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Multi Technology Based Controller for Wheelchair Locomotion

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Abstract: ***An automated system is developed to control the rotation of the wheel chair based on touch screen and head movement by the physically challenged person. Independent movement can be done by them with the help of an accelerometer device which is fitted on person's head and a touch screen is placed with the wheelchair which can be operated by the person [1]. Based on the touch and head movements, the accelerometer and the relay will drive the motor fitted with the wheel chair. The wheel chair are often driven in any of the four directions. The machine-controlled wheelchair is based on simple electronic control system and the mechanical arrangement that is controlled by a Programmable Interface Controller. This automatic wheel chair additionally helps people who have various other disabilities by simply using the accelerometer and touch screen to manage the wheel chair movement. Other than this we have implemented the subsequent applications in our wheelchair: GSM communication, Heart Rate Monitor, UV Sensor.***

Index Terms: **Wheel chair, Programmable Interface Controller (PIC), Accelerometer Device, Touch Screen, Sensor, and GSM.**

I. INTRODUCTION

There are different reasons for which people need an artificial means of locomotion such as a wheelchair. The number of people, who need to move around with the help of some artificial means, because of an illness or accident, is also continuously increasing. Moreover implementing a controlling system in it enables them to move without the help of another person is very helpful. This means have to be increasingly sophisticated, taking advantage of technology evolution, in order to increase the quality of life for these people and facilitate their integration into their working world. In this way a contribution may be made for facilitating movement and to make this increasingly simple and vigorous, so that it becomes similar to that of people who do not sufferany deficiencies. However, there are still important advances that can be done in this field. Here we used Touch Screen and Accelerometer Technology .We engage the above two technologies in a wheel chair which can help physically challenged people to control the wheelchair locomotion in an easy manner.

II. EXISTING METHODOLOGY

(a) Alex Dev, Horizon C Chacko (2011) used EOG to control the wheelchair locomotion. A pair of electrodes is placed horizontally to left and right Eye. If the eye is moved from the center position towards one electrode, a potential change occurs between the electrodes. Due to the changes in the potential the wheelchair can be controlled.

(b) Sangmeshwar S. Kendre (2010) used Voice control system to control the locomotion of the wheelchair. They store the default commands in the PIC IC (micro controller) by the usage this commands the wheelchair can move. Change in the words restricts the wheelchair movement.

(c) Chun Sing Louis Tsui, Pei Jia (2008) used EMG control for wheelchair locomotion. They used eyebrow muscle activity to obtain required signal. By using the signal the wheelchair movement has been controlled.

(d) S.Tameemsultana and N. Kali Saranya (2011) used head and finger movement for wheelchair locomotion. In finger movement they use flex sensor, placed on the finger. It is an analog resistor usually in the form of strip long vary resistance. Due to the bending of finger the resistance varies which controls the locomotion of the wheelchair. Bending the sensor at one point more than 90 may permanently damage the sensor which is a main drawback.

The system already existing for the physically challenged person controlled by other different technologies has some defects:

- In Eye ball sensor they use infra red sensor to control the wheelchair where continuous fall of IR radiation in the eye causes irritation to the patient (Alex Dev, Horizon C Chacko and Roshan Varghese, April, 2012, ISBN.)
- In voice control the person must use the exact commands only to control the movement. Change in the words restricts the wheelchair movement (Manuel Mazo, 1995) .

All the electronic system and also the philosophy for functioning has been sufficiently refined to attain the subsequent performances:

- To ensure easy, comfortable driving.
- To reply to the speed requirements for a system of this kind (maximum speeds of up to three m/s).
- To be simply adaptable to any kind of commercial wheelchair chassis.
- To ease learning to handle the chair and getting most potency.
- To ensure much constant speeds, to an oversized extent independently of the characteristics of the surface over that the wheel chair is moving (greater or lesser

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roughness of the ground and also slope of same) and the weight of the person using it.

- To form the system simply configurable, on the premise of the needs of the user: activating or de-activating of the different sensors, and choice of various speed margins, human-machine interface which allows up-to-date information on the state of the wheelchair, etc.
- To form it possible for the similar wheelchair to be utilized by various people
- To form the electronic system opens to future additions [2].

III. OVERVIEW OF ACCELEROMETER

The accelerometer sees the acceleration related to the development of weight experienced by any mass at rest within the frame of reference of the accelerometer device. In order to facilitate people who are affected by Quadriplegia disease (cannot move their body parts except their head) for freelance movement, on the head of the person an accelerometer device is fixed. Accelerometers can be used to measure vehicle acceleration. Micro machined accelerometers are progressively gift in portable electronic devices and computer game controllers, to observe the position of the device or offer for game input. Accelerometer is a capable of measuring how fast the speed of object is dynamic. It generates output as analog voltage that is employed as an input to the system [2]. The accelerometer employed in this system is MMA2260D (±1.5g axis). It is a single axis accelerometer, which senses the tilt in 2 directions only, the supply voltage is 5V [3]. The device is sensitive to tilt within the 0g position, using this Accelerometer speed of the wheelchair may be controlled.

