

# FINAL YEAR PROJECT

## Autonomous Hover of a QuadCopter

### Project Supervisor

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## Introduction:

### Background

Unmanned Aerial Vehicles (UAVs) have emerged over the last few years as a very active research area. Due to the large variety of missions, they can replace humans in accomplishing complex tasks. They are especially used in dangerous environments and long endurance missions for both military and civilian applications. Moreover, small quadcopters have some advantages with respect to their vertical takeoff and Landing. Quadcopter is lifted by four rotors. In order to build a quadcopter one must first understand the mathematical model and the control theory.

### Purpose

The main purpose is to investigate and devise a software which helps to achieve the stability of quadcopter in 3D space and invoke path planning i.e. hovering around in 3D space using Artificial Intelligence techniques. It will investigate how mathematics can be applied to real world problems, in our case controlling the quadcopter.

### Scope

This research focuses upon achieving the stability of the quadcopter in 3-D space. It's main focus is on understanding the mathematical model for the quadcopter. The mathematical model is the base for the research. It has been integrated with the PID (Proportional, Integral and Derivative) controller. The model was first simulated in a mathematical software (MATLAB). Later on the quadcopter was made to hover in space autonomously.

Stereo image triangulation techniques will be implemented in order to locate the quadcopter in 3-D space. The model is being implemented on the physical device, marking the end of the project. However, if the time permits we can incorporate different interactions to the quadcopter such as managing the copter virtually with the help of a gaming device Kinect.

## **Procedure**

We have referred to research papers and articles published in research journals and science magazines. First we have applied the mathematical model with control theory in MATLAB and have successfully simulated it. Then we shifted to Simulink (Software which is used to analyze, model and simulate dynamics of systems). We are now at the stage of implementing our theory on the actual hardware. Interfacing with the hardware is being done with help of a computer.

## **Limitations**

The hovering of the quadcopter will be done in a small confined space, so to study it more carefully. External environmental factors are not included at this stage of our research. The medium of communication between the quadcopter and the computer is Bluetooth which has a confined range.

The photograph below shows the assembled hardware of our quadcopter.



## Appendix:

### Appendix 5: Work distribution

All three of us did equal amount of work on both hardware and software side of the project.

### Appendix 6: Project Timeline

DATE	DESCRIPTION
09/02/2013	Proposed FYP topic to the supervisor
09/09/2013	Understanding the mathematical model of the quad
09/30/2013	Implementation of the model in MATLAB
10/22/2013	1st Progress Report
11/05/2013	Controlling the Z-Coordinate of the QuadCopter
12/07/2013	2nd Progress report
12/16/2013	Visualizing the model in MATLAB
12/30/2013	Interfacing between MATLAB and C# using socket
01/06/2014	Interfacing with gyroscope and accelerometer with arduino
01/27/2014	Working with Kinect on indoor positioning system
01/28/2014	Demo of presentation of FYP-1
02/4/2014	Testing of model on Simulink block wise
02/25/2014	Testing of model on Simulink as a one block
03/4/2014	Testing of motors
03/18/2014	Testing of ESC (electronic speed control)
03/25/2014	Testing battery with esc and motors
04/4/2014	Testing battery with esc, motors and arduino mega
04/10/2014	Assembling of the frame with all the components on it
04/17/2014	Soldering wire connections
04/22/2014	Testing all the connections
04/29/2014	The first flight of the quad