Hand Motion Controlled Drone

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Abstract : This paper presents a unique solution for the implementation of a motion based drone controller system. In this study a glove mounted Arduino Nano microcontroller that will be interfaced with an Inertial Measurement Unit (MPU6050) to provide the necessary roll, pitch and yaw control to the quadcopter, is used. After processing the input from the IMU, the output goes towards the NRF24L01 module which acts as a radio transceiver. This output from NRF24 module is received by another NRF24 module located on the drone to control it's movements. The flex sensor is used to provide the necessary altitude control.

***Keywords* - Flex Sensor, Arduino Nano, motion control.**

I. INTRODUCTION

Drones are fast becoming ubiquitous in our daily lives. The first UAV technology was developed in 1930 when the U.S Navy began experimenting with radio-controlled aircraft resulting in the creation of the Curtiss N2C-2 drone in 1937. Today drone technology has evolved to be much more smaller, mobile and more stable. Even so, the operation of drones requires a skilled pilot to perform the necessary maneuvering. A simple motion controller can make the task much simpler and would require less skill.

The topic of concern here is the motion control of a quadcopter drone. Motion refers to the hand motions that imitate the movement of the drone to control it. In our implementation we use an Arduino Nano as the central processor that takes input from the MPU6050 IMU and transmits the signal via the NRF24L01 module to the quadcopter where another Arduino Nano interfaced with NRF24L01 module accepts it and thereby controls the direction of movement of the drone.

There are previous implementations of motion control by using hand motions. However none of them had an adjustable altitude control, instead having a fixed altitude for flying. In our implementation of the system we employ the use of flex sensors to control the altitude of the quadcopter. In this way we are extending the functionality by not only making the quadcopter respond to the pitch, roll and yaw motion of the hand, but also to control the altitude of the quadcopter using a flex sensor, whose variable resistance output can be remapped to control the altitude of the quadcopter.

II. IMPLEMENTATION OF THE SYSTEM

Mechanism

Quadcopter can be described as a small unmanned aerial vehicle with four propellers attached to the end of the cross frame. This aim for fixed rotors is used to control the vehicle motion. The speeds of these four rotors are independent. By independent pitch, roll and yaw attitude of the vehicle can be controlled easily. Pitch, roll and yaw attitude of Quadcopter.

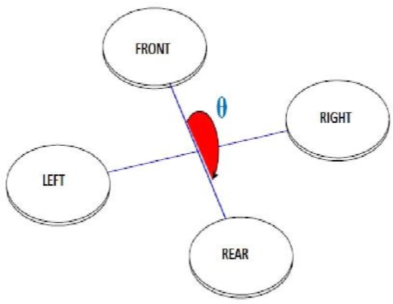


Fig1. Pitch

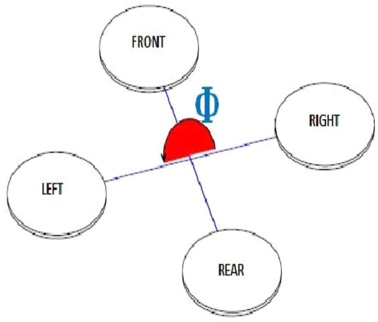


Fig2.Roll

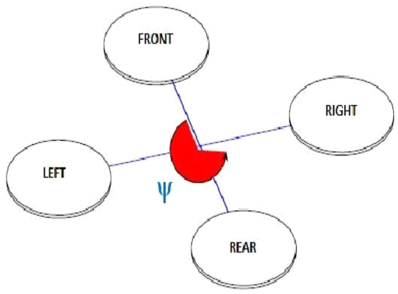


Fig.3 Yaw

Taking-off and landing motion mechanism

Hovering or static position:-

The hovering or static position of the Quadcopter is done by two pairs of rotors, by rotating in clockwise or counter-clockwise respectively with the same speed. By two rotors rotating in clockwise and counter-clockwise position, the total sum of reaction torque is zero and this allows the Quadcopter to be in a hovering position.

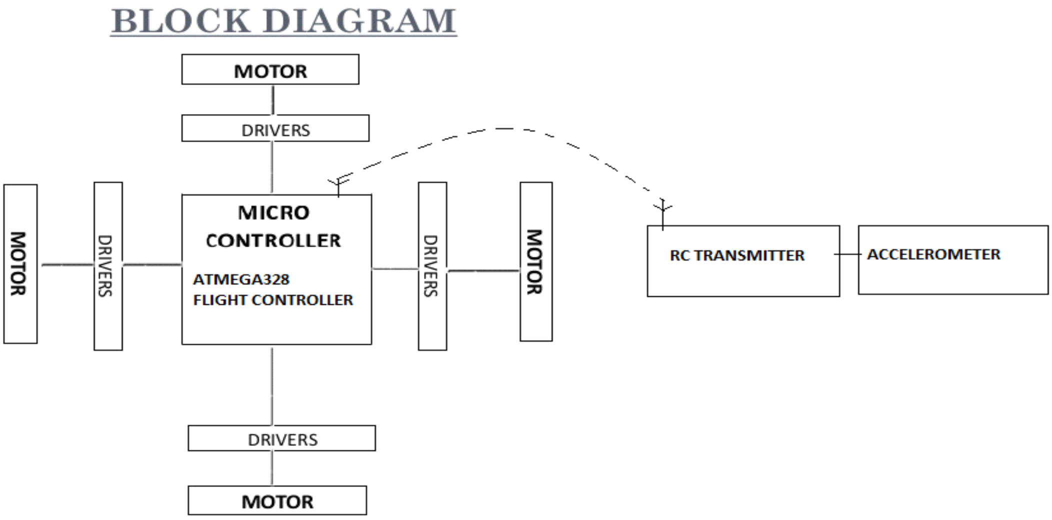
Forward and backward motion:-

Forward (backward) motion is controlled by increasing (decreasing) speed of rear (front) rotor. Decreasing (increasing) rear (front) rotor's speed simultaneously will affect the pitch angle of the Quadcopter.

