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CONTROLLING OF WHEELCHAIR FOR PARALYZED PATIENTS USING THE MOVEMENT OF HEAD

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ABSTRACT

In this project we design a smart wheel chair for paralyzed person using head motion. The main objective of the project is to create a user-friendly wheel chair (for physically challenged person) which is based on head motion and distance to detect an obstacle or object. This project consists of ultrasonic sensor and accelerometer. Ultrasonic sensor is used in finding the distance between wheel chair and its opposite obstacle. Movement of wheelchair is programmed using head movement of physically challenged person. During that movement period ultrasonic sensor will calculate distance and when wheel chair is going closer any other object, wheel chair alarm will be activated and it will stop. It is the effective way of controlling a wheel chair in turning left and right movement and is easily controlled by head motion based on user it will automatically stop the wheel chair its closer any obstacle. In this method, controlling a wheel chair is easily handled by physically challenged person.

Keywords-: **Wheel Chair, Sensor, Arduino, Micro Controller.**

I. INTRODUCTION

The advancement and development of technology has always influenced a few parts of our lives since quite a while and will keep on doing as such later on with additional capacity and more unexpected development. In our project we have attempted our best to correlate between the advancement of technology and the human requirement, for human ease.

The main aim of this project is to control wheel chair through human direction. This project is mainly designed for physically challenged people who are dependent on wheelchairs and especially those people who can't utilize their hand to drag their wheel chair on account of some incapacity.

In this system we have used head motion module to recognize the motion of the user for controlling the direction of the wheelchair. The prototype of the wheel chair is built using Arduino, chosen for its low cost, in addition to its versatility and performance in mathematical operations and communication with other electronic devices. The system has been structured and actualized in a savvy way so that if our venture is marketed the poor clients in developing nations will profit by it. We trust our project for some valuable activity and give some headway in innovation, and most vital this may give some assistance to the debilitation individual.

The main aim of this project is to facilitate the movement of the disabled people and elderly people who cannot move properly so with this we can enable them to lead better lives without any problem.

The accelerometers can measure the magnitude and direction of gravity in addition to movement induced acceleration. In order to calibrate the accelerometers, we rotate the device sensitive axis with respect to gravity and use the resultant signal as an absolute measurement. Integrating a single chip wireless solution with a MEMS accelerometer would yield an autonomous device small enough to

apply to the fingernails, because of their smallsize and weight.

Accelerometers are attached to the fingertips and back of the hand. Arrows on the hand show the location of accelerometers and their sensitive directions, that the sensitive direction of the accelerometer is in the plane ofthe hand.

The gesture based wheelchair is suitable for the elderly and the physically challenged people who are unfortunate to have lost ability in their limbs due to paralysis or by birth or by old age.

II. RELATED WORKS

SMART WHEELCHAIRS BY RICHARD C. SIMPSON

Several studies have shown that both children and adults benefit substantially from access to a means of independent mobility, including power wheelchairs, manual wheelchairs, scooters, and walkers. Independent mobility increases vocational and educational opportunities, reduces dependence on caregivers and family members, and promotes feelings of self-reliance. For young children, independent mobility serves as the foundation for much early learning. No ambulatory children lack access to the wealth of stimuli afforded self-ambulating children. This lack of exploration and control often produces a cycle of deprivation and reduce motivation that leads to learned helplessness.

The author compares the smart accessible factor that ever produced Smart wheelchairs that navigate autonomously to a destination often do so with an internal map, commercialisation and future plan to upgrade smart accessible Smart wheelchairs have been used to explore a variety of alternatives to the more “traditional” input methods associated with power wheelchairs (e.g., joysticks, pneumatic switches). Voice recognition has often been used for smart wheelchairs (e.g., Nav Chair, SENARIO, Tetanuran because of the low cost and widespread availability of commercial voice recognition hardware and software. Authors identify the problems faced by smart wheelchairs i.e. technical weakness, high cost, cumbersome and lack of standard communication protocol.

APPARATUS FOR WIRELESS POWER TRANSMISSION

Disclosed is an apparatus for wireless power transmission between an external power source and an electric mobility vehicle. The present invention allows a user with limited physical mobility to electrically connect the present invention to an electric mobility vehicle so that the portable power source of the electric mobility vehicle can be recharged. The present invention includes a power charger, which can be connected to the charging section of a device such as an electric wheelchair. It is to be understood that many other possible modifications and variations can be made without departing from the spirit and scope of the invention as hereinafter claimed [5].

