Wheelchair Therapy : A System for Disabled Person

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Abstract— **Each and every person in this world has a desire to live a normal human life but accidents, diseases, eldership make their desire into debility. Moreover, there are lots of handicapped as well as the number of paralyzed people are increasing day by day. They always need help from others for moving and have to go under some physical therapies under the guidance of a therapist to recuperate their strain back. The proposed system helps them to move freely & safely and also takes the activities of a therapist in a cost effective manner. This system is a combination of different controlling features, has the ability to detect obstacle and provides few kinds of therapies. A voice controlled recognition system is also added to control the movement of wheelchair with an Arduino interfaced joystick. Besides, an ultrasound system provides the facility of automatic obstacle detection. The wheelchair contains a heart attack detection unit also with this it is possible to detect the onset of a heart attack and inform the doctor or person concerned.**

Keywords— *Wheelchair, Arduino, Joystick, Voice recognition, Physical exercise.*

I. INTRODUCTION

Superior stage of spiral cord damage, accident and brain as well as nervous system anarchy are such types of cases which causes inhabitants to loss control of arms or legs or together arms. In addition, physical disorder at the time of born also makes people immobilize. However, wheelchair is the way to make this group to being able to move. But, in the occasion of upper limb injury, it is difficult for some people to use the manual wheelchair, which is operated by arm's muscular strength. So, they have to depend on others to give the manual force to move the wheelchair [1]. The objective of this project is to help the handicapped and paralyzed people to move freely and safely. It can monitor chances of heart failure and can also carry out therapy without much human intervention for physically disabled people in a cost effective manner by using this wheelchair [2] .This proposed project is quite exceptional in the sense that it provides a combination of controlling part, therapy part and a heart attack detection part. Therapy parts give some

therapy facilities to the disabled person to overwhelm their debility. Again, the controlling part includes two types of controlling method which are joystick and voice control method. The joysticks are Arduino interfaced and can be easily organized by fingers movement [3]. Voice command system is done by the use of Bluetooth module which eliminates the necessity of personal computer. Therefore it is cost effective [4]. Here using of Arduino environment, reduces the circuit complexities. Moreover, obstacle detection provides additional safety in case of any sudden hurdle. An Arduino shield and therapy facilities may provide a new revolution on wheelchair history and it may improvise the previous work [4]. The heart attack detection part will help to detect the onset of a heart attack and it will inform the doctor or person concerned. The critical delays in medical treatment, patient unawareness and lack of early warning will lead to the death of patient [5]. Moreover, to help a paralyzed person to move freely was not only the main concern but also help them to recover their strain as well as they can easily go back to their normal life, which is considered as the special feature of this effort[6].

II. PROBLEM STATEMENT

In the occasion of upper limb injury, it restricts the patient to use manual wheelchair which is operated by the patient itself or they have to depend on others to give manual force to move the wheelchair. A person with a physical disability may require some assistance or the use of some sort of equipment to aid with mobility.
In order to assist physically handicapped person, a voice control facility is going to be added which can control the wheelchair by voice commands. In order to move the wheelchair by the finger movements, an Arduino interfaced joystick will be added to it. Moreover, obstacle detection provides additional safety in case of any sudden hurdle. With these technologies it will be able to eliminate the mobility problems to an extent. A paralyzed person needs some important therapies regularly and for a long period of time. In

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order to avail these therapies a therapist or a doctor is essential. Moreover, a therapist or a doctor demands a large amount of fee which is a burden for a person of middle or lower class family. In this proposed project the handicapped person can accomplish some basic therapies without much help of a therapist. Moreover, the main concern of the project is not only to help paralyzed people to move freely but also to provide some relief so that they can easily go back to their normal life ,which can be considered as the special feature of this effort. The first few hours after a heart attack are critical in saving much of the dying heart muscle which are starving due to lack of oxygen supply and preventing permanent heart damage. The most common reason is the critical delay in the medical treatment due to unawareness and lack of early warning. It is possible to detect the onset of a heart attack and inform the doctor or a person concerned by implanting a chip on this wheelchair, in order to access this feature the patient is required to carry a cell phone equipped with Bluetooth and GPS. As soon as the implanted chip detects the heart attack, it will alert the cell phone which in turn call for help and provide the patient's location to the emergency number saved on the cell phone automatically. Thus it helps in providing early heart attack detection so that the patient can get medical attention within the first few critical hours.

