Towards a New Modality-Independent Interface For a Robotic Wheelchair

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Abstract- *This study presents a novel PIR motion detection sensor and MEMS Accelometer based independent Robotic wheel chair. MEMS sensor can be implemented in a system that detects velocity, position, shock, vibration, or the acceleration of gravity to determine orientation. Motion Detector is used for detecting motion. Bluetooth is a communication device which is used as wireless communication between Mobile phone and microcontroller. For this purpose a software has been developed, BLUETERM which can be installed in any Mobile Devices based on android platform. Using the Bluetooth, the movement of the robotic wheelchair can be controlled in four direction, i.e. front, left, right and stop. The MEMS accelerometer controls the left and right movement of the wheel chair whereas the Motion sensor has been implemented to control the forward and backward direction.*

Keywords- Advanced wheelchair, robotic, Bluetooth and mems sensors, Android control

I. INTRODUCTION

Life has become more advanced than we imagined. Everything we see around us is more advance and more compact than last decade. Even the handicapped people can move around the places more easily. And this is only because of advanced processors and programs that we use in the robotics. The Advanced Robotic wheel chair that we are making are programmed to as many as more sensors to make the chair move easily. It is even connected to Mobile phone to make it more convenient for the disabled person. if he is far away from chair.

In the existing system of wheel chair used just , it is used the move the wheel chair using the keypad alone . In proposed system, we can design a new automated wheelchair which can even stop from colliding into obstacles, if the disabled person went out of control

Existing System	Proposed System
The existing system just controls the movement of the wheel chair automatically by using the keypad alone **Drawbacks of existing system:** ➢ Paralysis people are unable use these technologies ➢ Its take more time for processing ➢ Complex to use.	Here different types of sensors are used to control the wheel chair. This robot is mainly developed for paralysis people Motion detection, Bluetooth and MEMS,are used for controlling the robot **Advantages of proposed system:** ➢ Flexible to use ➢ Less processing time ➢ It is affordable and simple ➢ High-level spinal cord injuries to control wheel chair.

II. MATERIALS AND METHODS

2.1. Sample preparation

The project is mainly based on embedded systems. An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system, often with real time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today.

Properties typical of embedded computers when compared with general-purpose ones are e.g. low power consumption, small size, rugged operating ranges and low per-unit cost. This comes at the price of limited processing resources, which make them significantly more difficult to

program and to interface with. However, by building intelligence mechanisms on the top of the hardware, taking advantage of possible existing sensors and the existence of a network of embedded units, one can both optimally manage available resources at the unit and network levels as well as provide augmented functionalities, well beyond those available.

Modern embedded systems are often based on microcontrollers i.e. CPUs with integrated memory or peripheral interfaces, but ordinary microprocessors (using external chips for memory and peripheral interface circuits) are also still common, especially in more complex systems. In either case, the processor used may be types ranging from general purpose to those specialized in certain class of computations or even custom designed for the application at hand.

The programming language used is embedded C. Embedded C is a set of language extensions for the C Programming language by the C standards committee to address commonality issues that exist between C extensions for different embedded systems . Historically, embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations.

Firstly the coding were written in MP lab which is used for PIC Microcontroller. Once the programming part was built without any errors the construction of hardware was done. The Main unit was built which is connected to various sensors such as MEMS accelerometer and Motion sensor. Beside this, the PIC microcontroller is also connected to a LCD and a Bluetooth Sensor.

The hardware's in prototype are connected according to their pin diagrams with the help of soldering process. In this prototype a battery of 12V has been used to supply power to PIC Microcontroller and Relay switch. The wiring for PIC Microcontroller and relay switch has been done separately but they are connected to the same switch. Beside this a step down transformer can also be used if we intent to use the 230 V DC supply. The step down transformer step down the voltage to 12V and using bridge rectifier, the AC supply is converted to DC supply. The power to sensors are given using the pin provided on the development board. The sensors requires a power supply of 5V.

n the control unit, a software BLUETERM has been installed in the mobile phone which does the feeding of information to PIC Microcontroller using Bluetooth sensor.

2.2 Functioning

The functioning of the wheel chair has been divided into two modes, they are:

a) Series Mode: In this mode the functioning of Robotic Wheelchair takes place via Bluetooth only. The Bluetooth controls the robot in forward, left and right direction. Beside a command has also been allocated to stop the robot.

b) Serial Mode: In this mode the wheelchair can be controlled using sensors. MEMS accelerometer controls the left and right motion of the robot while the Motion sensors controls the forward and backward motion of the robotic wheelchair.

III. RESULTS AND DISCUSSION

Given Input and Expected Output Of Each Component Was Verified

Power Supply Unit:

Given Input:
230V, 5A, 50 Hz AC Supply
Expected Output:
12V, 500mA- 1A, DC Voltage

Microcontroller Unit:

Given Input:

The readings of MEMS accelerometer and Motion sensor is given as input to the PIC Microcontroller. Besides this, Input is also given through a Moblie Phone Via Bluetooth.