HUMAN-MACHINE INTERFACE FOR ASMART WHEELCHAIR

Defining the control protocols between the human and the robot technology. There are different types of wheelchairs including basic, lightweight, folding, multi-function, powered, fully/partially autonomous and so on. The main focus of the article demonstrates the design and performance of the interface between sensory feedback and the computer-controlled system. The real time data processing is addressed here for a smart wheelchair that functions as a low speed autonomous vehicle. The focus is on the implementation of mobile high-performance computing (HPC) cluster comprised of a multi-computer system connected over a local area network (LAN).

Parallel processing capabilities of LabVIEW and the eight processing threads on the Intel I7 hyper-threading CPU, the task parallelism for the vision system can improve the CPU usage up to 80%. A dedicated computer is utilized for the LRF data processing cluster configuration that can be optimized. Advances are made on the technology of smart wheelchairs with sensors and driven by intelligent control algorithms to minimize the level of human intervention. The presented vision-based control interface allows the user to adapt and command the system at various levels of abstraction [6].

SMART WHEELCHAIR USING ANDROID SMARTPHONE FOR PHYSICALLY DISABLEDPEOPLE

The authors identify there are existing technologies which allow the users to use human gestures such as the movements of hands, movements of leg, tongue and head and synchronize them with the movements of the wheelchair for a better wheelchair controls for example smart wheelchair. A smart wheelchair is developed to help an elderly or physically disabled person (user) to move from one place to another independently. An android application is developed and installed in the android smartphone. The authors describe development of a smart wheelchair system with voice recognition and touch controlled using an embedded system.

An android application is developed and installed on the android smartphone. The system is divided into two main modes: voice recognition mode and touch mode. For the voice recognition mode, elderlies or physically disabled people (users) can provide the voice input, for example, "go", "reverse", "turn to the left", "turn to the right" and "stop". The wheelchair will move according to the command given. For the touch mode, the user can select the specified direction displayed within the four quadrants on the screen of the android smartphone to control the wheelchair.

An Arduino Uno is used to execute all commands. The MD30C motor driver and HC05 Bluetooth module are used in this system. This system is designed to save time and energy of the user. It consists of two controlled modes, the first mode is the touch mode and the second mode is the voice recognition mode [8].

In the first mode, the user can give the voice input using an android smartphone. The android smartphone will convert the voice commands into a string of data and this string of data will be sent to the Bluetooth module and lastly delivered to Arduino Uno. After that, Arduino will decodes and process it. The motor driver will direct the wheelchair according to the command given. For the second mode, the user can determine the wheelchair's movement by selecting the desired direction on the android smartphone phone screen. The command given by the user will be forwarded to the Arduino Uno via Bluetooth. The main objectives were to design an android application that can direct the movement of a wheelchair, to develop the voice recognition mode and touch mode to help the elderlies and physically disabled people to move their wheelchairs independently and to provide the elderlies and physically disabled people with the 7 ability to control the movement of the wheelchairs by using android smartphones. The system designed has undergone a few tests and successfully completed the basic performance. The objectives were achieved as the software and hardware implementation work well as expected.

DEVELOPMENT OF WIRELESS CONTROLSYSTEM FOR CONTROLLING ELECTIC- POWERED ROBOTIC VEHICLE WHEELCHAIR PROTOYPE

The author a multiple control systems were developed using commonly used wireless communication protocols like Bluetooth, Xbee, and Wi-Fi. The author both Xbee and Wi-Fi technology based control systems were able to guide the robotic vehicle through the corridor. Wireless technology enables the devices to transfer/receive data from matched devices and the web without using any physical connection. It may be concluded that for short distance communication, the implementation of Bluetooth wireless technology is efficient and cost-effective where as for long distance communication wireless technology is economic.

III. PROPOSED METHODOLOGY

The present system is designed for persons who able to move arm or fingers. Reading the movements of the fingers the sensory system understands the changes in the finger gesture and controls the motor.

There are some limitations existing with traditional wheelchair system such as complexity in service when repaired, use of joystick may be difficult for challenged persons, the wheel chair cannot sense any obstacles' on the path, and to move the chair they need some external help.

The limitations of the existing systems can be eliminated in the present system. The wheel chair system design and the required components are discussed in this section.The wheelchair system contains two parts, they are transmitter and receiver. The block diagrams of transmitter and receiver are shown below respectively. The components are classified

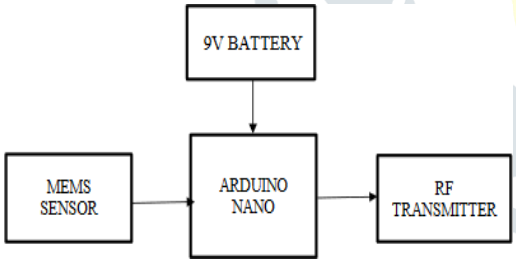
into two types, one is hardware and the second one is software component.