III.   METHODOLOGY

This project was implemented concentrating to design a power wheelchair which has both control systems for the disabled having just lower limb or both lower limb and upper limb injury as well as provide some therapy facilities to support them to gain their stain back. So the whole system is a combination of controlling part, therapy part and a heart attack detection part.

1.   Controlling part
A block diagram representing all the elements used in the wheelchair is shown in Fig. 01 joystick shield which sits on top of Arduino board was castoff for joystick operation and turns it into a simple controller. There is a joystick with one arm. This arm can be used as the replacement of joystick [16]. Bestowing to potentiometer movement of joystick, an analog data is acknowledged through Arduino shield and the motors are driven rendering to the digital outputs provided by it for the four directional movements of wheelchair (forward, backward, left, right).
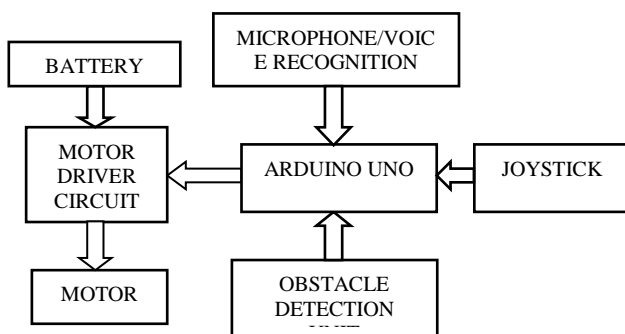

Figure 1: controlling part

As the operating voltage for both the Arduino board and joystick shield is 5V-12V dc, a 9V dc battery filled up the requirement. Person having permanent disabilities in upper limbs also partaking the option to use the chair via using voice command unit. An android phone and a Bluetooth module (HC-05) are the fragments of this module. HC-05 module is nothing but a Bluetooth SPP (Serial Port Protocol) component, which is premeditated for transparent wireless serial connection setup. The voice command (sound wave) from the user is collected through the microphone of the android phone and formerly this command is harmonized with some predefined command with the help of an android application. If both commands are the lookalikes then android application generates an equivalent character which indicates the users command. Besides these, the output signal from the obstacle detection unit is always observed by the Arduino shield. In addition, a ultrasonic sensor is used to perceive obstacle. The sensor can measure the distance ranging from about 0.2 meters to meters. The working procedure of ultrasonic sensor is to transmit an ultrasonic surge and to provide an output pulse resembling to the time required for the burst echo to reappearance to the sensor. The detachment to target can just be calculated through appraising the echo pulse width. Once it founds a hindrance within its quantified range, it contributes an output to central control unit which stops the wheelchair instantaneously. When the output signal from the ultrasonic sensor is low, Arduino shield process the required signal to the motor driver circuit to power up the motors. The driver circuit consists of four 12 V relays and four n-p-n transistors. Two 12 DC series motors are used. DC series motors are chosen because of offering high starting torque, vigorous, having a simple design and pretty low cost. The voltage and current ratings of both motors are 12 V and 5 Amp. The RPM of both motors is 1050 and after a gear mechanism which has the gear ratio is 15, it appears as 70 finally. For making the connection between the motor's shaft and wheels, freewheel and ruler chain are used. The rear wheel's radius is 0.35 m and the front cluster's radius is 0.05 m. Front casters swivel as the wheelchair turns in response to changes in the speed of the rear wheels. A 12 V DC lead acid battery is used as power supply for the motors. Another 9 V battery is used to supply power to obstacle distinguishing unit.

2.   Therapy Portion
The therapy unit includes manually controlled weight loading, trunk flexors exercise and automatically controlled pulley system, vibration pad. The automatic pulley system is used for upper limbs due to left or right cerebral nervous system disorder .It helps the patient to regenerate blood circulation in upper limbs. We have used a servo motor (TowerPro MG995) which rotates within a specified angle. Its stall torque is 10.00 kg-cm and speed is 0.20 sec/60°. The rotational range is 180 degree. It can hold up to a 10 Kg weight. The motor makes a revolution of 180 degree to raise the hand. When the rotor rotates anti clockwise, it raises the hand and vice versa. In case of trunk flexors, the abdominal muscles may be worked by using 10-15 kg resistance, one to each hand. This has the effect of offering resistance to the abdominal muscles of up to 20-30 kg as the springs are being

