



REMOTE FARMING USING UNMANNED AERIAL VEHICLE

¹Dr.Jaiprakash Narain Dwivedi

¹ASSOCIATE PROFESSOR

²J.I Chakravarthy

²ASSISTANT PROFESSOR

³Sravani Reddy Kethiri

³Btech STUDENT

⁴D Sai Surya Krishna Dixit

⁴Btech STUDENT

⁵Aishwarya.K

⁵Btech STUDENT

¹Electronics and Communication Engineering Department,

¹Malla Reddy Institute of Technology and Science, Hyderabad, Telangana, India.

Abstract: UAV is Unmanned Aerial Vehicle which can be operated by a man without being present in it. The UAV can be operated to lift up vertically and to fly in all directions. Technological advances have reduced the cost and increased the performance of UAV. The main of the system is to modify and make improvements in UAV to design and obtain stable flight and spray fertilizers and pesticides in the farm. Agricultural spraying UAV is used for reducing human power and time. The UAV includes the KK BOARD 2.1.5, FS-I6 transmitter, FS-I6 receiver, Electronic speed controller (ESC), Brushless motors, batteries, frames were interfaced with the Quad copter's frame. The sprayer module consists of a Bluetooth device, battery, Arduino board, L293D driver circuit and DC motor.

Index Terms- Quadcopter, Unmanned Aerial Vehicle, Bluetooth Module, Arduino Uno, DC motor.

I. INTRODUCTION

Agriculture is the important source of Indian economy. The agriculture production depends on various factors like temperature, Monsoon etc. Agriculture is a nature friendly and most peaceful method of livelihood. Many people from developing nations rely on agriculture for livelihood. INDIAN agriculture is made out of numerous yields, with the preeminent nourishment like rice and wheat. The major crops that are grown by farmers in Indian are divided into four categories viz. Food grains (Rice, Wheat, Maize, Millets and Pulses). The crops are being affected by various pests and diseases carriers which can be prevented by using pesticides and fertilizers. This product is basically a quadcopter frame structure design and development, and a spray mechanism to reduce human effort time. The agricultural fertilizer spray drone is used for spraying pesticides throughout the field which decreases the farmer's work. Drone is a pesticide spraying quad copter which can spray all over the required farm from a safe and secured place.

II. SYSTEM DEVELOPMENT

POWER SUPPLY

A LiPo battery or Lithium polymer is a Rechargeable battery based on lithium polymer chemistry. The battery can power up the motor present on the quadcopter as it has high energy density. Li-Polly batteries are fully charged when they reach 4.7v/cell, and their minimum safe charge, is 3.0v/cell. 3.7v is pretty much in the middle, and that is the nominal charge of the cell. Capacity of battery is 2200mah. Voltage of the battery is 11.1v and current of battery is 5.5 Amp.



Figure1- Lipo battery

FLIGHT CONTROLLER KK 2.1.5

The original KK gyro system has been upgraded to an incredibly sensitive 6050 MPU system.KK 2.1.5 is the most stable and also adds the addition of an auto-level function.At the heart of KK2.1.5 is the ATMEL Mega 644PA 8-bit AVR RISC-based microcontroller with 64k of memory. The input ranges from 4.6v to 6v.



Figure2- KK 2.1.5 Flight controller

ELECTRONIC SPEED CONTROLLER (ESC)

An Electronic speed controller is an electronic circuit which is used to control Brushless DC motor's speed.It possibly acts as a dynamic brake.The operating voltage of ESC ranges between 7.4V-22.4V.



Figure3-Electronic Speed Controller

BRUSHLESS MOTOR

A motor converts electrical energy into mechanical energy.Among all those motors, for constructing a quadcopter we are using brushless motor. The advantage of this motor is High speed and good efficiency.



Figure4-Brushless motor

PROPELLERS

Propellers are used in the drones in order to provide thrust and therefore give a vertical lift to drone.



Figure5-Propellers

HJ450 FRAME

HJ450 is the glass fibrequad copter outline which is basic and simple to assemble brushless motors and places a KK BOARD 2.1.5 on it.



Figure6-HJ450 Frame

FS-i6 TRANSMITTER

Fly sky FS-i6 Transmitter is a 2.4GHZ 6-channel telemetry transmitter using a robust Automatic Hopping Digital System (AFHDS) with features such as digital trimming, backlight LCD screen and easy programming. The channel order will be Aileron-CH1,Elevator-CH2,Throttle-CH3,Rudder-CH4, CH5 &CH6 open to assignment to other functions.