In the present work, the hand gestures represent a small movement of hand or fingers made in different directions. An accelerometer sensor is used to detect different hand gestures. In the present work MEMS sensor is used as accelerometer sensor. The sensor can be either fixed directly with the hands of the person or can wear with hand gloves.

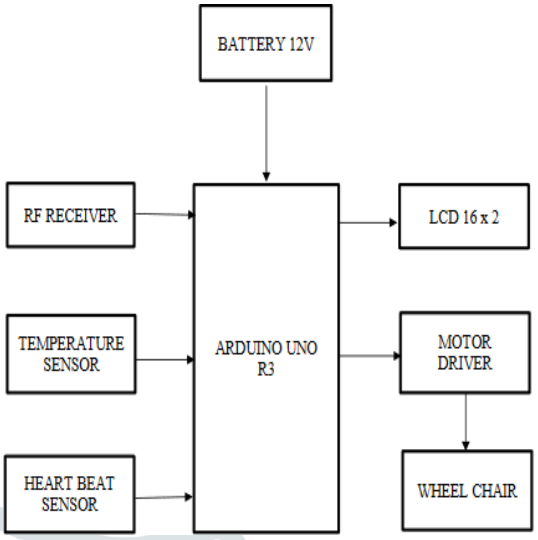
Then the Arduino UNO board sends signal to DC motor driver in order to control the movement and direction of the wheelchair in required direction. The hand gestures are sensed and converted into displacement of the wheelchair in different direction such as left, right, forward, backward directions and stop whenever it is required.

Some patients that cannot manipulate the wheelchair with their arms due to a lack of force or psychomotor problems in the superior members require electric wheelchair. The wheelchair is operated with the help of accelerometer, which in turn controls the wheelchair with the help of hand gesture.

The wheelchair moves front, back, right and left. Due to which disabled and partially paralyzed patient can freely move.



3.1 BLOCK DIAGRAM OF TRANSMITTER PART



3.2 BLOCK DIAGRAM OF RECEIVER PART

3.1 COMPONENTS

3.1.1 ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

3.1.2 ARDUINO NANO

Arduino NANO is an microcontroller board based on the ATmega328P. It has 14 digital input/output pins(of which 6 can be used as PWM outputs), a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller.

3.1.3 MEMS SENSOR

MEMS stands for Micro-Electro-Mechanical Systems and applies to any sensor

fabricated using microelectronics manufacturing techniques. These techniques typically create microscopic-sized mechanosensing structures on silicon. When used in conjunction with microelectronic circuits, MEMS sensors can be used to measure physical parameters such as acceleration.

The accelerometer in the present work is used to measures acceleration by gravity and changes the angle of direction with respect to the earth. The accelerometer further controls the speed and device direction while moving. The accelerometer is interfaced with three analog inputs of Arduino NANO processor [9].

3.1.4 RF TRANSMITTER MODULE:

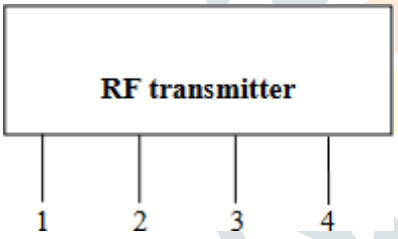
Functional block of Tx section where 1,2,3,4 are the pins

1 - Antenna

2 - Data input

3 - Ground

4 – VCC



In this transmitting section the 1st pin is the antenna pin where we can able to fix the antenna for transmitting the data in the Radio Frequency, the 2nd pin is the data input pin in which the output of the encoder is given; the 3rd pin is the ground and the 4th pin is the VCC which is given to operate the transmitter section.

3.1.5 RF RECEIVER MODULE:

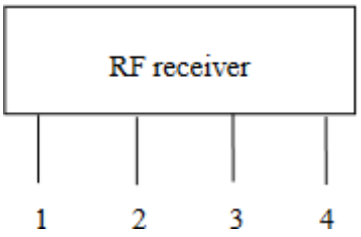
Functional block of Rx section where 1,2,3,4 are the pins

1 - Antenna

2 - Data input

3 - Ground

4 - VCC



In this receiving section the 1st pin is the antenna pin where we can able to fix the antenna to receive the data in the Radio Frequency, the 2nd pin is the data output pin to the decoder circuit, the 3rd pin is the ground and the 4th pin is the VCC which is given to operate the receiver section.

