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Wheelchair for Physically and Mentally Disabled Persons

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Abstract: **This paper includes the wheelchair that can control using voice, eye and joystick. And it monitors the room conditions like temperature, humidity, fire etc... And according to patient/ user health conditions it will inform the doctor/ analyzer via text message. Also it check the body conditions of the user and according to unnecessary changes in his heart and brain conditions and inform it any changes happen. According to user wish the wheelchair can be made in to a semi sleeper bed. Also for physically handicapped ones the wheelchair will help to have food/medicines and other needy things which can only done by his hand can be done using robotic hand that is being integrated with it. Also it monitors the human presence and informs the user.**

Keywords: **Automatic wheelchair, Voice Recognition, Controller, Iris Movement Sensors, Servo Motor, and Heart Rate Monitor.**

I. INTRODUCTION

This work includes the wheelchair that can control using voice, eye and joystick. And it monitors the room conditions like temperature, humidity, fire etc... And according to patient/ user health conditions it will inform the doctor/ analyser via text message. Also it check the body conditions of the user and according to unnecessary changes in his heart and brain conditions and inform it any changes happen. According to user wish the wheelchair can be made in to a semi sleeper bed. Also for physically handicapped ones the wheelchair will help to have food/medicines and other needy things which can only done by his hand can be done using robotic hand that is being integrated with it. Also it monitors the human presence and informs the user.

The present world the medical field is very much focuses about to care the patients, and the patient/ handicapped one are like to leave individually without the help of any others so, this proposed product will be very effective for them.

II. LITERATURE REVIEW

A wheelchair is a wheeled mobility device in which the user sits. The device is propelled either manually (by turning the wheels by the hand) or via various automated systems. Wheelchairs are used by people for whom walking is difficult or impossible due to illness (physiological or physical), injury, or disability. Wheelchairs today are now considered not only a means of transportation but also as a way to allow users to express their individuality. Users can find custom-made high quality ultra-light high-performance wheelchairs as well as accessories that enable them to individualize their look and style.

Wheelchairs have been around for hundreds of years, but early wheelchairs were intended only to help a disabled individual move from point A to point B.As society progressed and disabled individuals became more integrated, the role of the wheelchair began to change as well. Wheelchairs today are now considered not only a means of transportation but also as a way to allow users to express their individuality. Users can find custom-made high quality ultra-light high-performance wheelchairs as well as accessories that enable them to individualize their look and style

There were many attempts to connect furniture to wheels dating back to the time of Christ. But perhaps the first wheelchair was invented for King Phillip II[7] of Spain. A drawing of the King dated 1595[7] shows him in a chair with wheels, armrests and footrests. However, he needed assistance to propel it and the chair resembled more a modern baby's highchair than a wheelchair of today. In 1665 one of the first self-propelled vehicles was invented by Stephan Farfler. But it looked more like a present day hand-bike than a wheelchair as it was propelled by hand cranks attached to the front wheel. The modern wheelchair began to take shape in the late 19th century to early 20th century with the advent of push rims for self-propulsion and slings for seat and backrests[7]. The 20th century saw a rapid development in wheelchairs, from the first motorized wheelchair, to the first folding wheelchair, to lightweight and sports wheelchairs. The most recent two decades have seen the progress in the modern wheelchair accelerate. They are lighter and perform better than ever before. There are many different types of wheelchairs that are used for various reasons. It is important to understand the limitations and safe operation of whatever wheelchair we choose.

A. Manual Wheelchairs[8]

Manual wheelchairs are the type that requires people to move them; there are three types of manual wheelchairs namely self-propelled, attendant propelled, and wheelbase. Many manual chairs can be folded wheelchairs for storage or movement into a vehicle.

A single-arm drive enables the user to turn either left or right while the two-armed drive enables user to move forward or backward on a straight line. Another type of wheelchair commonly used is a lever-drive wheelchair. This type of chair enables the user to move forward by pumping the lever back and forth.

B. Electric Wheelchairs[9]

The electric powered wheelchair was said to be invented by George Klein who worked for the National Research Council of Canada, to assist injured veterans during World War II.A power chair can be used by someone who hasn't got the dexterity or mobility, perhaps, to drive a mobility scooter due to arm, hand, shoulder or more general disabling conditions, and do not have the leg strength to propel a manual chair with their feet. EPWs can offer various powered functions such as tilt, recline, leg elevation, seat elevation, and others useful or necessary to health and function.