Figure7-FS-I6 Transmitter

FS-i6 RECEIVER

This is a compact 6-channel receiver with a range exceeding 500m and it comes with interference rejection capabilities. Each transmitter has a unique ID and so when binding, the receiver remembers this ID and accepts data from that transmitter only.



Figure8-FS-I6 Receiver

ARDUINO BOARD

The Arduino UNO is a microcontroller board based on ATmega328. The operating voltage of Arduino board will be 5v. The Arduino has 28 pins which consists of 14 digital pins, 6 analog pins and other pins. DC current per input and output pins are 40ma. DC current per 3.3v pin is 50ma.



Figure9-Arduino board

L293 MOTOR DRIVER

L293D is a typical Motor driver or Motor Driver IC which controls and allows DC motor to drive on either direction. It is a 16pin IC whose maximum voltage ranges from 5v and up to 36v.



Figure10-L293D Motor driver

BLUETOOTH MODULE

Serial Bluetooth module for Arduino and other microcontrollers is HC-05. The operating voltage will be around 4v to 6v. The operating current will be 30ma.



Figure11-Bluetooth module

DC MOTOR PUMP

DC motor pump converts electrical energy into mechanical energy. It is a low cost, small size submersible pump motor which can be operated from a 2.5~6V power supply. It can take up to 120ltrs per hour with very low current consumption of 220mA



Figure12-DC motor pump

BATTERY

Hi-Watt 9v battery is used to power up the Arduino Uno board for the sprayer module.



Figure13-9v battery

III. DESIGN AND RESULTS OF SYSTEM DEVELOPMENT

UAV DESIGN

Its motivation is to balance out the airplane during flight. To do this it takes the sign from the 6050MPU gyro/acc (move, pitch and yaw) at that point passes the sign to the Atmega644PA IC. The Atmega644PA IC unit then processes these signals according the users selected firm ware and passes control signals to the installed Electronic Speed Controllers (ESCs). Its motivation is to balance out the UAV during flight. To do this it takes the signal from the 6050MPU gyro/acc (move, pitch and yaw) at that point passes the sign to the Atmega644PA IC. Atmega644PA IC via the aileron, elevator, throttle and rudder inputs. Once this data has been transmitted, the IC will send unique signals to the ESCs which will turn the rotational speed of each motor to induce controlled flight (up, down, backwards, forwards, left, right, yaw).

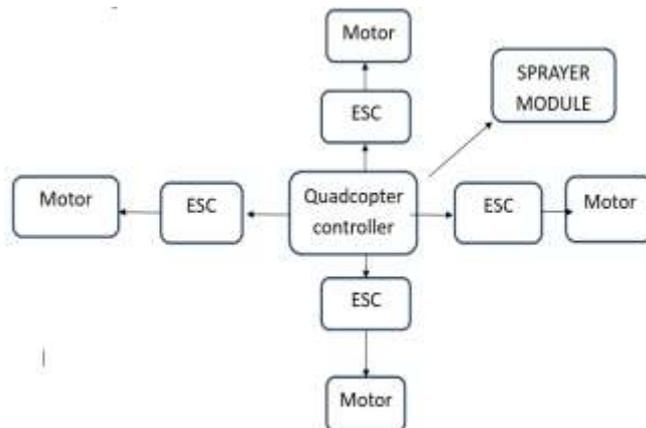


Figure14-Block diagram of Quad copter (UAV)

SPRAYER MODULE USING BLUETOOTH

The interface between phone and Bluetooth module is done initially by pairing the phone with the module with the passkey. In order to send the commands from the phone to the Bluetooth module install an application in the phone (Bluetooth terminal HC-05). According to the code dumped in the Arduino the following commands will be given in the application that is been installed in the phone. When the command 1 is given in the phone the motor is ON and when the command 2 is given in the phone the motor is OFF. When the motor is ON the pesticide is been sprinkled from the container with the help of the motor.

