The transmitter & receiver is as shown in Fig. 3.

Fig. 3

C. Brushless Dc Motor:

Brushless DC electric motor also identified as electronically commutated motors (ECMs, EC motors) are synchronous motors that are powered by

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DC source via an integrated inverter/switching power supply, which produces an AC electric signal to drive the motor is shown in Fig. 4.In this context, AC, alternating current, does not imply a sinusoidal waveform, but somewhat a bi-directional current with no limit on waveform. Additional sensors and electronics control the inverter output amplitude and waveform. [8] discussed about principles of Semiconductors which forms the basis of Electronic Devices and Components.

Fig. 4

D. Electronic Speed Controller:

An electronic speed control (ESC) is an electronic circuit with the point to differ an electric motor's speed, its direction and possibly also to proceed as a dynamic brake is shown in Fig.5. ESCs are often use on electrically powered radio controlled models, with the mixture most often used for brushless motors essentially providing an electronically generated three-phase electric power low voltage source of energy for the motor.

An ESC can be a stand-alone unit which plug into the receiver's throttle control channel or included into the receiver itself, as is the case in most toy-grade R/C vehicles. Some R/C manufacturers that set up proprietary hobby-grade electronics in their entry-level vehicles, vessels or airplane use onboard electronics that join the two on a sole circuit board.

Fig. 5

E. Lipo Battery &Lipo Charger:

A lithium polymer battery, or more properly lithium-ion polymer battery, is a rechargeable battery of lithium ion technology in a pouch format is shown in Fig. 6. Unlike cylindrical and prismatic cells, Lipo's come in a soft package or pouch, which makes them lighter but also less rigid.

The term "lithium polymer" has caused disorder among battery users because it can be interpreted in two ways. Originally, "lithium polymer" represented a rising technology use a polymer electrolyte instead of the more general liquid electrolyte. The result is a "plastic" cell, which theoretically could be thin, flexible, and made in different shapes, without risk of electrolyte leakage. The technology has not been completely developed and commercialized and research is ongoing.

Fig. 6

V. METHODOLOGY

First of all we are going to use etched PCB or switch board sheet for making of the strong frame and the exoskeleton of the drone .They have high tensilestrength and give high workability. Two brushless dc motor are used for the propulsion purpose because they give high speed (4500RPM) which is more than enough to lift a weight of about 4kg/motor. To individually driven stepper motor for high operative control which provides easy control and stability fight. We are using a 6channel transmitter and a receiver (FLYSKY FS-T6). It is a 2.4 GHz transmitter and a receiver. It is an AFHDS computerized digital proportional R/C airplane and a helicopter system. AFHDS stands Automatic Frequency Hopping Digital System .This highly sophisticated radio transmission system will guarantee you a long range, jamming free and long battery life experience. For light weight consideration we are using a lithium ion battery which can deliver a high power. Since it is our prototype we have not made any modification for the installation of camera and a mini gun.

The radio system works in the frequency range of 2400 to 2.4835 GHz. This band has been divided into 160 independent channels. Each radio system uses 16 diverse channels and 160 different types of hopping algorithm. By using various switch-on times, hopping scheme and channel frequencies,

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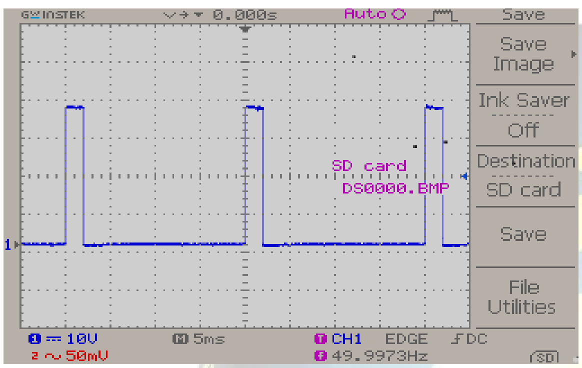
the system can guarantees a jamming free radio transmission. This radio system uses a high gain and high quality multidirectional antenna. It covers the whole frequency band associated with a high sensitivity receiver; this radio system guarantees a jamming free long range radio transmission.