A power chair user might also have special seating or arm and leg rest requirements that are better served by a power chair than a mobility scooter. The technology involved in electric wheelchairs is similar to that of mobility scooters and some power chair manufacturers are offering models that look more like a mobility scooter than a traditional wheelchair. Today you will find three general styles of electric powered chairs (EPWs)[13]: rear, centre, front wheel driven or four wheel driven. Each style wheelchair has particular handling characteristics.EPWs are also divided by seat type; some models resemble manual chairs, with a sling-style seat and frame, whereas others have 'captain's chair' seating like that of an automobile. EPWs[8] run the gamut from small and portable models, which can be folded or disassembled, to very large and heavy full-featured chairs (these are often called 'rehab' chairs).

The user typically controls speed and direction by operating a joystick on a controller. Many other input devices can be used if the user lacks coordination or the use of the hands or fingers, such as chin controls and puff/sip scannersPower chairs are usually controlled by a joystick on the armrest which can be fitted on either armrest to suit left or right handed use. The arm rest can usually be swung out of the way so that the user can get closer to a desk or table for example. If a joystick control isn't appropriate for the user's needs, there are other methods[12] of operating the power chair, including a head controller, a sip and puff tube, fingertip control or foot control for those with C2-3 spinal cord lesions or head injuries (the user blows into a tube located near the mouth, which controls the movement of the chair).A power chair or electric wheelchair can bring independence and freedom to those currently reliant on others. Once you have decided on a power chair rather than a mobility scooter or wheelchair, there are still plenty of other choices to be made. Including the price, the style and size of the power chair, how portable the power chair is, and how far it goes between charges.

C. Pediatric Wheelchairs[10]

Most pediatric wheelchairs fall under the following categories:Standard Wheelchairs – These are the so-called traditional styles, Small Child Wheelchairs[14] – This variety is designed for kids under the age of six, Sports/Lightweight

Wheelchairs – These are popular for everyday use because of their sporty appearance, lightweight frames, and independent movement.

Junior/Child/Growing Pediatric Wheelchairs – They are intended for children who are six years old and over, Specialty Wheelchair – These models require various alterations to a basic chair such as a tilting or reclining option.

D. Types of Wheelchairs For Kids [11]

Like adult wheelchairs, the pediatric models are available in different shapes, sizes, colors, and designs. You can even have one especially designed and custom-made based on the child's needs. You can also choose between a manually propelled and a motorized wheelchair.

E. Manual Pediatric Wheelchair[11]

Manual pediatric wheelchairs are the most popular type used by kids of all ages. Motors do not propel this type of wheelchair [15], so either the occupant or caregiver must push the chair around. In addition, children with severe disabilities are not advised to use such kind of mobility aid since they don't have the capacity to move without assistance.

F. Draw Backs of Presently Available Wheelchairs:

Used for a particular disability.
A system does not monitor the surrounding conditions and health condition of patient.
No systems for bed lying patients.
No systems for mentally challengers.
Physical barriers place additional requirements on the strength and durability of wheelchairs.

III. BLOCK DIAGRAM

We divided the project into main there sections. The first one consists of vehicle (wheelchair) with all sensory parts. The controlling unit for this section is again separated in o two. One is for motor driver control with vice reorganization part, which will be incorporated in PIC18F877A. And other all facilities like sensors and wireless control will be done using Arduino controller. The vehicle control using voice, eye movement, joystick and remote. According to user's wish he/she can change the controlling mode. So according to user disability the vehicle will ready to use. Also the sensor part will sense the real time temperature, humidity and obstacle. It will more helpful for the patient lo survey form any hazard conditions. These sensory results will be monitored at the LCD fixed on remote controller. The heartbeat sensor unit will also sense the heartbeat and if any drastic change happens it will inform the doctor/concern person via SMS, it is done by GSM module incorporated with the Arduino. These are the features that we incorporate in the vehicle section. The motors used for controlling the vehicle movement is servo motor, and semi sleeper part is also done with servo, and the robotic hand will be controlled using both stepper and servo motor, the control signal will be derived from PIC microcontroller.