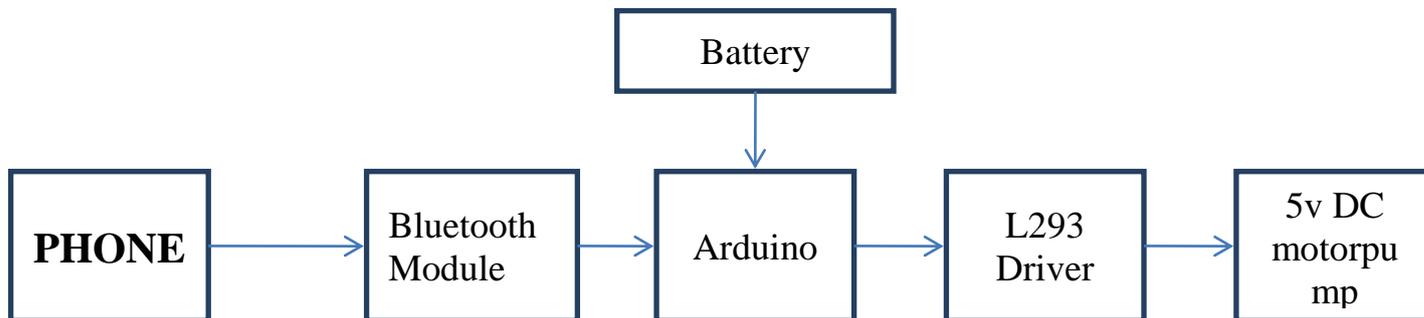


Figure15-Block diagram of sprayer module

RESULT

Quadcopter consists of KK 2.1.5 flight controller, brushless motors, electronic speed controllers, propellers, HJ450 frame, Fs-i6 Transmitter, Fs-Receiver, Arduino uno, Lipo battery, sprayer module. The transmitter acts as controller from the user. It is a radio communication wireless control system. The required signal is received by the receiver placed on the frame of the quadcopter through the antenna in a receiver. The signal from a receiver is given to KK 2.1.5 flight controller. This board will impart the sign to all the electronic speed controllers from that speed of the engines constrained by the transmitter. The regulation plan utilized in the middle of transmitter and receiver is Pulse Position Modulation (PPM). When the data has been handled the IC will impart changing signs to the ESCs which thus modify the rotational speed of each engine to initiate controlled flight. With the help of the mount the sprayer module is attached to the drone. Here the phone acts as a controller from the user. It is the Bluetooth controlled system used for switching between motor ON and motor OFF. As per the code dumped in the arduino commands given in the phone (Bluetooth terminal HC-05) when 1 is given as input in the phone then the motor is turned ON and the pesticides is sprinkled and the status keeps on showing that the motor is ON for every second and when 2 is given as input in the phone then the motor is turned OFF and the status shows motor is OFF for every second till the next command is given.



Figure16- Interfacing between the quad copter and the sprayer module.

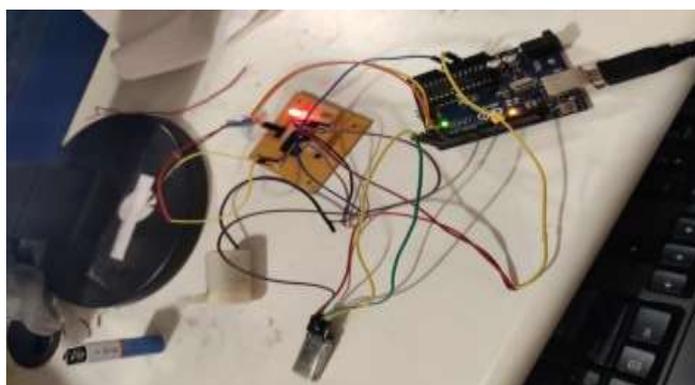


Figure17- Agriculture spraying drone using bluetooth module.



Figure18-Bluetooth terminal output

FUTURE SCOPE

- 1) Flight time can be increased by increasing the battery limit.
 - 2) The Quadcopter's weight lifting capability can be improved by increasing the number of motors or by increasing the size of propeller or by increasing the engine rpm.
 - 3) Additional nozzles can be used to protect or cover the larger areas.
 - 4) The capacity of pesticides sprayer can be increased by increasing the size of the tank.
 - 5) Agricultural drone can assist farmers to reduce the chemical load on the environment by spraying on the plant that required attention.
- Therefore, it can further be called as green-tech tool.

CONCLUSION

The main advantage of the drone (UAV) will be helpful for farmers in spraying pesticides, fertilizers and crop growth protection while being monitored by a single person operating from a safe and secured location.

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