Expected Output:

The input given to the microcontroller are being processed and the outputted value is being used to control the movement of the Robotic Wheelchair.

Communication Unit.

Bluetooth

Given Input:

Bluetooth is used for giving input to the PIC Microcontroller. A Software has been developed for this purpose called BLUETRAM. The various input available in BLUETRAM are:
"a"-forward
"b'-stop
"c"-left
"d"-right

Expected Output:

Depending on the input given by the user, the PIC microcontroller controls the Robotic Wheel Chair.

MEMS Accelerometer

Given Input:

The MEMS accelerometer acts as a sensor and is used to control the left and right movement of the Robotic Wheelchair. The rotation of the MEMS accelerometer at certain degree gives the input to the PIC Microcontroller.

Expected Output:

The input from the MEMS accelerometer is processed by the PIC Microcontroller and the wheelchair is moved in right or left direction accordingly.

Motion Sensor:

Given Input:

The motion sensors control the movement of the wheel chair in forward and backward direction depending on the amount of pressure it receives. These pressure serves as the input for the PIC microcontroller.

Expected Output:

Depending on the input feed by the Motion Sensors, the PIC Microcontroller controls the movement of wheelchair in forward or backward direction.

LCD:

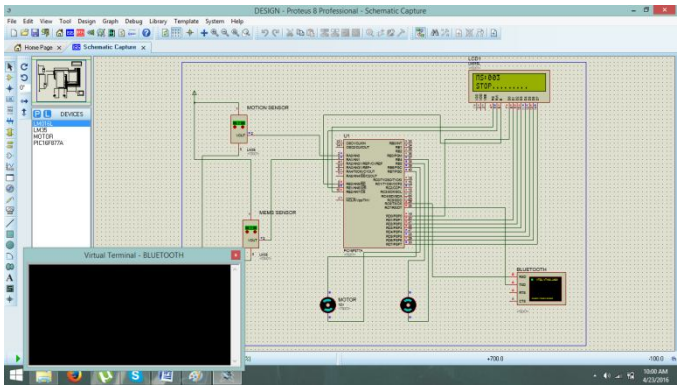
Given Input:

The text from the microcontroller indicating the device status is given as input to the LCD.

Expected Output:

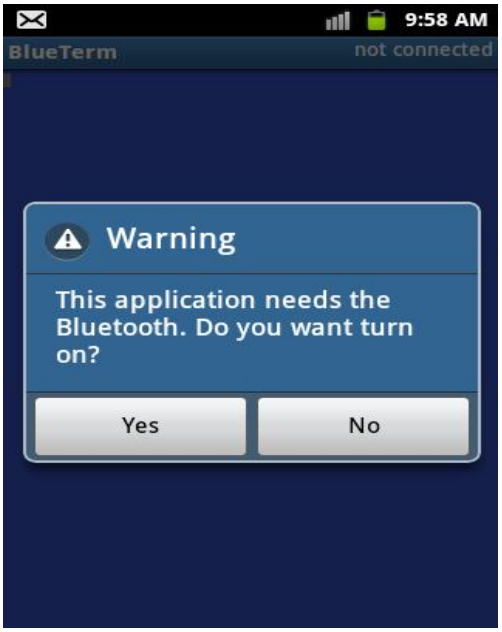
The received text is displayed on the LCD.

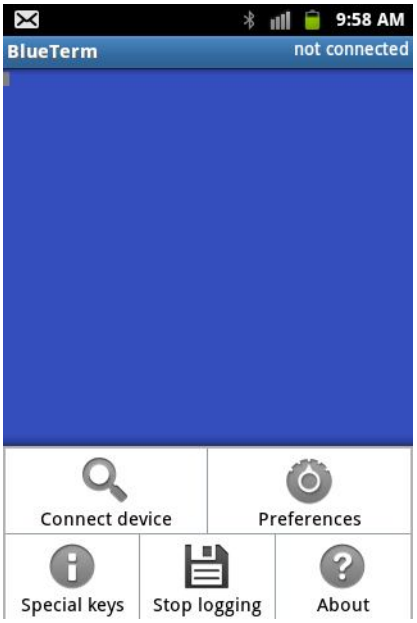
The various text displayed by the LCD:



Sample Screen Shots

Screenshots For Mobile Control





IV. CONCLUSION

The program was successfully burned on the micro-controller using USB programmer. As said earlier the functioning of robotic wheelchair has been divided into two modes i.e. serial an series mode. When we use the robot in serial mode, an individual can control the movement of robot using sensors. When he rotates the MEMS accelerometer upto a certain angle. The movement of wheelchair take place either in left or right direction depending on the degree of of MEMS accelerometer. And when he applies certain amount of pressure on the motion sensor, the movement of wheelchair changes in forward or backward direction..When an individual switch to SERIES Mode, he can control the movement of robot using an application, BLUETERM which is installed in his mobile phone. The mode in which the system is currently working on, is displayed on the LCD. The system is efficient comparing to the existing system.

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