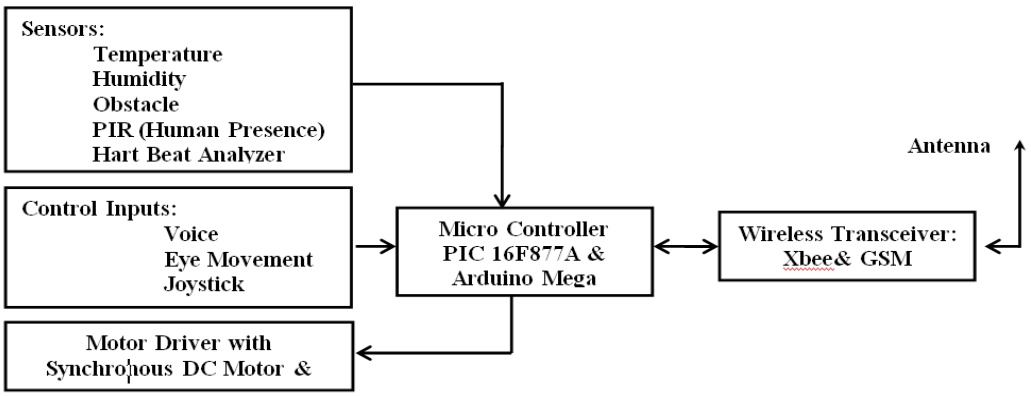

Fig 1. Wheelchair section

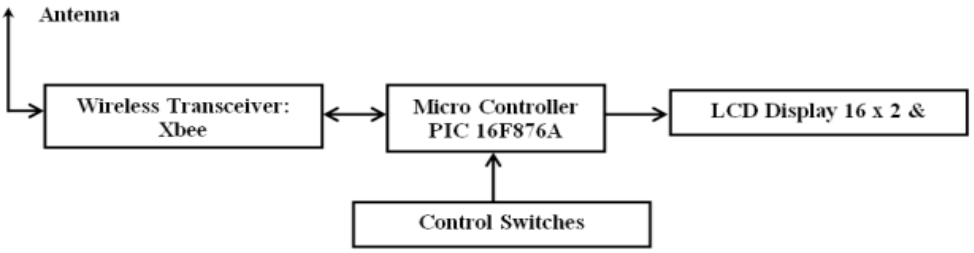

Fig 2. Remote Section

Fig 3. Mobile Phone Section

The second section (Remote) consisting of a LCD (16x2) and a keypad. The LCD is used to monitor the sensory results that are get from the vehicle sensory part. And it overcome the threshold level the buzzer that is attached to this device will produce indication sound. And the keypad is used to control the vehicle in remote manner. That will be use full for controlling a mentally disabled one.

The next section is mobile phone that is with concerned person of this patient. It is used to indicate the patient condition to him by SMS facility. The patient heartbeat is changed to a drastic mode then the SMS will be delivered to his phone.

IV. CIRCUIT IMPLEMENTATION

In this section is mainly concentrated on wheelchair circuit implementation and the circuit is divided in to three parts they are, Wheelchair controlling unit for the vehicle movement and Arm movement, Sensor unit and Remote unit. Also it's implemented in a low cost manner which means for avoiding the MATLAB and computer interface we use DSP activated chips for that.

A. Section one Implementation

This section consist of a Microcontroller for controlling the whole unit, that we use PIC16F877A [2]. For taking the voice commands the usual method is to analysis the voice data in MATLAB, but for the convenience we use EasyVR[5] a DSP based chip which having inbuilt as well as pre-loaded commands by recognising the commands the EasyVR will be given to Pic controller via USART. So for that the specific commands need to be stored in the PIC controller, according the commands the controller will controller the wheelchair movement. For the wheelchair movement can be controlled by two similar synchronous motors when both motors are rotating in flowered direction then wheelchair go in forward direction also if both motes rotate in reverse direction the wheelchair will move backward. If one motor is only moving whether left or right then opposite to that motor position the wheelchair will be turning. According to that the motor aliment will be fixed. The Synchronous DC Motors [6] are used because to get high control as well as it give synchronous speed. The robotic arm fixed on right side of the wheelchair and it is controlled by 6 servo motors and the PWM will be generated from the PIC16F877A controller according to the commands. The whole circuit will be working in 5V supply and servo as well as De motor will be having supply of 12V.