Left and right motion:-

For left and right motion, it can be controlled by changing the yaw angle of the Quadcopter. Yaw angle can be controlled by increasing (decreasing) counter-clockwise rotors speed while decreasing (increasing) clockwise rotor speed.

III. BLOCK DIAGRAM



The motion controlled quadcopter is designed using a glove mounted MPU6050 unit which is the primary Inertial Measurement Unit interfaced with an Arduino Nano and an NRF24L01 module; all of them powered by a 9V battery.

The MPU6050 contains an inbuilt MEMS gyrometer and accelerometer. The output from the MPU6050 is given to the Arduino Nano, which acts as a central processor and transmits the output via an NRF24L01 tranceiver module. The flex senor also sends it's output via this transceiver module to control the altitude of the quadcopter.

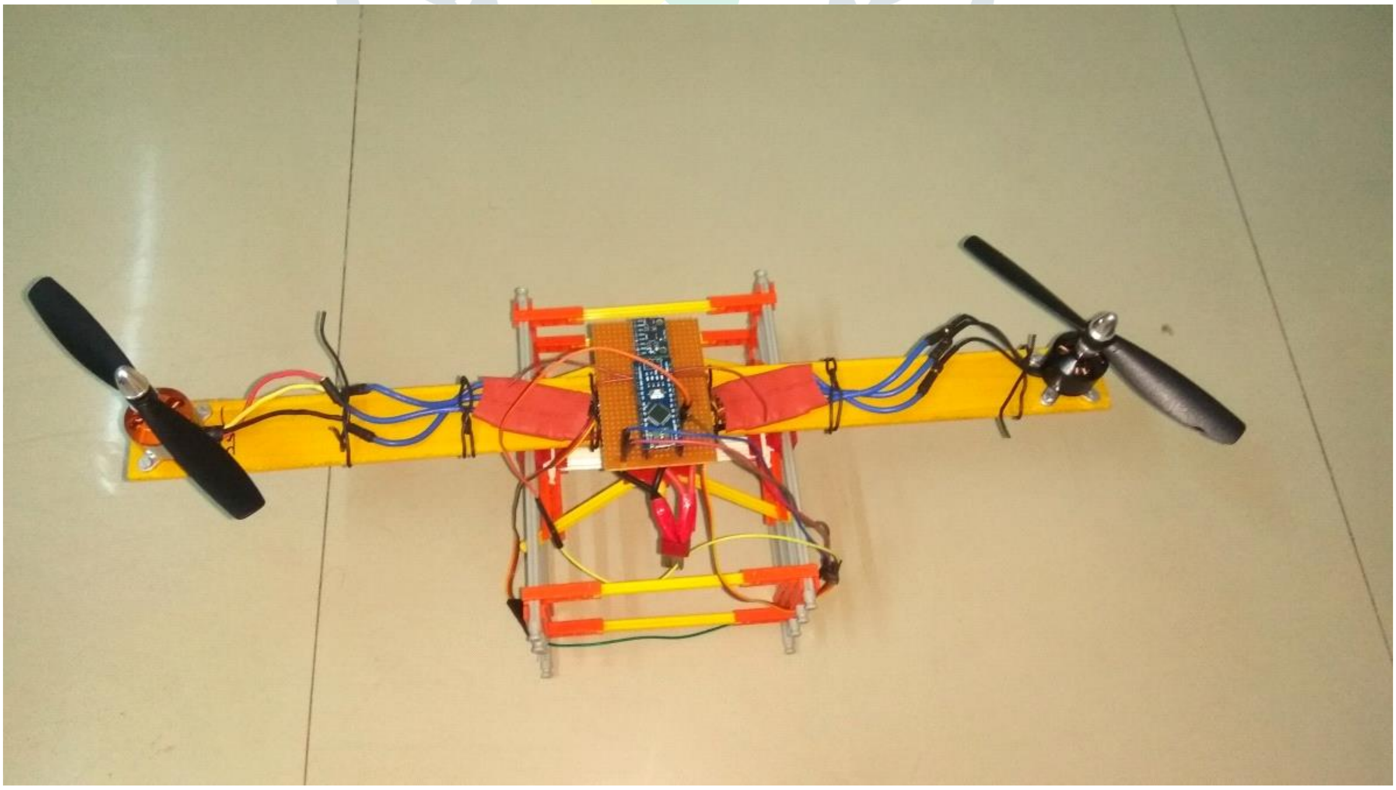
The output of this transceiver module is transmitted to another NRF24L01 tranceiver module located on the body of the drone. The module then transmits the signal to another Arduino Nano unit housed on the drone body. This unit is then used to generate PWM signals which are given to the ESC, which acts as a motor driver.

This ESC then transmits the PWM signal to the BLDC motors and can therefore be used to control it's speed. The variations in the PWM signals provides the necessary speed control.

This variation in PWM signal comes from the motion controlled input obtained from the glove mounted transmitter unit.

All the components that are housed in the quadcopter body are powered by an 11.1V Li-Po battery.

IV. FINAL DRONE PROTOTYPE



V. CONCLUSION

Thus, with the help of the MPU6050 IMU and the flex senor, we have been able to control the roll, pitch and yaw of as well as the altitude of the quadcopter. This can help in much better piloting by relatively unskilled pilots and can be used to perform various tasks such as aerial photography and videography, crowd monitoring etc to name a few.

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