used in parallel or with the patient sitting holding a pole to which are attached two springs. Weight loading exercise increases strength and stability. The improvement of these types of loading is that the patient is moving a known weighting with every endeavor. The disadvantages are that secure anchorage is sometimes difficult to achieve and the patient may not make a maximal effort at each attempt. The benefits of Vibration pad are to build Strength and burn calories. Here, we have used Grove vibration motor to make the vibration pad. If the input is logic high, then it makes vibration. Here, an audio supported system is provided to help the disabled persons. The persons are capable to know about the remunerations of each therapy and process to perform using the system. It resides of a micro SD card shield, Arduino UNO, an n-p-n transistor, four 1 K Ohm resistors, a speaker and four on-off switches. The Arduino SD Card Shield is used for conveying data to and from a standard SD card. For picking the flash card slot, there is an adjustment. The ADC (analog digital converter) yields sampling, quantizing, encrypting and adapting the analog audio signal into digital data and saves as files, which are the basic principles and methods of digital audio processing technology. Of course, throughout the playback, the digital data drives through the DAC, digital analog converter to re-establish the analogy signal form to be frolicked out by the sound scheme. A specific switch is used to play an individual audio file adjacent to a particular therapy. When the user pushes one of the switches, he will get the procedure and benefits of prescribed therapy. This system can be also used for recreation or counselling purposes also.

3. Heart Attack Detection Part

GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone.GSM (Global system for mobile) uses a process called circuit switching. This method of communication allows a path to be established between two devices. Once the two devices are connected, a constant stream of digital data is relayed.GSM networks consist of thee major systems the Switching System (SS), The Base Station(BSS) and the Mobile station(MS). Arm Microcontroller LPC2148 microcontrollers are based on a 16-bit/32- bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine the microcontroller with embedded high-speed flash memory ranging from 32 kB to 512 kB.
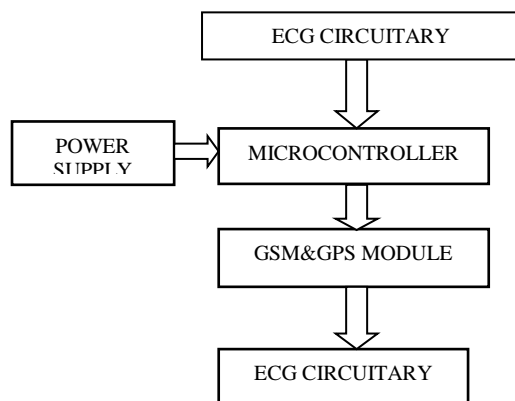

Figure 2: heart attack detection module

A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2148 are ideal for applications where miniaturization is a key requirement, such as access control and point-of sale. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems. A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone.GSM (Global system for mobile) uses a process called circuit switching. This method of communication allows a path to be established between two devices. Once the two devices are connected, a constant stream of digital data is relayed.GSM networks consist of thee major systems the Switching System (SS), The Base Station(BSS) and the Mobile station(MS).

RESULT

This project provides the handicaps and paralyzed people to move safely and provide some kinds of therapies that help them to regain their health without minimal use of human help. By this system the patient will be able to identify the chances of heart attack also.

REFERENCES

[1] Md. Mamunur Rahman, Swarup Chakraborty, Md. Azad Hossain, Ali Mohammed Jobayer, "Wheel Therapy Chair: A smart System for Disabled Person with Therapy Facility", International Conference on Electrical, Computer and Communication Engineering (ECCE), February 2017.

[2] AAnoop K.J, Inbaezhilan , Sathish raj, Ramaseenivasan, Chola Pandian, "Designing and Modelling of Voice Controlled Wheel Chair Incorporated with Home Automation", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 3, Issue: 2, April 2014 .

[3] HHarsha C. Puranik, S.S. Kataria, " Wireless Walking Stick with Heart Attack Detection", International Journal of Innovative Research In Electrical, Electronics, Instrumentation And Control Engineering, Vol. 2, Issue: 10, October 2014.

[4] Prof. R. S. Nipanikar, Vinay Gaikwad, Chethan Choudhari, Ramgosavi, Vishal Harne, "Automatic Wheelchair for Physically Disabled Person", International Journel of Advanced Research in Electronics and Communication Engineering,
 Vol. 2, Issue: 4, April 2013.

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[5] TThomas Rofer, Christian Mandel and Tim Laue, "Controlling an Automated Wheelchair via Joystick/Head-Joystick Supported by Smart Driving Assistance", IEEE 11th International Conference on Rehabilitation Robotics Kyoto International Conference Centre Japan, 2009.

[6] Deepthi J, Col Dr T S Surendra, "Various types of wheel chair control methods: a review ", International journal of electronics and communication engineering & technology (ijecet) , Volume 4, Issue 1.