Wireless Control Quad copter Self-Balancing System

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ABSTRACT: **This research focused on a remotely operated Quad copter system. The Quad copter is controlled through graphical user interface (GUI). Communication between GUI and Quad copter is done by using wireless communication system. All signals from sensors are processed by PIC microcontroller board. Output from PIC microcontroller board used to control Quad copter propellers.**

The experiment shows that Quad copter can hover with maintain its balancing and stability. They are called rotorcrafts because unlike a fixed wing aircraft, here lift is generated by narrow chord aero foils. They are the mixture of streams of mechanical, electronics and especially

aviation .

Keywords- Quad copter, Quad Rotor,GUI, Rotorcrafts.

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I. INTRODUCTION

Quad copter, also known as quad rotor, is a helicopter with four rotors. The rotors are directed upwards and they are placed in a square formation with equal distance from the center of mass of the quad copter. The quad copter is controlled by adjusting the angular velocities of the rotors which are spun by electric motors. Quad copter is a typical design for small unmanned aerial vehicles (UAV) because of the simple structure. quad copters are used in surveillance, search and rescue, construction inspections and several other applications. Quad copter has received considerable attention from researchers as the complex

phenomena of the quad copter has generated several areas of interest. The basic dynamical model of the quad copter is the starting point for all of the studies but more complex aerodynamic properties has been introduced as well. Different control methods has been researched, including PID controllers. Control methods require accurate information from the position and attitude measurements performed with a gyroscope , an accelerometer, and other measuring devices, such as GPS, and sonar and laser sensors . The purpose of this paper is to present the basics of quad copter modeling and control as to form a basis for further research and development in the area. This is pursued with two aims. The first aim is to study the mathematical model of the quad copter dynamics. The second aim is to develop proper methods for stabilization and trajectory control of the quad copter. The challenge in controlling a quad copter is that the quad copter has six degrees of freedom but there are only four control inputs.

II. SYSTEM DESCRIPTION

The quad rotor helicopter used in this project is a Draganyer X-Pro (X-Pro). It differs from traditional helicopters regarding the design as it has 4 horizontal rotors and no vertical rotors. Traditional helicopters can adjust the angle of the rotor blades as well in order to control the helicopter, but on the X-Pro the blades have a static angle. The only variable that can be adjusted in right is the rotational speed of the rotors. The reason for this is to aid the development of a model and controllers for the X-Pro, without the risk of flying into the wall. This will of course give reduce the movements of the X-Pro.
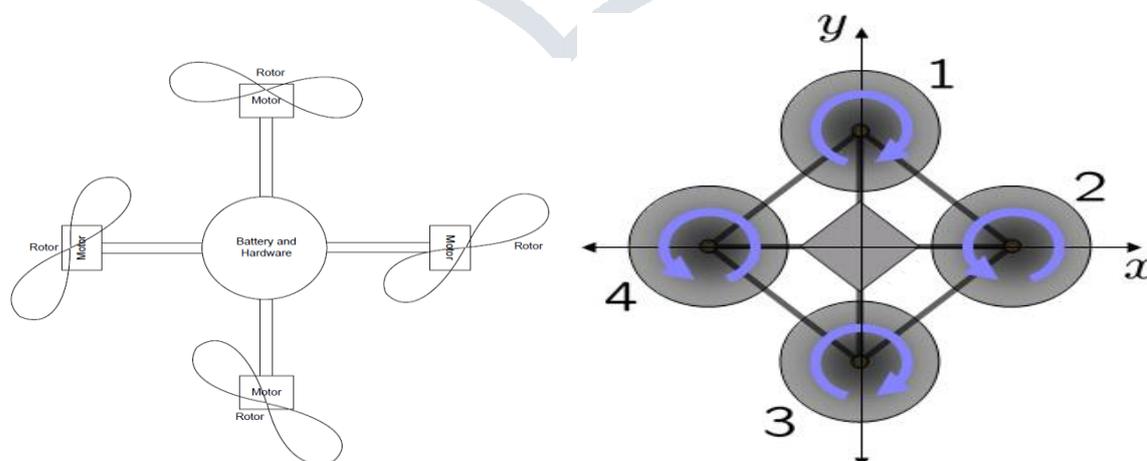

Fig.1 Whole structure of rotations in quadcopter

The Design

The X-Pro consists of a base in the center and 4 arms equally spaced in a shape of a cross. The motors are mounted on the end of the arms and connected to the rotors using 1 to 10 gearing. The base of the X-Pro is the joint between the 4 arms and contains a battery and the remote control (R/C) electronics. The basic structure of the X-Pro can be seen in figure. The X-pro has two motors working in the same direction in ths case 4 and 2 rotating anticlockwise whereas, the other two motors 1 and 3 rotated in opposite direction to the other motors that is 4 and 2 making the X-pro rotates stable and vigorous!.

