

DESIGN AND IMPLEMENTATION OF MULTITASKING FLYING ROBOT (QUADCOPTER) CONTROLLED BY ANDROID APPLICATION

Sahyadri R. Mane¹, Prakash S. Andhare², Swapnali B. Gaikwad³

^{1,2,3}Fabtech Technical Campus College of Engg. Sangola, Solapur,

ABSTRACT

Nowadays, technology of science is developing very fast. Quadcopter is not a new concept in the fastest developing technology. Quadcopters are used for video recording or image capturing in case of defense in surveillance. The "multitasking flying robot" is used for observing in the agricultural field and to carry the weight from one place to another place. It is used to locate the video camera for long distance communication. It requires small guidance for navigation and control system to be developed and tested. There are several methods to do the control quad copters such as Zigbee, Wi-Fi, Bluetooth and GSM. GSM (Global system for mobile communication) technology is used for communication. The robot is wirelessly controlled by GSM based android application. It can perform functions like temperature and humidity sensing and obstacle detection. Signals are transmitted wirelessly through the mobile application to quad copter. All the operations are performed on the basis of microcontroller/Arduino Uno which is the master in doing operations in simple way. This paper focuses hardware and software level of design aspects. It have capabilities like seeing and detection of obstacle and give the notification to the transmitter side means mobile act as a trans-receive. Quadcopter maintain stable position when flying. Quadcopter accept load disturbance up to 100g during hover condition. Approximate time of operated quadcopter is 3 minutes using 1500mAh battery and operate time can be increased by using largest battery capacity. In the multitasking flying robot is efficient utilization of resources and reduce labor work.

Keywords: Android application, Arduino board, GSM module, Quadcopter, Navigation, Sensors.

I. INTRODUCTION

Multitasking flying robotic systems are used to implement into transportation field as a carrier to carry some weight from one place to another place without damaging it. Thrust concept is used for standing delivery to weight. It requires some mechanical force to generate thrust, due to this it becomes easy delivery of weight. This is one of the multitasking flying robot application, another applications are image capturing, video transmission and reception, temperature and humidity sensation. Quadcopter required dynamics in order to account for gravity effect and aerodynamic forces. It operated by thrust that produce by four motor that attach to the quadcopter body. Quadcopter changes direction by manipulating transmitter side of mobile. From the transmitter side speed of motor can be controlled by given input signal[4]. Robotic is the branch of design,

construction , operation, and application of robots, as well as computer system for their control, sensory feedback, and information processing[6].

The camera used for image capturing and video recording in that Quadcopter which rotates in 360^0 vertically and horizontally for any target. Using PIR sensor it perform human detection, it can rotate 180×180 horizontal to vertical range to get target motion. Flying robot has night vision camera for capturing continuous live streaming and send to the control unit. All this system controlled by a single microcontroller[7]. Use of a mobile phone for flying robot control can overcome these limitations. It provides the advantages of robust control, working range as large as the coverage area of the service provider, no interference with other controllers and up to controls. So This system will be a powerful and flexible that will offer this service at any time, and from anywhere with the constraints of the technologies being applied. Possible target appliances include climate control systems[8]. This paper divides into five sections first section (I) is about to Introduction of multitasking flying robot (Quadcopter). In the second section (II) mentioned that the system development of the multitasking flying robot. After the system development third section (III) mentions that experimental result of the project. In the fourth section (IV) the conclusion gives the output of the system.

II. SYSTEM DEVELOPMENT

This multitasking flying robot consist of two types of design-

- Hardware design
- Software design

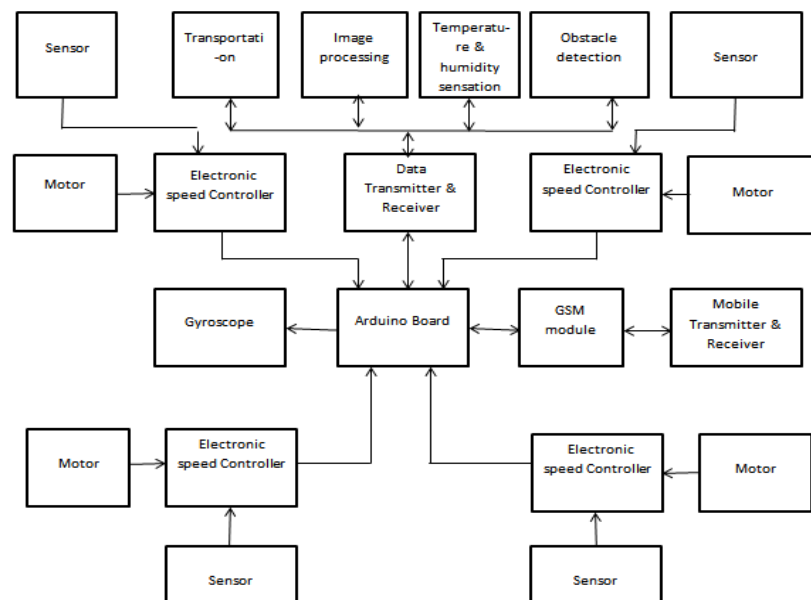


Fig 1: Block diagram of proposed system

A central controller controls the robot prototype and different modules are interfaced with a single controller on the arduino board. The multitasking flying robot has ATMEGA328P controller at its core. It is interfaced with GSM module for communication with the base station. It is connected to L293D motor driver IC for the control of the robot motion. The overall system controlled android application and performs the operation. The signals are transmitted through GSM module to the Arduino board . Arduino board performs the operations and gives

the acknowledgement to the transmitter side. And the performing operations display on the mobile screen where we can send the signals.

