Software Requirements Specification

CS684 Project

Hand Gesture Controlled Accelerometer Based Wireless Vehicle
Group 18

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1 Introduction

A very intuitive way of moving things about is to using hand gestures. People are already used to gesturing to other people; giving them directions or hinting things to them without even talking. The use of intuitiveness in the use of a device can prove to be a massive factor in favor of any product in market, as was exemplified by the market dominance of IPhone over other smart phones. It will be of great convenience and a case for very easy learning, if we could allow a person to control a car, its speed and direction, with the movement of his or her hand.

In our project, we will towards this goal and give a user control of a firebird bot by allowing him to steer it by hand gestures. The hand gestures of a user will be captured by a hand glove worn by him. The glove will be mounted with accelerometers and it will be able to transmit data wirelessly to the bot. The microcontroller on the bot will sense the gestures and the motion will be executed as per a predefined set of norms.

1.1 Definitions, Acronyms and Abbreviations

- Accelerometer MMA7455 / MMA7260 – are multi-axis devices that detect magnitude and direction of their acceleration as a vector quantity
- PCB - Printed circuit board
- CC2500 is a radio chip

1.2 References

1. Firebird V Hardware and Software manuals
2. ATMEGA8 Datasheet
3. MMA7260 Datasheet
4. MMA 7455 Datasheet
5. ZigBee Reference Manual

2 Overall Description

- **Product Perspective**: Hand Gesture Controlled Accelerometer based Car
- **Product Functions**: The project is aimed at making a hand gesture controlled car using the core technology of accelerometers. We propose to develop the hardware of the hand glove on which numerous other projects could be built.
- **User Characteristics**: Anyone and everyone
- **Constraints**: Line of sight will be a constraint depending upon the wireless transmission quality
- **Assumptions and Dependencies**: An obstacle free path is assumed to be present for the robot to traverse. In case of obstacles, on board microcontroller of firebird V will take charge from the user
- **Requirements Subsets**: ZigBee modules, Firebird V, Accelerometer MMA7455 / MMA7260

3 Details

3.1 Functionality

- The Accelerometer data will be sampled accordingly, in case we're using the analog accelerometers
- The Accelerometer data will be transmitted through SPI interface in case we are using digital accelerometer
- The data received by the microcontroller ATMEGA8 will be filtered and transmitted via ZigBee modules to the Firebird V module
- The Firebird V will receive the data using ZigBee module and interpret the signals to convert them to the motion specific commands
- The commands will then be executed by giving appropriate signals to the DC Motors
- In case of any obstacle, the Firebird will stop and a visual notification of some kind will be given to the user
- The Glove PCB is versatile with functionality to interface digital as well as analog accelerometer
- The PCB also has a fall back option of using CC2500 as the data transmitter instead of Zigbee

3.2 Supportability

- We will insure that our code is readable and reusable, and also work towards its portability.
- We will employ Splint Static analyser to improve our coding standard.
- We will follow the naming convention mentioned at http://www.psgd.org/paul/docs/cstyle/cstyle.htm
- We will employ PrettyPrinter to beautify our code.
- We will use Doxygen to provide for our documentation.
- We will follow the firebird specific guidelines, file structure and the project submission format as specified in the ERTS lab coding guidelines.

3.3 Design Constraints

- Speed of the hand gestures will be limited depending upon the sampling rate of the microcontroller and the transmission rate of the Zigbee Module
- Speed of the gesture will also be limited by the maximum acceleration value that can be sensed by the accelerometer which in this case is 1.5g-6g
- Speed of the car will be limited for it to react in time to the hand gestures
- The range of the ZigBee module will determine the range of the user to control the car within certain radius

3.4 On-line User Documentation and Help System Requirements

We will provide for our project documentation using Doxygen.

3.5 Interfaces

3.5.1 User Interfaces

- Hand Glove
  a. Sample the accelerometer data
  b. Send the data to microcontroller through SPI
  c. Interpret the data and thus the gesture
  d. Transmit the filtered data using the ZigBee communication module

3.5.2 Hardware Interfaces

- Accelerometer
  a. Capable of sensing the acceleration in the range of 1.5g-6g
  b. Can be interfaced with ATMEGA8 and transmit the values to the microcontroller

- ZigBee module
  a. Connected to ATmega 2560 on firebird through RxD0/PE0 (pin 2) and TxD0/PE1 (pin 3)
  b. Connected to ATmega 8 on GLOVE through RxD and TxD

- AVRISP mkII In-System Programmer for programming the microcontroller

3.5.3 Software Interfaces

- AVR Studio 4
- WinAVR

3.5.4 Communications Interfaces

The system will use the ZigBee wireless module for communication between the hand glove and Firebird V.