International Journal of Research in Engineering, Science and Management
Volume-2, Issue-3, March-2019
www.ijresm.com | ISSN (Online): 2581-5792

Enhancing Agricultural Activities using Drone

L. Jocelyn[1], R. Karthikeyan[2], K. Kathirvelan[3], P. Karthick Raja[4], R. Karthik[5]
[1,2,3,4]*UG Student, Department of EEE, Valliammai Engineering College, Chennai, India*
[5]*Professor, Department of EEE, Valliammai Engineering College, Chennai, India*

***Abstract*: Agriculture is the major source for the economic growth of the country. The use of unmanned aerial vehicle is used for monitoring, safety and transport. Recently, UAV method has been widely used in the field of agriculture. The scope of the project is to increase crop field and crop efficiency and to reduce manpower. The ultimate aim of the project is to enhance agricultural activities by spraying pesticides and water in agricultural lands. The auto-drone mainly consist of BLDC motors, lithium polymer (li-po) battery, pesticide tank and supporting frame. The fascinating hardware and software system present in miniature aerial vehicle used for navigation purpose based on Arduino programming. Sensors like accelerometer (ASXL 335), gyroscope (MPU-6050), magnetometer (HMC5883L), barometer are used to control direction, orientation and altitude. We have scratched only the surface which is relatively new technology and a miniature model which is applied for agriculture.**

***Keywords*: Arduino, GSM module, interfacing, serial data network, micro air vehicle, mission planner, pixhawk flight controller, sprinkler**

1. 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. 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. The key contribution of this project is to design light weighted system. The GSM/GPRS network is used for its attractive global coverage. The subsystem is based on Arduino platforms and components for converting the GSM/GPRS data to the appropriate UAV communication portal and forwarding it to the UAV autopilot (Pixhawk flight controller). The navigation system is based on the Pixhawk autopilot, an open source hardware is capable of accomplishing missions autonomously based on the preloaded data.

This drone mounted sprayer is very useful for spraying of chemicals on normal crops as well as crops under terrain lands. This technology has a potential application in reducing consumption of pesticide and water but also biological efficacy of application technology. Agents that cause plant disease are thought to travel long distances in the atmosphere and the transport mechanisms are not well understood [1], [3].

A. Structure

1) On-board Processing

Current Miniature Aerial Vehicle (MAV) research using either GPS/INS navigation on a microcontroller. GPS module provides a slow update positional information with bounded error, while the Inertial Navigation System (INS) system provides unbounded integration error, but with a fast update rate. Using the two, it is possible to achieve best localization estimation. This system brings the multi-process architecture and onboard processing capabilities from the wide range to vehicles around 1 kg liftoff-weight.

2) Block Diagram

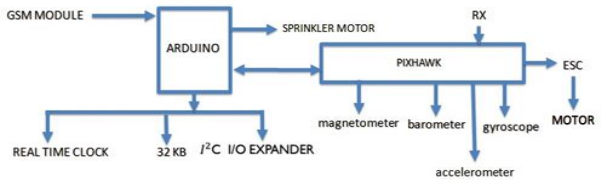

Fig. 1. Block diagram

Fig. 1. represents the main components of the autonomous drone. At first any user (farmer) must load the map into the Mission Loader. Lithium Polymer (LiPo) battery is used to run motors which is rechargeable. PIXHAWK flight controller is an open source hardware used to interface the BLDC motors of drone and to interface software with hardware.

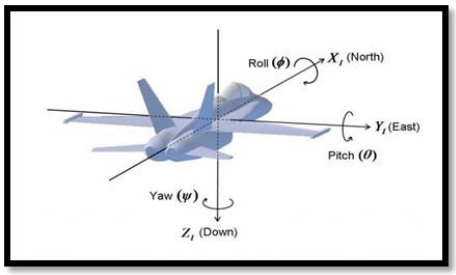

Fig. 2. Inertial frame

The accelerometer will measure acceleration forces which may be static or dynamic. Accelerometer and gyroscope are used to find the pitch angle, yaw angle and roll angle. Gyroscope gives output to maintains the orientation and 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. Sub-missible pump is submersed inside the tank and pumps the pesticide, water and sends to the sprinkler motor for spraying activity.

3) Electronics

The electronics system schematic consists of an inertial measurement unit, Pixhawk flight controller, Motor, GSM, Sprinkler motor.

Autopilot unit:

T/8he pixhawk is an autopilot and open source hardware and supports many additional sensors like barometer, magnetometer, accelerometer and gyroscope. The flight control hardware and autopilot software used in drone industry. Pixhawk is suitable for running the drone automatically. It is more flexible and reliable when compared to other copter controllers. It provides the required I2C bus to make the system compatible with peripheral devices and sensors, ADC input and other peripherals. It is interfaced to processing unit through UART and it operates at a rate of 200-500 Hz. [6]

Processing unit:

The processing unit is the core piece of the system and consists of a two-board stack. The pxCOMEx base board provides the USB and UART peripherals to interface machine vision cameras, communication equipment and the pxIMU module. It can accept any micro COM express industry standard module. Currently, a Kontron etxExpress module with Intel Core 2 DUO 1.86GHz and 2 GB DDR3 RAM is used, but future upgrade options include Intel i7 CPUs. It has 4x UART, 7x USB 2.0 and 1x S-ATA 2.0 peripheral options. The typical onboard setup consists of 4x PointGrey Firefly MV monochrome, 1x USB 2.0 802.11n Wi-Fi adapter and 1x S-ATA 128 GB SSD with more than 100 MB/s write speed. The pxIMU unit, the GPS module and the XBee radio modem are connected via UART to the processing unit. With a weight of 220 g including cooling and 26 W peak power consuming, the processing unit can be easily lifted by a wide range of UAV.

