DATA ACQUISITION SYSTEM & VISUAL SURVEILLANCE AT REMOTE LOCATIONS USING QUAD COPTER

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ABSTRACT
The military use of unmanned aerial vehicles (UAVs) has grown because of their ability to operate in dangerous locations while keeping their human operators at a safe distance. Quad copter is basically an unmanned aerial vehicle which can be manually controlled by remote controller. The PID controlling algorithm is used to stabilize the Quad Copter in the environment. There are several advantages to quad copters over comparably-scaled helicopters. The use of quad copter in the field of armed appliances has grown drastically to operate in dangerous situations where human can be safe at a distance. It is possible to build a small-scale Quad copter that could be used for both military and commercial applications. Visual aid is also a crucial factor when monitoring hostile environment. A camera or a camera module is essentially used to capture and transmit frames (video) at regular intervals from the unmanned vehicle to the operator via a wireless channel. The data transmission is done with the help of ZIGBEE protocol.

KEYWORDS: *Quad Copter, PID controller algorithm, Data Acquisition System, Camera module, ZIGBEE module*

I. INTRODUCTION

The objective or aim behind the quad copter we have designed is to collect the data from remote areas where humans cannot reach or are not safe and surveillance in those remote areas. The quad copter is the flying robot which can be manually controlled through remote controller while the operator staying at the convenient and safe place.

1.1. Operating Principle of Quad Copter

The Quad copter means it has four arms and one motor is connected at the end of each arm. One pair of the motors which is connected at the opposite arms of the quad copter is rotated in clockwise direction and the other pair of motors connected at the remaining opposite side arms is rotated in anti-clockwise direction at constant speed to hover or to take off the quad copter in the atmosphere. To

stabilize quad copter in the atmosphere both the opposite pairs of motors are rotated at the same speed.

Figure shows the operating principle of the quad copter. To move the quad copter in the forward direction the speed of the motor connected at the back side is increased proportionally while the speed of other motors is unchanged. Similarly, the quad copter will make a movement in other directions also. The roll, yaw and pitch movements are also made possible by similar operations.

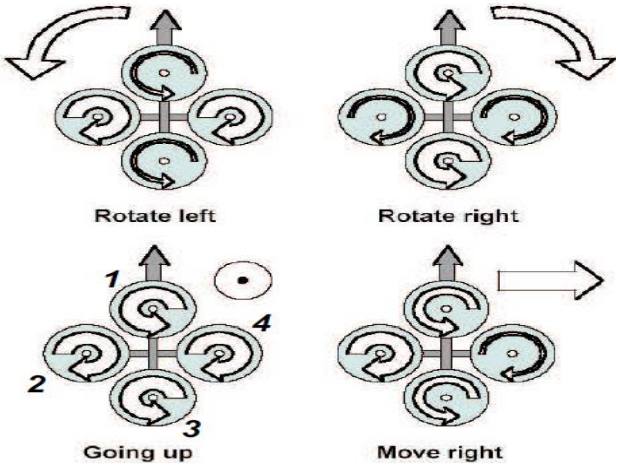

Figure 1. Operating principle of Quad copter

II. OUR QUAD COPTER

The KK2 board is used to control the whole operation of quad copter and ARM7 processor is used for the data acquisition system mounted on the quad copter.

The operator at remote station will give control signals to the quad copter through the radio controller. The radio controller is the 6 channel RF module which can transmit the radio signal. Out of 6 channels we are using only 4 channels for communicating. This radio controller operates at the frequency of 2.4GHz and the modulation technique used in it is FM and operates on GFSK programming type. The RF module receiver having the same specifications as that of radio transmitter/controller is connected to the KK2 board as an input. The PWM output signal of the KK2 board is given to the ESCs according to which the ESCs will give the control signal to the motors to control their speed. The radio controller can cover the distance up to 1km.

We have designed our quad copter with the dimensions of its arm as 50*50 cm. Along with the four motors connected at the end of the arms; four ESCs (Electronic Speed Controller) are connected each for the single motor. These ESCs are used to control the speed of the motor by giving the control signals to them. The motors that we have used are BLDC motors having rpm rating as 1100rpms/v and maximum thrust of 1130g.

After hovering or take off of the quad copter, the main aim was the stabilization of the quad copter in the air. This was the big challenge in front of us. To solve this problem the PID controller algorithm is used in the KK2 board.

