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GSM BASED AGRICULTURAL MONITORING SYSTEM USING DRONE

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Abstract - *The mobility of UAV(Unmanned Aerial Vehicle-Drone) with GSM monitoring system used for data retrieval. The main objective of this project is to develop GSM monitoring system to collect real time information by interfacing with arduino. Arduino which gives the proper signal to flight controller. To maintain stability and sustained operation, Pixhawk flight controller is used. The GSM is processed and produce a digital output. The digital output is then interfaced with arduino uno microcontroller by connecting TXD of GSM with RXD of arduino and vice versa. The interfaced output is used to activate the drone. Based on the arduino program, the drone is used for enhancing agricultural activities like spraying pesticides and water.*

Key Words: **Arduino, Communication link, GSM module, Interfacing, Pixhawk flight controller, UAV(Unmanned Aerial Vehicle).**

1. INTRODUCTION

The control communication link between the user and the Unmanned Aerial Vehicle(UAV) is one of the most important aspects of a UAV control system [1].The existing system uses remote control for controlling the drone activities.But the composed sytem uses Arduino programming for the better activity of drone by interfacing the Arduino with GSM.This paper proposes and demonstrates the implementation of an agricultural UAV control subsystem,which is programming oriented (e.g. waypoints insertion,return to base commands etc.),aiming to a omnipresent UAV mission management at long distances beyond the visual line of sight, through the GSM/GPRS cellular network.The GSM/GPRS network is used for its attractive global coverage [1]. The subsystem is based on Arduino platforms and components for converting the GSM/GPRS data to the appropriate UAV communication protol 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 like map.The field which is to be sprayed can be selected by using the waypoints in the mission planner of pixhawk.The waypoints are used to find the flight path [3].The drone duration is about 20 minutes with a payload [5] of 1litre pesticides covering about certain area.

The Arduino programming is done by using Integrated Devlopment Environment (IDE) which accepts C/C++. Now, the GSM is interfaced with ArduinoUNO by connecting the transmit and receive pins and vice versa.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 downned output is given to Pixhawk autopilot.

A short message service cell broadcast (SMSCB) message is to sent to one of the two cell broadcast channels [2]. The GSM antenna and SIM card is used to send and receive text messages from mobile phone to UAV through GSM module.By receiving text message from GSM, UAV starts to activate according to the commands like AT commands (Attention commands) which instructs the drone for doing present works.

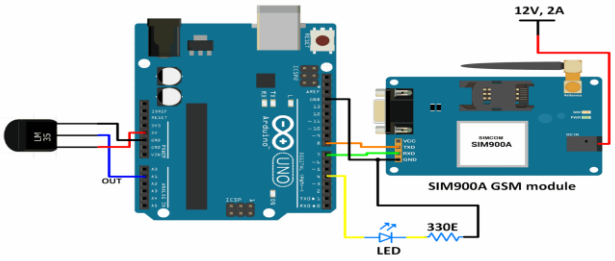

Fig-1: System Schematic Diagram

Fig.1. shows 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.

2. ARCHITECTURE:

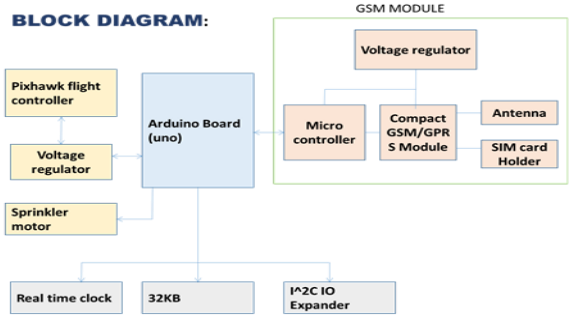

Fig-2: Block Diagram

Fig.2. represents the architecture of interfacing of GSM module with Arduino UNO. GSM module composed of microcontroller, voltage regulator, sim card holder and compact GSM/GPRS module. This module is interfaced with Arduino UNO which includes real time clock,32KB (additional memory) and I^2C IO expander.

2.1. Arduino Platform:

The main controller unit is Arduino UNO as shown in Fig.2.1., which is interfaced with GSM module. The Arduino consists of ATMEL Atmega 328 is an 8-bit microcontroller with 32KB flash memory and speed of 16 MHz. The Arduino is selected due to its availability, low cost, reliability and uses C/C++ for programming. It consists of 16 pins including 6 analog pins,8 digital pins, VCC and GND.

I.REAL TIME CLOCK: It is an in-built time keeper used to track the current time.

II.I^2C IO EXPANDER: It provides simple, robust, inexpensive and easy communication link between the peripheral devices like sensors for interfacing.

Fig-3:Arduino UNO Microcontroller

2.2. GSM module:

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 wireles 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 compatibily, 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-4: GSM module

2.3. PIXHAWK Flight Controller:

The pixhawk is an autopilot and supports many additional sensors like barometer, magnetometer, accelerometer [4] and gyroscope. Its a 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.