B. Section two Implementation

This section consist of a sensors for monitoring the atmosphere conditions for that we include appropriate sensors. For measuring the room temperature we use a temperature sensor that is LM35, for breathing problem peoples we include a humidity sensor and it will sense the water content in the air the sensor that we use was SY HS 230. For the disabled

persons we attach a gas sensor for getting noticed with the LPG or CNG leakage the sensor that we attach was MQ-6[2]. For getting information about obstacles in the path a obstacle detector is attached that is an Ultrasonic (PWM output). And we monitor the heart rate of the person and for that a simple heart rate monitor is used that is 1157 Sundrom made sensor.

Joystick will be a Variable resistor; this can be directly connected to Arduino main board. A continuous buzzer is used to indicate any sensor output is exceeding the limit. Also for wireless control Xbee will be using and to send message SIM900A GSM module is used.

C. Section three Implementation

The remote unit consists of LCD monitor for displaying the real time environmental condition that was sensory from the wheelchair sensor.The communication between remote and wheelchair is done by Xbee transducer. And the remote unit can control the whole wheelchair by joystick buttons present in the remote unit.Also the buzzer in this unit will produce sound while the sensors reached threshold values. We use the PIC16F876A for the controlling of this remote device.

V. DESIGN AND DEVELOPMENT

The wheel chair is controlled by three ways, voice and eye movement of the patient and by joystick (on the vehicle).The vehicle is also can controlled from a short distance through remote section via Xbee module. And for checking environmental and body condition of the patient different sensors such as temperature, PIR, humidity, obstacle and heart beat sensors are used. The results of sensors are displayed in the LCD which is at the remote section. The heartbeat sensor will sense the heartbeat and if any drastic change happens it will inform the doctor/concern person via SMS, it is done by GSM module. And a robotic arm is connected to wheel chair for assisting the patient.

The movement of the wheel chair is controlled by servo motor by microcontroller PIC16F877A.The voice recognition and joy stick can be treated as two mater of control of wheel motors. The easy VR module is programmed so that forward, backward, left, right movements are possible with the voice that has been pre-recorded.The joystick position is made to front, back, right and left according to the convenience of patient. The robotic arm is being used to assist the bed lying patient intake of pills in course of time for that the following servo/DC motors are used. The main function are pick and place.

Fig 4. Wheelchair Developed

The Arduino board (PIC16F876A) is used for the monitoring and examining of patient's bad conditions. The sensors will check the heartbeat, humidity conditions, human presence temperature and other unhealthy conditions. This can be displayed to the outsider through16x2 LCD display. This transfer of data is done through Xbee module. In addition to this display facility the nearby doctor or concerned person can be informed if any assistance id needed by GSM module attached with the Arduino board. The microcontrollers are set to a band rate of 9600 for better performance. The supply voltage is +5v to the whole circuit.

VI. RESULTS AND DISCUSSIONS

We can able to complete our project successfully. The wheel chair can control by three ways ie by eye movement, joystick and voice recognition. Sensor checking the body and environmental conditions and results are displayed on LCD.When heart beat is crossing the threshold value SMS is sent to the concern person/doctor via GSM. The short range controlling of wheel chair is also possible via Xbee. We can implement our project on PCB and got the output.

VII. FUTURE WORK

The Intelligent Vehicle for Physically and Mentally Disabled Persons designed in this project has a lot of advantages, but can also be improved on. Here the vehicle is controlled by three ways, eye movement, voice recognition and joystick. Controlling by EEG signals is a better option for the patients who cannot adopt methods which are already mentioned. Another proposed method is the controlling of the vehicle by the control of mind. By this a person can control the motion of the same by just thinking itself. This vehicle can be modelled in such a way that it can be easily turned into a semi sleeper mode in order for the patient to feel more comfortable and thereby reduce the continuous one mode sitting problem. Other already invented methods in wheelchair can also be incorporated with this. Like step climbing wheelchair and inter communication between devices-which is just an upcoming project trying to be implemented on road vehicles. The communication aid with these wheelchairs will help the deaf and dumb to communicate with each other's too. These all are the (much more can be thought of) Future works we can propose regarding this vehicle.

VIII. CONCLUSION

The vehicle which we are introducing by doing this project will be help full for many of the people who are disabled mentally as well as physically can make use of this vehicle without the requirement of relying up on any external aid. So this is a multifunctional medicinal aid focusing on the improvement and self-reliability of multiple disabled people. Modifications made in the prevailing equipment meant for the disabled ones will be of great use in upcoming time. And we were able to apply our theoretical knowledge into practice. All data provided are precise to the best of our ability.

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