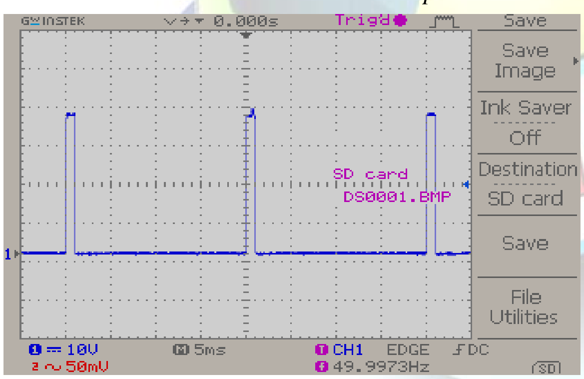
Each transmitter has a unique ID. When binding with a receiver, the receiver save that unique ID and can accepts only data from that unique transmitter. This avoids picking another transmitter signal and dramatically increases the interference immunity and safety.

VI. PRACTICAL RESULT

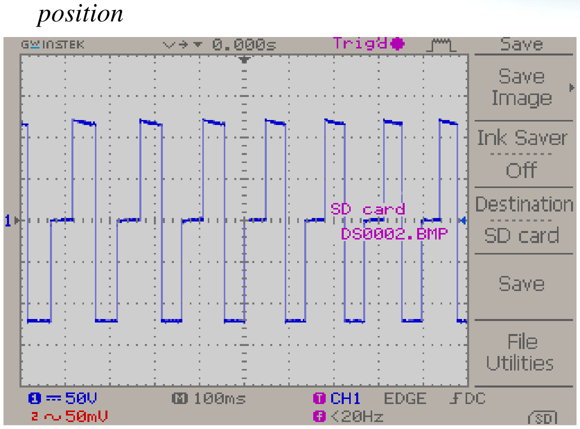
A. Servo motor in high stick position



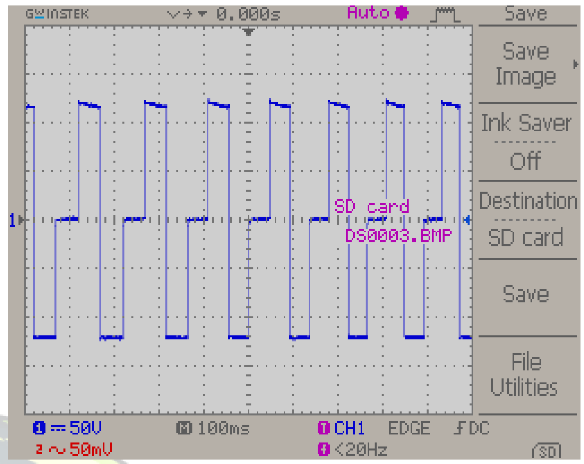
B. Servo motor in low stick position



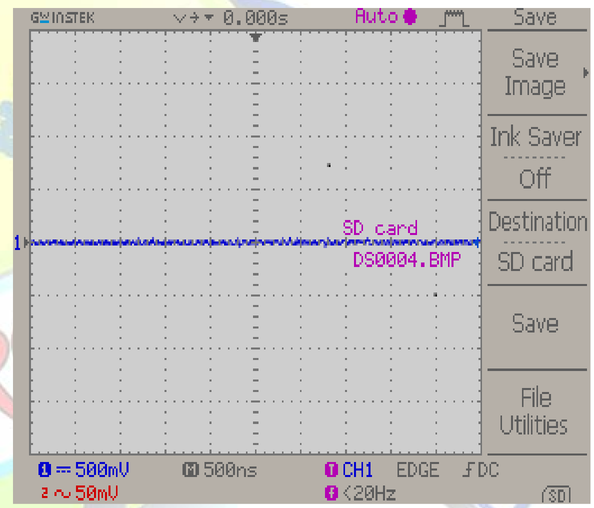
C. Electronic speed controller output in high stick position