3.1.6 ENCODER AND DECODER

In most of the applications the encoder is used to detect RF signals. In the present design the encoder is used for remote control accessing. The 12-bit digital data is converted serial data which is used to enable RF transmitter on the transmitter board. The 12-bit data is partitioned into 8-bit address and 4-bit data. The address bits can be used to sect multiple receiver devices at receiver end. The decoder is used to control remote operations. It converts serial input data into parallel data [10].

3.1.7 DC MOTOR DRIVER:

The DC motor-driver (L293D) controls the DC motor in possible rotations. In the present work the motor-driver controls two DC motors simultaneously. That means it controls the direction of two motors simultaneously which will help in moving vehicle wheels synchronously.

3.1.8 LCD:

A liquid crystal display (commonly abbreviated LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. It is often utilized in battery-powered electronic devices because it uses very small amounts of electric power.

3.1.9 HEART BEAT SENSOR

Heart beat sensor is designed to give digital output of heart beat when a finger is placed on

it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

3.1.10 TEMPERATURE SENSOR

The working principle of a temperature sensor is the voltage across the terminals of the diode. If there is an increase in the voltage, the temperature also increases. This is followed by a drop in the voltage between the terminals of the transistor of base and emitter in a diode. There are also temperature sensors that work on the principle of stress change caused by changes in temperature.

3.1.11 BUZZER

The piezo, also known as the buzzer, is a component that is used for generating sound. It is a digital component that can be connected to digital outputs, and emits a tone when the output is HIGH. Alternatively, it can be connected to an analog pulse-width modulation output to generate various tones and effects. In this proposed method the buzzer is used to alert the patient and care taker by the parameters of temperature and heart rate which the temperature goes above [11] 40 degree Celsius and heart rate goes above 100 and below 60, in these conditions the buzzer will give the alarm.

IV. EXPERIMENTAL RESULTS

- ADVANTAGES:

 The wheel chair detects the obstacle at the front and stop the movement within a range of

50 CMs.

 Without any external help the paralyzed person can operate his own chair.

 The prototype of the system is successfully developed to move the wheel chair Left, Right,

Forward, and Backward directions or stay in the same position.

SYSTEM REQUIREMENTS

5.1 Software Requirements:

Arduino

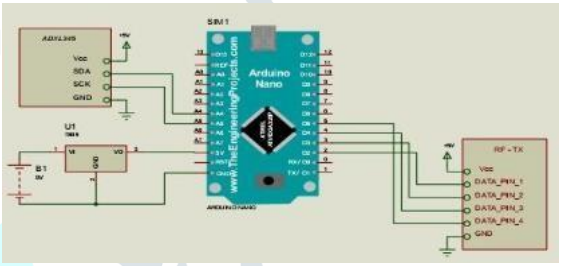
 Arduino NANO

 Arduino UNO

5.2 ARDUINO NANO

The Arduino Nano is same as the Arduino Uno is a microcontroller board based on the ATmega328.

This Arduino Nano is used in the transmitter part to transmit the signal that given by the patient's head tilt movement which help to move the wheelchair by the specified command.



4.1 ARDUINO NANO

V. CONCLUSION AND FUTURE ENHANCEMENT

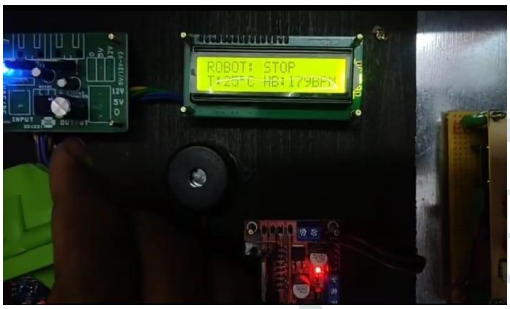
With the completion of our wheelchair, we have concluded that it works well for head tilt motions and it proves to be an effective solution for quadriplegic patients with more than 45 % disability or for the patients with spinal cord injury who could not move their hands and legs for driving a manual or automatic wheelchair. This system proves better than automatic joystick powered wheelchairs in terms of ease of operation and head tilt control. Also, the project comes out to be economical as compared to other available wheelchairs in the market.

This work elaborates the design and construction of Smart Electronic Wheelchair with the help of MEMS Module. The circuit works properly to maneuver because the command given by the user. After coming up with the circuit that allows physically disabled to regulate their wheel victimisation associate MEMS device application in their sensible phones and it's conjointly been tested and valid.

The detection of any obstacle is with success controlled by the microcontroller.

As the person switches on the circuit and starts moving, any obstacle that is anticipated to lie among a spread of four metres are detected by the unhearable device. This planned system contributes to the self-dependency of otherwise abled and older folks.

RESULTS :



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