Using head movement the accelerometer drives the motor connected to the wheel chair in any of the four directions. The wheelchair is based on simple electronic control system and also the mechanical arrangement that is controlled by a Programmable Interface Controller [1]. The vehicle may drive at a normal speed. Accelerometer could be used to measure the correct acceleration which is experienced by people and objects.

A. PIC Microcontroller

The Micro Controller that has been utilized in this project is PIC IC(PIC16F877A). PIC microcontroller is that the initial RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data permitting simultaneous access of program and data memory.

Table 1: Specifications

PROGRAM FLASH	DATA MEMORY	DATA EEPROM
8K	368 Bytes	256 Bytes

The main advantage of CMOS and RISC combination is low power consumption leading to a very miniature chip size with a small pin count. The major advantage of CMOS is that it has immunity to noise than alternative fabrication techniques. Technology that is utilized in PIC 16F877 is flash technology, so that data is retained even once the facility is shifted [4]. Easy Programming and Erasing are other features of PIC 16F877.

Microcontroller contains several peripherals like 10 bit ADC module, 3 timers, USART, SPI, Capture, compare and PWM module. In this project PIC IC controls wheel chair locomotion with the help of touch screen and accelerometer. PIC IC also controls the UV Sensor, GSM communication and heart rate monitoring system.

B. Overview of Touch Screen

A touch screen is an electronic visual display that the user can control through simple or multi-touch gestures by touching the screen with additional fingers. The touch screen permits the user to interact directly with what is displayed, instead of employing a mouse or any other intermediate device.

There are variety of touch screen technology used to sensing the touch

- Resistive
- Surface acoustic Wave
- Capacitive

However in this project we used the resistive touch. It consist several layers, the most important layers, which are two thin electrically resistive layer separated by a thin space. A voltage is applied to one layer and sensed by the other layer.

IV. OVER ALL VIEW

In this project, we have made use of touch screen and accelerometer technology to control the locomotion of wheelchair. Both these modules are controlled by a PIC IC which also controls the Heart rate monitor, UV sensor, GSM which are integrated together to enable to user for the navigation of wheelchair.

Using the touch screen and accelerometer we able to control the movement of the wheelchair. The PIC is interfaced with motor unit which is fitted with the wheel chair after getting control signal from the PIC IC motor moves the wheel chair correspondingly.

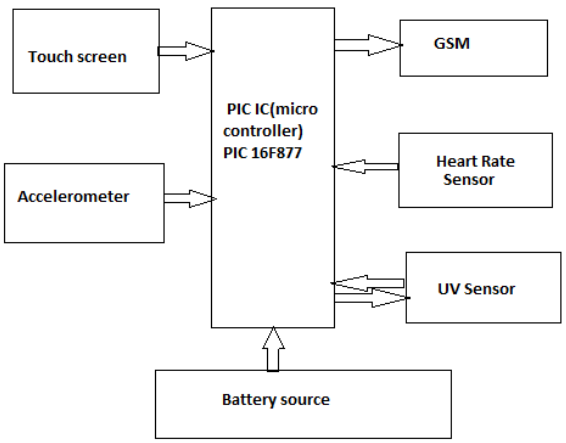

Fig 1 over all block diagram

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The figure 1 shown the data transfer between the Micro Controller and the External device. We have selected either touch screen (or) accelerometer by using the control switch. The UV Sensor are use to detect the obstacle on the pathway, It is used to monitor distance from the obstacle and also display the range. The GSM has a inter linked with the heart rate sensor, if the heart rate reached the abnormal values the message (sms) will be sent to the caretaker (or) near by hospital.

V. RESULT

- When a person wears a band fixed with accelerometer and tilts his head the robot moves in corresponding direction based on the head movement.
- When the person touches his finger on the touch screen, the robot moves in corresponding direction based on the touching point of the finger.

VI. CONCLUSION

As the accelerometer and touch Screen based automated system has been presented which would be very helpful for physically challenged persons and for the persons who cannot move their body except head and hand except finger. Touch Screen is calibrated by using X and Y axise of the screen, based on that movement is taken place. Also the accelerometer sensor is calibrated such that it produces particular analog voltage for a corresponding tilt. PIC C compiler is used to program for analog to digital conversion in PIC. A hardware set up has also been done to validate this technology.

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