VISVESVARAYA TECHNOLOGICAL UNIVERSITY
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Video Monitoring System in Flood Affected Areas using an Unmanned Aerial Vehicle

A project report submitted in partial fulfillment for the requirement in the degree of

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in
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Abstract

In this project we present the implementation of a Video Monitoring system using an Unmanned Aerial Vehicle (UAV). Initially we present the design details for the control system of the UAV built around a quadrotor configuration. Quadrotor UAVs are being increasingly deployed in military warcraft and off late, they have also found varied applications in the field of law enforcement, traffic analysis, swarm intelligence and mainly in various rescue operations. UAVs require sophisticated control system which are very challenging to build. Our focus in this project, is on the electronic control of the UAV rather than the mechanical aspects of its design. We propose a control system consisting of two stages - the Inertial Measurement Unit (IMU) and the UAV Flight Control. We demonstrate image transmission from UAV to the base station using a Zigbee link.

We demonstrate a low cost realization of IMU by fusing the output of MEMS sensors (accelerometer and gyroscope) using the Kalman Filter. The Kalman Filter takes input from both the accelerometer and gyroscope and returns an accurate estimate of the position of the UAV. We also describe the associated state modeling and optimization of the Kalman filter. We then demonstrate the superior performance of the Kalman Filter compared to raw sensor data. We implement the Complementary Filter and compare its performance with that of the Kalman Filter.

In flight control part, we achieve the flight of the UAV by differentially controlling the speed of each of the four motors. A possible implementation of the motor driver and differential speed control with PWM signals is shown. We implement the Proportional Integral Derivative(PID) controller to obtain error parameters for yaw, roll and pitch. These error parameters are then used to generate appropriate PWM signal for each of the four motors. We then present the tuning of PID controller for this application.

We mount a serial camera on the UAV and transmit images to the base station via a Zigbee link. The images from the UAV can then be used for surveillance and to guide rescue operations in flood affected areas.