Figure 2. Our Quad copter

III. DATA ACQUISITION SYSTEM

Our main motivation of building quad copter is for data acquisition at remote places. The ARM7 processor is used in data acquisition system. The temperature sensor LM35, humidity sensor RHT03 and pressure sensor are interfaced with the ARM7 processor and used for data acquisition system.
This data acquisition system is mounted on the quad copter and will capture the data i.e. temperature, humidity, pressure at the remote places where the quad copter will arrive.
There is monitoring system established at the convenient place where the operator can monitor and analyze the data received at the monitoring system.
The ZIGBEE module is used at both quad copter and monitoring system for transmitting the information that has been captured by the sensors at remote locations.
We have connected the ZIGBEE module to the hyper terminal of the computer so that we can monitor the data that has been received by ZIGBEE module on the computer.
The second main objective of our quad copter is to visual inspection at the hazardous places where the humans are not safe to go there. So we have used the better quality camera module which will capture the videos and the pictures from that remote locations and the transmitter will send those frames to the monitoring system.

IV. BLOCK DIAGRAM

The overall block diagram of our project is shown below.
Our project is divided into 3 parts:

1. Controller Unit
2. Robot Unit
3. Monitoring Unit

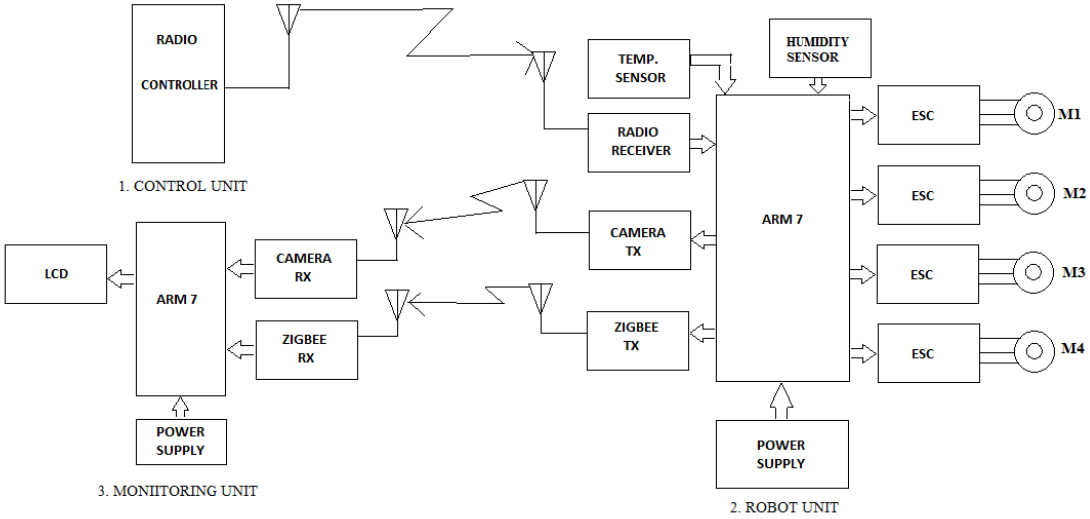

Figure 3. Block Diagram

1. Controller Unit consists of the radio controller through which the operator can control the movement of the quad copter from the distant place which is convenient to the operator. This radio controller that we are using can cover distance up to 1km.
To control the quad copter, we have used HK-6X 6 channel radio controller system. This controller works on the frequency range of 2.4GHz & the FM modulation technique is used. The programming prototype used is GFSK.
2. Robot unit is the quad copter and the data acquisition system mounted on it. The quad copter built up of 4 BLDC motors, 4 propellers, 4 ESCs and the KK2 board used to control the overall operation of the quad copter. And the data acquisition system is of as mentioned above, the sensors i.e. LM35, RHT03, pressure sensor & the camera connected with ARM7 processor to capture the data at remote locations. There is ZIGBEE module Xbee s2 also connected to transmit the data to the monitoring system.
This robot (quad copter) is controlled by the radio controller and can be sent to the remote locations from which we want to collect the information.
3. Monitoring system is mounted at the convenient place from where the operator can easily monitor and analyze the data that has been received.
The zigbee receiver and the camera receiver module is connected at the monitoring system to receive the information. This is directly connected to the hyper terminal of the computer i.e. PC or the LCD is interfaced for the display purpose.

V. CONCLUSION

We have designed the Quad Copter which basically we are going to use for the Data Acquisition System and the Visual surveillance at the remote locations where the human reach is difficult.

VI. FUTURE SCOPE

Other than these basic applications this Quad copter has wide range of applications in military security purpose, in surveillance of hazardous areas like in the building running with fire to find if any humans are left in it, finding the mines in the land where sending the soldiers or humans is more dangerous, in inspection of the stadium ground, in going to the building which is very new to us and preparing the map of that building with adding the image processing etc.
These and many more applications can be created by adding the intelligence to the Quad Copter.

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