III. TECHNIQUE USED

Pulse Width Modulation (PWM) Signal is a method for generating an analog signal using a digital source. A PWM signal consists of two main components that define its behavior: a duty cycle and a frequency. The duty cycle describes the amount of time the signal is in a high (on) state as a percentage of the total time of it takes to complete one cycle. The frequency determines how fast the PWM completes a cycle (i.e. 1000 Hz would be 1000 cycles per second), and therefore how fast it switches between high and low states. Technique used in the movement of the quad copter is PWM(Pulse Width Modulation) . **pulse-duration modulation** (**PWM**), it is a technique used to encode a message into a pulsing signal. It is a type of modulation. Although this modulation technique can be used to encode information for transmission, its main use is to allow the control of the power supplied to electrical devices, especially to inertial loads such as motors. In addition, PWM is one of the two principal algorithms used in photovoltaic solar battery chargers, The PWM switching frequency has to be much higher than what would affect the load (the device that uses the power), which is to say that the resultant waveform perceived by the load must be as smooth as possible .The major advantage of using PWM in the quad copter is that power loss in the switching devices is very low. When a switch is off there is practically no current, and when it is on and power is being transferred to the load, there is almost no voltage drop across the switch. Power loss, being the product of voltage and current, is thus in both cases close to zero. PWM also works well with digital controls, which, because of their on/off nature, can easily set the needed duty cycle. PWM can be used to control the amount of power delivered to a load without incurring the losses that would result from linear power delivery by resistive means.

IV. CONCLUSION

While the initial goal of creating an autonomous quad copter capable of sensing obstacles was not reached in ten weeks, our group still learned a substantial amount about robot design, fabrication, control, and arduino programming. We used the spring test rig to determine the motor and propeller thrust for various PWM signals. We used this information for quad copter frame down selection and control. We learned important soldering and electric system fabrication skills including making a power harness and digital to analog motor control. Our group all became proficient arduino programmers by necessity as it was the most complex part and required a group effort. In these ten weeks we succeeded in stabilizing the quad copter in two degrees of freedom. The end of the project is bittersweet. We are proud of our accomplishments, but wish that there were more time to improve the quad copter. With another ten weeks we would further fine tune the stability and add code to handle yaw and translation in the XYZ-axes

CIRCUIT DIAGRAM OF MICROCONTROLLER USED IN THE QUAD COPTER
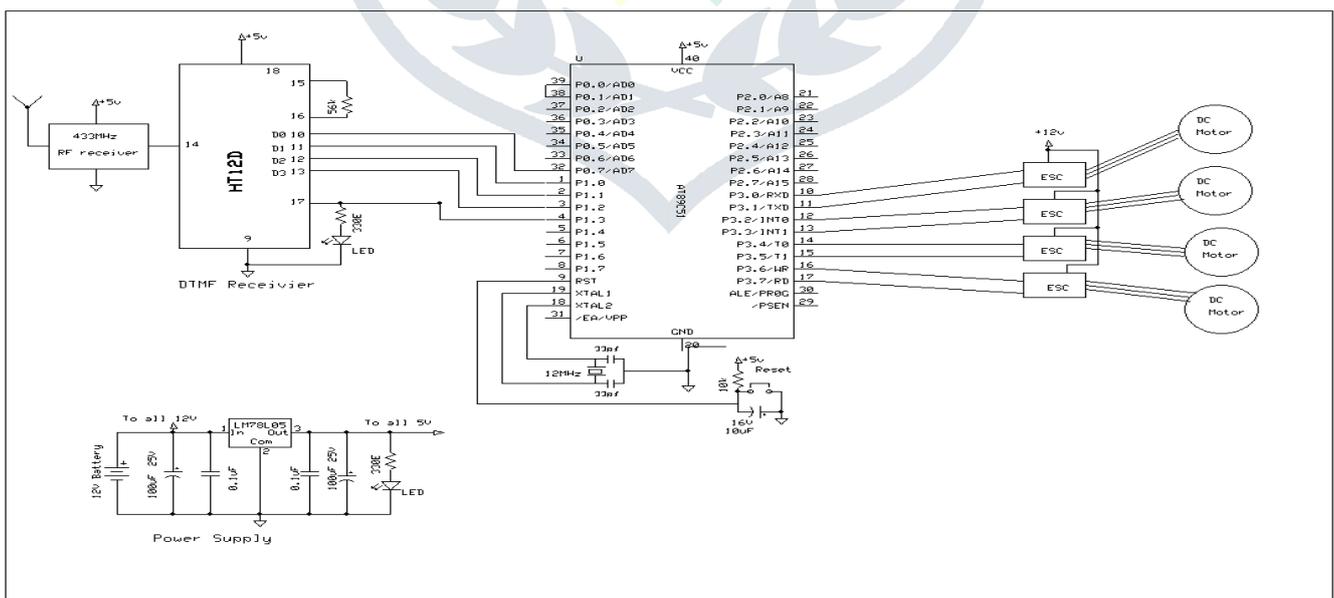
The circuit shows how the PIC microcontroller is used to control the electronic speed controllers(ESCs) which control the speed of the motor which in turn controls speed of the propellers of the quad copter.

