

## MY PROJECTS

### ● 5 DOF MANIPULATOR ROBOT

This was the first project that I have ever done. The project was done during the winter semester. The final aim of the project was to completely automate a mobile manipulator in the Mechatronics/Robotics Laboratory. This project gave me exposure to MatLab based “pose” estimation and application of basic electronics in mechatronics. We used self-designed MOSFET based motor drivers for driving the heavy robot. Rotatory encoders were used at each of the links to obtain precision angle measurements. The mobile manipulator uses line following to move from one location to the other and to perform various tasks.

### ● ATmega 16/32 DEVELOPMENT BOARD

This project was done during the vacation after first year winter semester. This aim was to create a simple development board which is directly programmable using USB without serial converters or FT232. So I did it by following a similar design solution by Fischl. I designed and tested the development board which was later supplied to over 200 students in the college as a tool during “The Introductory Robotics Workshop” to teach the basics of robotics. The board hardware other than the USB port itself and the microcontroller.

### ● GESTURE CONTROLLED ROBOT

The project was aimed at creating a robot which could be controlled using hand gestures. I completed the project using the ATmega16 using two wheel differential drive. The robot direction and speed can be varied based on the hand gesture. This project was later made semi-automatic by including collision avoidance. The motor drive of this robot was done using H-bridge based L293D microcontroller.

### ● SPEAKER RECOGNITION ALGORITHM

The aim of this project was to figure out a method to distinguish and uniquely identify the person who is speaking. This was done by analyzing the extracted features of the speech in the Mel frequency range. The extracted key points were used to create a speech codebook using vector quantization. The codebook created was later used to detect the speaker, based on the minimal error between the centroid of the quantized speech and the extracted codebook features. The project upon completion provided 100% success rate for the test speech data obtained from the internet. But due to high noise levels in the input taken through the low quality microphones, the project used to give erroneous results during the test done using microphones.

### ● SD CARD I/O LIBRARY FOR STELLARIS LAUNCHPAD

The aim of this project was to create an I/O library interfacing an SD/SDHC/MMC card to the Stellaris Launchpad based on LM4F120H5QR. This was the first project that I have done using an ARM architecture based microcontroller. I used the specification provided by SD Association to create the library. This project helped me understand the need for properly analyzing the timing diagrams. During the project I used to face a lot of problem as the timing

do not agree. But fortunately, I succeeded in it as I could make required changes in my library to agree to the timing.

#### ●SHOP AUTOMATION ROBOT

This project is aimed at demonstrating a novel idea to automate a complete shop. A lot of subsystems were involved in the project and therefore integration indeed was a challenging task. The robot is keeping a database of all the items and the stack in which they have been kept. The robot receives the names of the items the customer wants to purchase through SMS. This data is taken into the ATmega2560 microcontroller through a GSM module. Once the decision about which stack it has to go to has been made, the robot moves to the particular stack using image processing. Once the stack has been reached, the robot scans for the correct item using the barcode scanner attached to its arm. Once the item is found, the robot uses pneumatic pistons to extend to the stack and vacuum pump to grab the item from the stack. The project was completed during the second year winter vacations and has been presented in front of the faculties.

#### ●CLOSED LOOP TRAFFIC SPEED CONTROL AND MONITORING SYSTEM

This is an ongoing project which is funded by the RECCA Innovative project funds. I have been granted INR 70,000 to complete the project. The sensor development for linear precision distance measurement using hall sensor array is underway. The project once completed will allow closed loop control of traffic speed. The details of violators will be transmitted wirelessly through an encrypted wireless channel to the police control room. This will come out as a replacement for the open loop speed guard system presently used in heavy motor vehicles.

#### ●ATmega QUICK PROGRAM ANDROID APP DEVELOPMENT

This is an open source android app development project funded by The Aakash Development Team, IIT Bombay. This project is intended to make microcontroller programming easy for anyone by creating an android app will automatically create the desired code for them. It means that the programmer no longer have to be concerned about the register configurations. Once the details of the features required for his project has been fed into the app, it automatically generates the sample code which the programmer can use. This will greatly reduce the time required to implement designs to practical systems.

#### ●VITERBI ALGORITHM IMPLEMENTATION ON XILINX VIRTEX-4 FPGA

This is the latest project that I have taken up. Presently as the primary stage, I am implementing simple logic circuits in the FPGA. I plan to take a gradual approach to complete the project. I hope that this project can be completed before the end of 6<sup>th</sup> Semester. I am presently implementing the hardware using VHDL but may migrate to Verilog