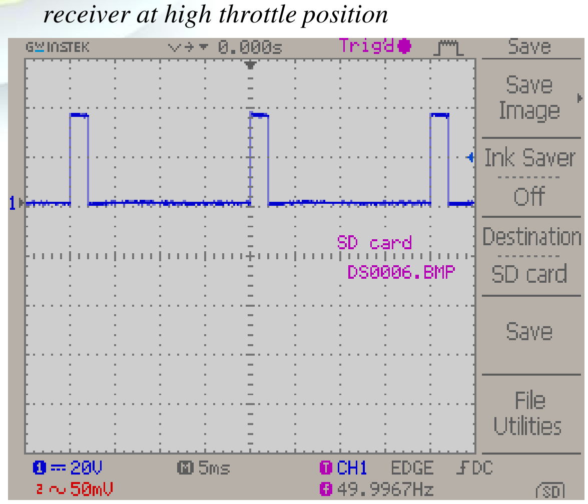
D. Electronic speed controller in the middle sticks position



E. Electronic speed controller in the low stick position



F. Electronic speed controller input waveform from receiver at high throttle position



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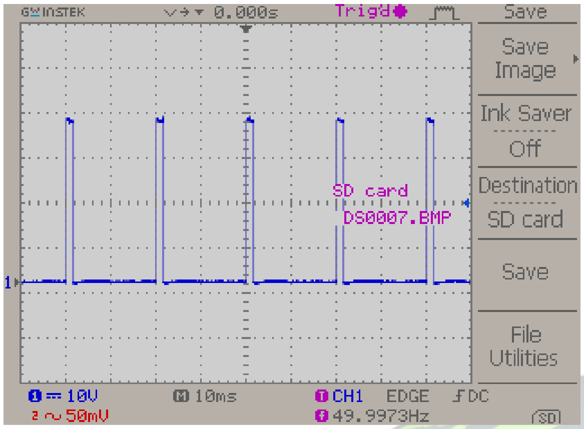
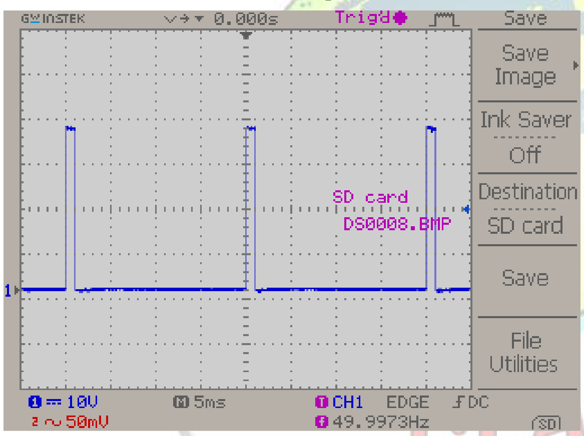
G. Electronic speed controller input waveform from receiver at middle throttle position



H. Electronic speed controller input waveform from receiver at the low throttle position



VII. CONCLUSION

Generally we have done a prototype of the drone with two motor drives functioning with BLDC motor for the thrust creation to provide lift. We installed two servo motor for the separate control of the flaps, so that we can control it with more control features, which results in better controllability.

a) FUTURE INSTALLATION:

Future we are plan to install the drone with the infrared cameras to capture the heat signature of the human and animal for capturing the photo of them and send images to the military for warning them about the illegal entry of the terrorist in the border and forest area near the border.

b) FUTURE OF DRONE:

New applications are coming into picture as the work efficiency and tolerance ability of the drones have surpassed all expectations. Recently India has also joined the picture by releasing its own drones.

Developments and modification are constantly being done on the structural and internal electronics. The new "helicopter drone" released by the US army carries a 1.8 Giga pixel camera to give clear ground images even from high altitudes. The sensors carried in the drones are also being made sharper to provide higher aerial surveillance. Programming software of the drone is being advanced such that the drone can take its own decision in situations where human error is probable.

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