Arduino board-



Fig 2: Arduino Board

Microcontroller	ATmega328P
Operating voltage	5V
Input voltage	7-12V
Input voltage (limit)	6-20V
Digital I/O pins	14(of which 6 provides PWM output)
Flash memory	32KB(ATmega328P) of which 0.5KB used by bootloader.
SRAM	2KB(ATmega328P)
EEPROM	1KB(ATmega328P)
Clock Speed	16MHz

Table 1. Specification of Arduino Board

Arduino/Genuino Uno is a microcontroller board based on ATmega328P. It has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; Simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. In the Arduino board the Atmega328P controller is used which has the following specifications- The Atmega328P is a high performance microchip Picopower 8 bit AVR RISC based microcontroller combines 32KB flash memory with read while write capabilities and 1K EPROM data memory, 2K SRAM data memory. 28 pins AVR controller. I/O pins 23, Timers- two 8-bit/ one 16-bit, PWM six channels. Many instructions are executed in a single clock. In the Arduino board, the Atmega328P microcontroller chip is used. The Atmega328P is a more advanced chip and it is also upgraded.

Accelerometer and Gyroscope-

An accelerometer is a highly sensitive accelerometer component of inertial navigation systems for aircraft and missiles. Accelerometers are used to detect and monitor vibration in rotating machinery. It is used in tablet computers and digital cameras so that images on screens are always displayed upright. In a drone, an accelerometer is used for flight stabilization. Coordinated accelerometers can be used to measure differences in acceleration, particularly gravity, over their separation in space; i.e., gradient of gravitational field. This gravity gradiometry is useful because absolute gravity is a weak effect and depends on local density of the earth which is quite variable. For example, an accelerometer at rest on the surface of the earth will measure an acceleration due to earth's gravity, straight upwards of $g \approx 9.81 \text{ m/s}^2$. Accelerometers in free fall will measure zero [6]. Single and

multi-axis models of accelerometer are available to detect magnitude and direction of proper acceleration, as a vector quantity, and can be used to sense orientation, coordinate acceleration, vibration, shock, and falling in a resistive medium.

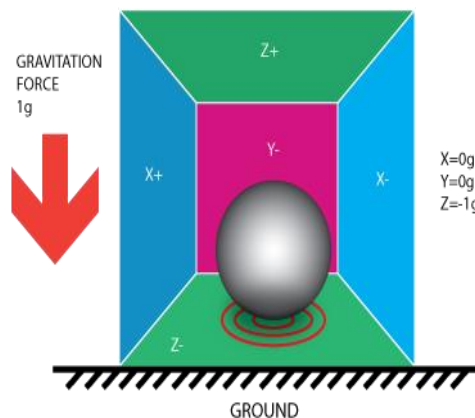


Fig 3: Accelerometer image

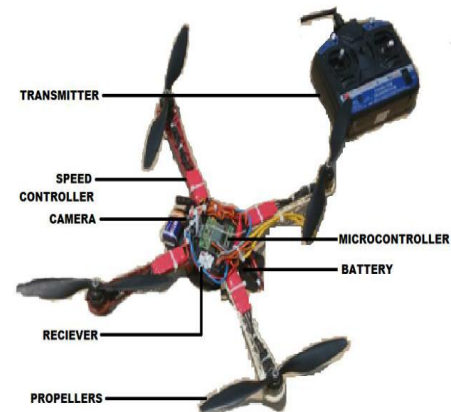


Fig 4: Implementation of Quadcopter

A gyroscope is a spinning wheel or disc in which the axis of rotation is free to assume any orientation by itself. When rotating, the orientation of this axis unaffected by tilting or rotation of the mounting , according to conservation of angular momentum. Because of this, gyroscope are useful for measuring or maintaining orientation.

GSM-

GSM (Global System for Mobile communication) is a digital mobile telephony system widely used in world. GSM uses a variation of time division multiple access (TDMA) and is most widely used of three digital wireless telephony technologies (TDMA,GSM and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own slot. It operates at either the 900 MHz or 1800 MHz frequency band.

Sensor- Sensor is an electronic component which is used for detect events or changes in its environment And sends the information to other electronics, frequently a computer processor. It is capable of converting any physical quantity to be measured into a signal which can be read, displayed, stored or used to control some other quantity.

