FREYR DRONE: PESTICIDE/FERTILIZERS SPRAYING DRONE – AN AGRICULTURAL APPROACH

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Abstract: ***The purpose of FREYR drone is to develop a quad-copter which carries pesticides to spray all over the farm which reduces the work of farmers as well as it finishes his work soon .The application of pesticides and fertilizers in agricultural areas is of prime importance for crop yields. This is to develop a user friendly interface for the farmers .The FREYR Drone is a pesticide spraying quad copter for agricultural purpose which helps the farmer to spray the pesticides all over his land so that it reduces his work which can evenly spray all over his farm. Here the farmer can control the drone using an android app and he can connect to the app using Wi-Fi module (ESP 8266) which is interfaced in the drone. It will precisely route the land area of that particular farmer's land using GPS no matter shape of the field and type of the crop the pesticide spraying drone will get the job done. Here we have used the Arduino board which is the open source electronics prototype platform which is interfaced with the Wi-Fi module and GPS. To balance the directions and orientations we have used the ACCELEROMETER (ADXL 335), GYRO (MPU-6050), MAGNETOMETER (HMC5883L). We have a wireless camera that can transmit and receive pictures with high resolution.***

Keywords: GPS, ADXL 335, ESP 8266

I. INTRODUCTION

The application of fertilizers and pesticides in agricultural areas is of prime importance for crop yields. The use of aircrafts is becoming common in carrying out the task because of the speed, accuracy and effectiveness in spraying operation. The farmers are using the spraying bags to spray pesticides all over the farm. The farmers have to carry the pesticide spraying bag which makes them get strained. Even then the farmers are unable to evenly distribute the pesticides all over the farm. And also it will be time consuming. The farmer can spray the pesticides using drone evenly all over the field .It reduces the workload of the farmers and also completes the work very fast.

II. LITERATURE SURVEY

Agricultural biota (e.g. seeds, insects, pollen, plant pathogens, etc) may be transported over long distance. It is important to understand the methods and techniques of airborne that transmit through the air, so as to minimize the propagation of unwanted species in crops that are important for human welfare. The long distance transport of biota takes place primarily in the planetary boundary layer (PBL) of the atmosphere- the layer of the atmosphere extending from approximately 50m to 1km above the surface of the earth. Investigator have identified and characterized seeds (Shields et. Al. 2006), insects (shields et. Al. 1999), and fungi in the PBI. One of the attractive techniques for characterizing specific airborne species is to collect samples at different altitudes under a variety of environmental conditions (e.g., day/night, temperature humidity, and wind conditions). One method that enables aerobiological sampling at various altitudes is the use of remotely controlled air craft designed to fly specific patterns and collect aerobiological samples at an altitude of interest. Remotely piloted vehicles (RPV) have been used for aerobiological sampling in agricultural ecosystem. Agents that cause plant disease are thought to travel long distances in the atmosphere and the transport mechanisms are not well understood [1][3].

III. PRODUCT DESCRIPTIONS

A. Product Perspective:

The main use of our product is we use in the agriculture field

978-1-5090-6221-8/17/$31.00 ©2017 IEEE

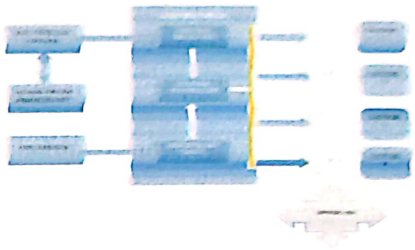
purpose for spraying the fertilizers. Our product is a replacement for an existing system, as we know that farmers use spraying bags and spray guns to spray the fertilizers to the entire farm. The Quad-copter which we have designed is already existing which it's controlled using the drone remote control. But we have designed an android app to control the Freyr Drone, which is interfaced with the drone and sprays the fertilizer.

B. Block Diagram

IV PRODUCT FUNCTIONS

We have already mentioned the main components in the above block diagram. At first any user (farmer) must connect to WIFI secured with WPA2 in android based mobile so that he can connect and then operate with our FREYR Drone. Li-Po rechargeable battery is connected to run motors. We use ARDUINO mega 2560 which helps in interfacing the app with the motors of drone that is interfacing software with hardware. An android app is interfaced with the ARDUINO mega board through Wi-Fi module. The ARDUINO MEGA-2560 is a 8-bit processor, 16MHz clock speed .This Arduino board can be programmed using the Arduino software (1DE). The accelerometer will measure the acceleration forces and the acceleration forces may be static or dynamic. We use an accelerometer + gyroscope (IMU) is connected to hardware system and interfaced with Arduino board. Gyroscope is a sensor which gives output to Arduino board and maintains the orientation of the drone. The gyroscope helps in balancing and stability of drone by giving values of x, y, z. GPS UBLOX NEO 6M is cost effective and high performance and helps in initializing the location of crop yield. We used an immersable pump which is immersed inside the fertilizers tank it then pumps the fertilizers and sends to the sprinkler to spray.

C. Data Flow diagram



V USER CLASSES AND CHARACTERISTICS

Mainly our drone is useful for high and low level crop yielders and farmers. Farmers should have at least basic. Knowledge of using a smart phone (Android based mobiles) so that user will be able to use the app which we have designed for our project. Agricultural Engineers and technicians can also use our product for testing purposes. Users can use our product for domestic irrigation purpose for example nursery etc…

VI OPERATING ENVIRONMENT

The Software operates on Arduino mega board. Arduino board a microcontroller on 16 MHz with no dedicated operating system, which runs on standalone software doesn't require any additional application support.