CIRCUIT DIAGRAM OF THE WIRELESS CONTROLLER
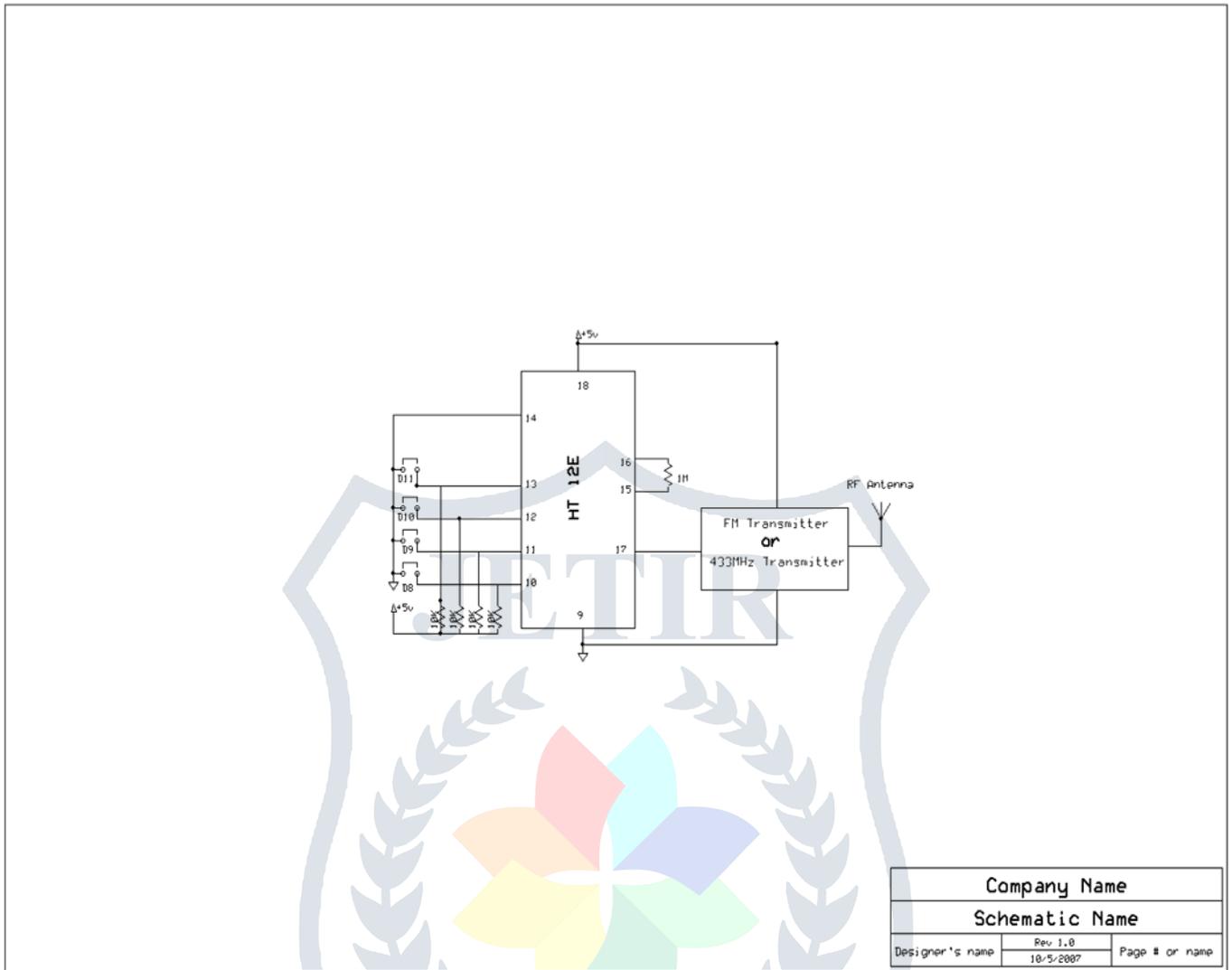
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