Fig. 3. pxIMU inertial measurement unit

4) Construction

A quad-copter consists of four arms and each arm is connected to a single high-speed BLDC motor, hence it does not have carbon contacts. These motors are mounted at the outer end of aluminum tubes. A 1l capacity fluid tank is fixed at the bottom of the glass fibred supporting plate and outlet of the fluid tank pipe is connected to the inlet of the spray motor. A sprinkler motor is used to spray the liquid. Inlet of liquid pipe of sprinkler motor is connected to the outlet of tank and it is connected to nozzles.

2. Operator control unit

The Miniature Aerial Vehicle (MAV) does not need sensor to be transmitted to the GCS for autonomous flight and suitable to reduce the communication and operator load and only send abstract system information such as remaining fuel/battery and position. The Q-Ground Control application allows to represent multiple vehicles. Fig. 4. shows the aerial map view. The relay in the Arduino helps the Miniature Aerial Vehicle (MAV) to initialize the Sprinkling system by turning the sprinkler motor.

Fig. 4. Mapping view

3. Communication

GSM module is a specialized hardware on Printed Circuit Board (PCB) accepts SIM card and used to transfer messages. GSM is a compact and reliable wireless module. The SIM900a is a dual band GSM/GPRS solution embedded in customer applications allowing benefit from small dimensions and cost-effective solutions. SIM900a provides better compatibility, low power consumptions and provides 900/1800 MHz performance for messaging service. The microcontroller in the GSM module is used for sending and receiving messages with the help of antenna. Voltage regulator is used to maintain the constant output voltage with respect to input voltage and acts as a buffer to protect the components from high voltage.

Fig. 5. GSM module

4. Interfacing of GSM with Arduino

The GSM is interfaced with Arduino UNO microcontroller by connecting the transmit and receive pins and vice versa. The

interfacing of GSM module with Arduino UNO microcontroller which is the essential part of controlling the activities of drone. The supply of the GSM module is about 12V,2A. The output from the Arduino UNO is about 5 volts, is step down to 3.3 volts by using voltage regulator which is bidirectional device and step downed output is given to Pixhawk autopilot is capable of accomplishing missions autonomously based on the preloaded data like map.

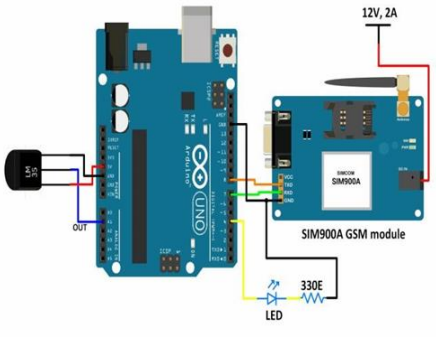

Fig. 6. Interfacing of GSM with Arduino

5. Experimental results

Artificial marker-based localization gives the results of UAV. The Flight covers the area of about 50 sq. Meter and the duration of drone is 20 minutes with payload. The two perpendicular movements are autonomous start off and landing. Fig. 7. Flight controller graph AR Toolkit including taking-off and landing. The AR Toolkit-based localization is used as the system is modular. The flight path contains takeoff and landing autonomously, and do the movement around the yaw axis of a rigid body.

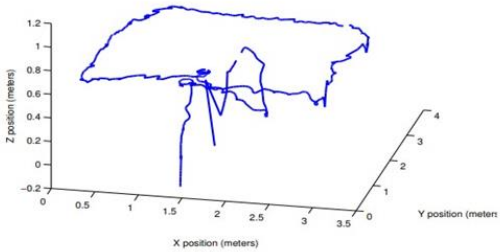

Fig.7. Flight controller graph in AR Toolkit including taking-off and landing

6. Conclusion

Autonomous drone used for agricultural purpose which helps the farmer to spray the pesticides all over the land so that it reduces the work and helps to spray the pesticide, water and fungicide uniformly all over the field. The purpose of this article is to develop and implement a low-cost solution. Financial resources, but also knowledge of farmers in IT is most often reduced. The monitoring and decision system use a simplified architecture as opposed to advanced monitoring systems with prices that are not accessible to any farmer.

Acknowledgment

The successful completion of the project requires a lot of guidance and assistance from many people and we are extremely happy to get this all along till the completion of the project. Through this project, we acquired sufficient knowledge about drone applications and future advancements will help this project, a great success. Everything we have done for the project only because of such guidance and supervision of the people and we would never forget to thank them. We would like to express our gratitude to the Valliammai Engineering College, for the encouragement our project. We would like to thank TamilNadu state council for science & (TNSCST) Technology for sponsoring this work under student's project scheme.

References

[1] J. Prof. Swati D Kale, Swati V Khandagale, Shweta S Gaikwad, Sayali S Narve, Purva V Gangal, "Agriculture Drone for Spraying Fertilizer and Pesticides" published in iijarsse Volume 5, Issue 12, December 2015.
[2] Xinyu, X., Kang., Weicai, Q., Lan, Y. and Huihui Zhang, 2014, Drift and deposition of ultra-low altitude and low volume application in paddy field. Int. J. Agric. Biol. Eng., 7(4): 23-28.
[3] Aditya S. Natu, S. C. Kulkarni, "Adoption and Utilization of Drones for Advanced Precision Farming: A Review," in IJRITCC, Volume 5, Issue 5, May 2016.
[4] http://www.atm.com
[5] Xue, X., Lan, Y., Sun, Z., Chang, C. and Hoffmann, W.C., 2016. Develop an unmanned aerial vehicle based automatic aerial spraying system. Computers and Electronics in Agriculture., 1(28):58-66.