Fig-5: Pixhawk Flight Controller

SENSORS IN PIXHAWK:

I. BAROMETER: It measures altitude by neutralising the pressure.

II. MAGNETOMETER: Magnetometer or magnetic sensor measures the direction of ambient magnetic field.

III. GYROSCOPE AND ACCELEROMETER: It is used to find the pitch angle, yaw angle and roll angle.

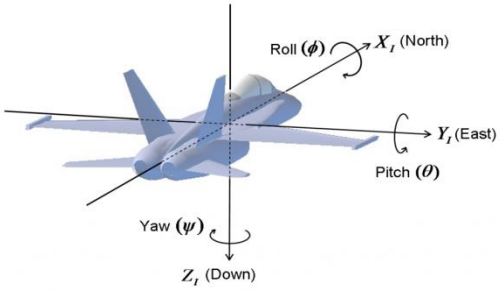

Fig-6: Inertial Frame

2.4. Sprinkler Motor:

In this project, sprinkler motor is used for spraying pesticides by sprinkler head in the predetermined area which is preloaded in the pixhawk. It is a DC type motor consume power of about 0.4 watt to 1.5 watt with a supply voltage of 3 to 6 volt.

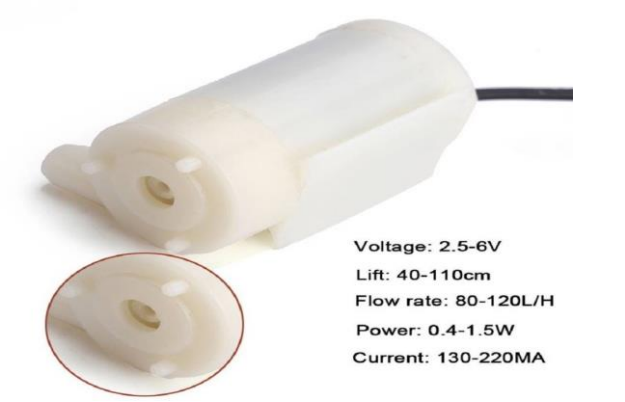

Fig-7:Sprinkler Motor

2.5. UAV (Unmanned Aerial Vehicle--Drone):

Through the use of '**bird's eye view'** can reveal many issues such as irrigation problems, soil variation, and pest and fungal infestations.

The UAV is used in agricultural field due to the following reasons:

- The purpose of spraying pesticides in the field by drone is to protect the farmers from skin related diseases.
- Consumption of pesticides is much reduced when compared to manual spraying.
- Uniform spraying of pesticide in the field.

Specifications of Drone:

BATTERY IN PIXHAWK	Li-Po battery
WEIGHT	1.5Kg
TYPE OF MOTOR	BLDC MOTOR
RADIUS	15cm
AREA TO BE COVERED	50 sq.meter

The voltage of the battery in the drone is 11.1 volts (3 cells),3300 mAh, time required to charge the battery is about 2 to 3 hours and weighs about 200 grams.The drone consists of four BLDC motors and Electronic Speed Controllers (ESC).The BLDC motor is chosen due to the absence of carbon contacts compared to other motors.

EXISTING SYSTEM:

- Remote control is used for controlling the drone activities.
- CC3D Flight Controller is used.

COMPOSED SYSTEM:

- Arduino programming is used to control the drone autonomously.
- Pixhawk Flight Controller is suitable for autonomous drone because it supports many additional sensors and devices.

3. SIMULATION:

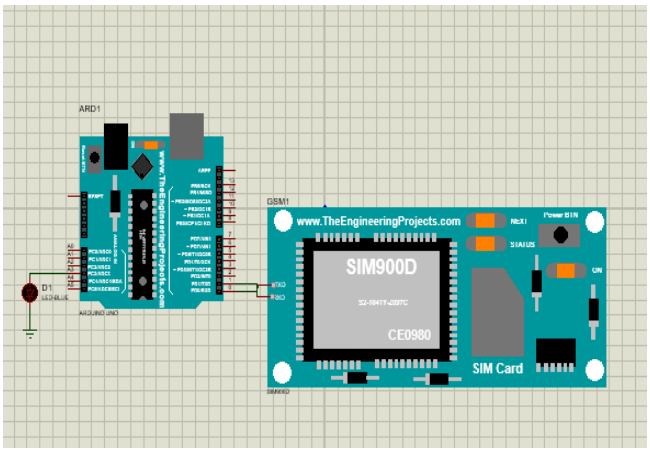

Fig-8: Proteus Simulation

The GSM module is interfaced with Arduino UNO in order to give the desired output and this is simulated by using Proteus software.The Arduino programming is written in IDE (Integrated Development Environment) and it is loaded in the Arduino UNO platform.

4. DISCUSSION:

In this project, we are going to implement the features such as autonomous working of drone based on the user commands.

RESULT AND CONCLUSION:

This project has lots of potential applications like spraying pesticides,fungicides and water.Nowadays these things are done manually using man power.Due to the advancements in technology and in order to reduce the man power,UAV done all these things.The development in technology paved the way for new inventions and tchnologies.This miniature drone lifts 1 kg weight and the development of embedded system helps in agricultural field to monitor the field and aids great help to the farmers.

ACKNOWLEDGEMENT:

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