Project Report Status

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e-Yantra
Summer Internship Program

Personal Details

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Summary of your contribution to the project:

The project assigned to us was Sensor Module Interfacing. My contributions to the project were the following:

- PIR Sensor : I have interfaced this sensor with the Firebird V and indicated the presence of humans on the LCD and LED Bargraph. I have also prepared the documentation, header files and video tutorial.
- Accelerometer : Along with my team, we wrote a code to interface the accelerometer with the Firebird with and without a Zigbee module. We tried to control the movement of Firebird V according to the tilt of the Firebird V sensor. We also controlled the speed of the motor movement depending on the degree of tilt. I have prepared its documentation and video tutorial.
- IMU (Inertial Measurement Unit) : This consist of an Accelerometer plus Magnetometer module and a Gyroscope module. The interfacing is done using I2C Protocol. We couldn't interface the unit as a whole, so we tried interfacing the modules individually. The Accelerometer module couldn't be interfaced. More specifically, the accelerometer could not be addressed when using the I2C protocol to communicate between the sensor and the FireBird Robot. We also interfaced the Gyroscope. Though, the interfacing was done successfully, we could not achieve the readings in Real time, hence we tried to solve this problem by using Serial Terminal to read these values and plot a graph using Scilab.

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Objective of the work:
The objective was to interface various sensor modules with the Firebird V Robot such as PIR Sensor, Accelerometer, RFID, Ultrasonic Sensor, IMU Sensor, TSOP and detect objects based on their shape, size and color. An interview process was taken for deciding the assignmernt of project. According to the result of the interview, Sensor module was decided as my project for the internship

Scope of the work:
The project required us to do the following tasks :

1. Ultrasonic Sensor Interfacing with Firebird V
2. Interfacing RFID module with Firebird V
3. Interfacing Accelerometer and IMU with Firebird V
4. Interfacing PIR Sensor with FireBird V

Completion:
The following were the tasks completed by me :

1. Interfacing Accelerometer and IMU with Firebird V.
2. Interfacing PIR Sensor with FireBird V.
3. Preparing the necessary documentation for the above tasks.

Results and Discussion:
The end result of our project was that, we prepared the code as well as the documentation necessary for interfacing various sensor modules with the Firebird V Robot.
The interfacing of the PIR Sensor was done individually by me, and the Ultrasonic and the RFID module was done by my teammates. And interfacing of the Accelerometer and the IMU was done as a team.

Task	Completion Status
Ultrasonic Sensor Interfacing with Firebird V	Completed
Interfacing RFID module with Firebird V	Completed
Interfacing Accelerometer and IMU with Firebird V	Completed
Interfacing PIR Sensor with FireBird V	Completed

Obstacles and how they were resolved:

- PIR Sensor: The PIR Sensor initially given for the task was defective and not working. If a PIR Sensor is defective it can be found out by checking the digital output on the CRO. The CRO output gives HIGH to LOW pulses in Normal Mode of operation which can be seen on the CRO. If no pulse is obtainerd, then we can know that the PIR Sensor is defective.

- Accelerometer : The analog values obtained during the practical operation of accelerometer was different from that mentioned in the Datasheet. There was a large difference in the analog and practical values. Hence, we had to calibrate the Accelerometer accordingly. We had to consider the practical values while deciding the thresholds during the tilting of the accelerometer to define the various tilts such as Forward, Backward, Still, Right and Left.

- IMU : An IMU consists of an Accelerometer+Magnetometer and a Gyroscope. The protocol used for interfacing with the Firebird Robot is I2C. But while interfacing the module as a whole, interfacing could not be done. So we decided to separate the two modules separately and test them individually. In case of the accelerometer interfacing using I2C Protocol, the addressing of the Accelerometer could not be done successfully. While in a gyroscope, the interfacing was done successfully, but the values obtained in the LCD, displaying the values in the X, Y and Z axes were not in real time. We resolved this by trying to read this value on the Serial terminal and displaying these values in a graph in Scilab.

Features & Bugs:

Features:

- Accelerometer: In Accelerometer, we have even developed an application involving the Zigbee module, where a Robot can be remotely controlled by using Zigbee.

- PIR Sensor: The sensitivity and the time delay of the PIR Sensor can be adjusted using the trimpots availiable on the sensor module.

- IMU : The IMU sensor consists of an accelerometer plus a magnetometer, and a gyroscope. The accelerometer and magnetometer are one module, and the gyroscope is another. The protocol used for data transfer from the IMU to the Firebird V uses I2C protocol.

Bugs:

- Accelerometer: In accelerometer, the output values in the x, y and z coordinates are in analog forms. These values can be checked using a multimeter. Also, ADC conversion can be applied to these sensors. The values obtained for various orientation are different in different accelerometers. Hence these should be calibrated properly to determine the threshold values.

- PIR Sensor: Incase of a PIR Sensor, the guard time between two consecutive HIGH/LOW pulses can be controlled using trimpot given in the sensor. This time can alos be controlled by changing the resistor and capacitor values in the module. Also there is a settling time required for the PIR Sensor to start before it can detect humans.

- IMU : The accelerometer module in the IMU could not be addressed while I2C Communication. And in case of Gyroscope, the values of the Gyroscope were obtained but those values were not real time. A method to obtain real time values must be present.

Future Work:
To start with, I2C protocol must be seen in depth such that the rate of the gyroscope module is fast enough for it to appear as real time.
Also, once this gets done, wireless modules must be used in addition to these, so that the robot can be controlled wirelessly.

References:

Softwares used:

- Atmel Studio 6.0

- AVR Bootloader

- Scilab 5.5.0

- Serial Terminal and Teraterm

Videos Referred:

- e-Yantra DVD Video Tutorials

Documents Referred:

- e-Yantra Firebird V Robot Hardware and Software Manual

- Nex Robotics Sensor Manual
- Sensor Datasheets