VII USER INTERFACE

The logical interface in the software product is Android standard UI .We have included the GUI standards ,screen layout constraints, standard buttons like altitude, moving front back left and right we also have the yaw left and yaw right buttons and functions like help. To start the drone we have the START button and LAND button to stop the drone.

A. Hardware Interfaces

MPU6050 Gyro+Acc is connected with Arduino using the I2C interface. HMC5883L Compass is interfaced using multiplexed I2C Bus, the ESC's are controlled by connecting it to analog ports. The software supported devices are the android mobiles, nature of the data is strings and text messages, the communication protocols are TCP/IP. The GPS 6050 is also interfaced with the Arduino board to find locations.

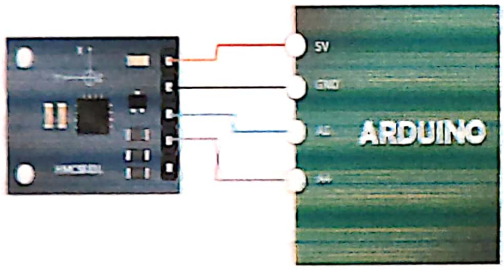


Fig 1. Arduino interfaced with hmc5883l

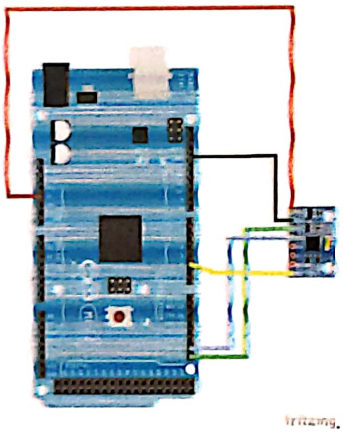


Fig 2. Arduino Interfaced with Gyro 6050

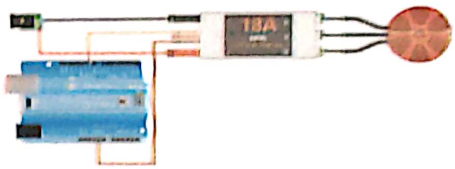


Fig 3. Arduino Interfaced with ESC

B. Software Interfaces

Using the android studio we have interfaced the software components. Library functions used are android's NDK (native development kit), SDK (software development kit).The data going out are the altitudes, movements, rotations. Nature of communication is through direct peer to peer. The HTTP Server is hosted through APACHE Server.

C. Communications Interfaces

Network server communication service is peer to peer. Message formatting is strings, plain text. Communication standard HTTP. Communication security is WPA2 PSK. Data transfer rate 100mbps

Fig 4. Prototype

VIII. SYSTEM FEATURES

Our pesticides/fertilizers spraying done will find its massive application in providing pesticides over a large area of land for farmer. It is highly efficient and of low cost. It is reliable for liquid pesticides and fertilizers. The mode of operation of out drone makes it easy to handle. It is controlled with the android based mobile app which is interfaced to the ARDUINO board,

GPS, ACCELEROMETER, WIFI MODULE, GYRO and DIGITALCOMPASS. The downward airflow generated is the propellers lifts the drone, moves forward and helps in spraying the fertilizers/pesticides.

IX. COMPONENTS DESCRIPTION

A. ADRUINO MEGA 2560: It is a micro controller which has 54 digital I/p O/p pins out of which 14 pins can be used as PWM pins. It allows inserting a new code, software running on the system.

B. ACCELEROMETER ADXL335: The three axis accelerometer IC used to read X, Y, Z acceleration as the voltages. It will measure the amount of acceleration due to gravity and with the help of it we can find out the tilting angle.

C. WIFI MODULE ESP 8266: The WIFI module uses the software serial port and the hardware serial port for uploading and debugging. The ESP 8266 is a transceiver module. It is of small size and low cost and will work on 3.3V and consumes current Upto250mA.It is not usually powered on battery it should be powered with 3.3V not with 5V so we use the level conversion to communicate with Arduino.

D. *LI-PO BATTERY:* Lithium batteries are the preferred power resources for most electric modelers today. They offer high discharge rates and a high energy storage/weight ratio. However, using them properly and charging them correctly is no trivial task.

E. GPS MODEL 6050: The MPU 6050 sensor contains accelerometer and MEMS gyro in a single chip. It has 16-bits analog to digital and has a sensor 12c-buss to get interface with Arduino. It contains both accelerometer and gyro.

F. HMC5883L 3 AXIS MAGNETOMETER: It is a three axis digital compass magnetometer which gives the direction of the drone it is interfaced using I2C with Arduino.

G. SERVO MOTOR: Servo Motor are used to control positions of objects, rotate objects. This can be used as a switch also. This is small in size and they have built-in circuitry to control their movements so that it can be directly connected to Arduino board also. It has three colored wires brown (GND), red (5V), and yellow (PWM). The PWM input will be connected to one of the Arduino's digital output pins.

CONCLUSION

The scope of the project is to develop a user friendly interface for the farmers. The Freyr Drone is a pesticide spraying drone for agricultural purpose which helps the farmer to spray the pesticides all over his land so that it reduces his work which can evenly spray all over his farm. Here the farmer can control the drone using an android app and he can connect to the app using Wi-Fi module which is interfaced in the drone. It will precisely route the land area of that particular famer's land using GPS no matter shape of the field and type of the crop the pesticide spraying drone will get the job done. Here we have used the Arduino board which is the open source electronics prototype platform which is interfaced with the Wi-Fi module and GPS. To balance the directions and orientations we have used the ACCELEROMETER, GYRO (MPU 6050), MAGNETOMETER (HMC 5883L). We have a wireless camera that can transmit and receive pictures with high resolution.

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