Table 2: comparisons between several communication technology

Para-Meters	Zigbee	GSM	Blue Tooth	Wi-Fi
Working Frequency	2.4 GHz	900 MHz	2.4 GHz	2.4 GHz
Modulation Method	O-QPSK	QPSK	GFSK	QPSK
Data Rates	20Kbps& 40Kbps	64Kbps-120Mbps	1Mbps	54 Mbps

Transmitter Current	23mA	380mA (M) 30mA (I)	15mA	4 to 20 mA
Operating Temp	-20° To 50°	-30° to 60°	-40° to 125°	-20°to 60°

This signal produced by the sensor is equivalent to the quantity to be measured. Sensors are used to measure a particular characteristic of any object or device.

b)Software Development-

Arduino Software- For The arduino integrated development environment – or arduino software(IDE)- contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the arduino/Genuino hardware to upload programs and communicate with them. Tools-for selecting hardware programmer when programming a board or chip and using the onboard USB-serial connection normally you won't need this, but if you are burning a bootloader to a microcontroller, you will be use this.

Arduino Programming-

The Arduino/Genuino Uno can be programmed with the (Arduino Software(IDE)). Select “Arduino/Genuino Uno from the tools> Board menu(according to microcontroller on your board). The ATmega328P on the Arduino/Genuino Uno comes preprogrammed with the bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol and you can also bypass the bootloader and program the microcontroller through the ICSP(In-Circuit Serial Programming) header using Arduino ISP or similar.

For the development of GSM based android application by using

JAVA: Java is a set of several computer software products and specifications from Oracle Corporation that provides a system for developing application software and deploying it in a cross-platform computing environment. Java is used in a wide variety of computing platforms from embedded devices and mobile phones on the low end, to enterprise servers and supercomputers on the high end.

ECLIPSE INDIGO IDE

- The main application for Android Smart Phone is coded in the environment of Eclipse
- Indigo IDE and compiled as a standard android executable that runs on platforms above.
- API level 8 (Gingerbread or higher).

Flow Chart of Proposed System-

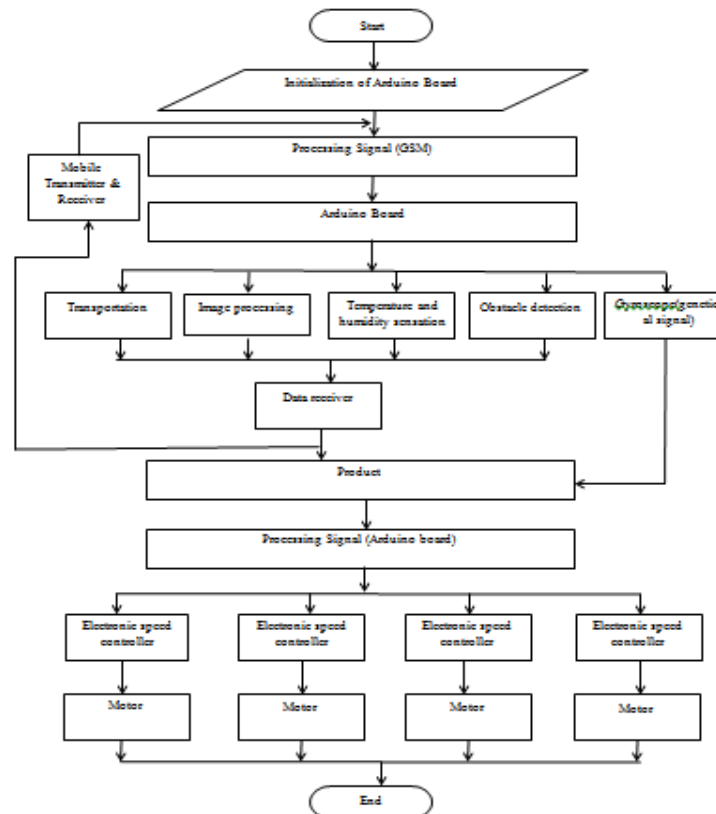


Fig 4: Flow chart Proposed System of overall multitasking flying robot

III. EXPERIMENTAL RESULTS

The proposed solutions have been designed using Arduino software and eclipse. It have capabilities like seeing and detection of obstacle and give the notification to the transmitter side means mobile act as a trans-receive. Quadcopter maintain stable position when flying. Quadcopter accept load disturbance up to 100g during hover condition. Approximate time of operated quadcopter is 3 minutes using 1500mAh battery and operate time can be increased by using largest battery capacity. In the multitasking flying robot is efficient utilization of resources and reduce labor work. This overall system controlled by using android application. The signals are transmitted and received by using GSM module.

IV. CONCLUSION

This paper concludes that the “Multitasking flying robot” has performed their work properly. Such kind of Quadcopter is useful for multipurpose works. Quadcopter makes difficult work easy for the people. This Quadcopter gives us the temperature and humidity sensation of environment as well as transportation makes easy by detecting any obstacle in their path. If there is any obstacle detects, then it gives the notification to the transmitter side. This system operated totally on a single controller.

Future Scope-

In the future the multitasking flying robot used in agricultural field for monitoring the farm, industrial purpose, weather forecasting, image capturing, video recording, also it will used in surveillance system.

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