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Wheel Chair with Health Monitoring System Using IoT

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Abstract – *we know that the needs of many people with disabilities can be overcome with power wheelchair, but some portion of this community is finding it difficult to operate power wheelchair. though we have evolved in the field of health care and technology, but we are still not good enough to solve difficulties of this sector of population. This project is related to an android phone controlled wheel chair along with an alternative use of manual joystick. The main objective of this project is to felicitate and increase the movement of people who are handicapped and the ones who are not able to move freely. therefore, we are coming up with a design of wheelchair which will be an asset for medical department and to make it more advance in existing technology, we have equipped our prototype with health monitoring system involving real time measurements of body temperature, heart-rate and humidity. Which will eventually decrease chances of miss-happening and allows the victim to live a freer life.*

Key Words: **Smart Wheelchair, Health Monitoring System, IOT, Android App, Physically Disabled, Temperature & Humidity Sensors, Arduino**

1.INTRODUCTION

In a very simple language, a wheelchair is a machine with wheels enabling easy movement, which empower a physically disabled person to move around with less dependency on others. People have disabilities with their hands, foots, lower extremities which puts a limit to perform regular task in their daily life. Still these wheelchairs have not satisfied the needs of the disabled people. It is therefore crucial that problems are understood in detailed and accordingly sensors should be equipped, hence this paper is a result of the needs and includes development of a multifunctional chair.

1.1 Objective

The main agenda of this project is to enable a disabled person to move with less difficult. Due to exponential growth of technology with time, it is the need of the hour to provide easily operated machines. The various modes of control will allow to move the chair with less human intervention.

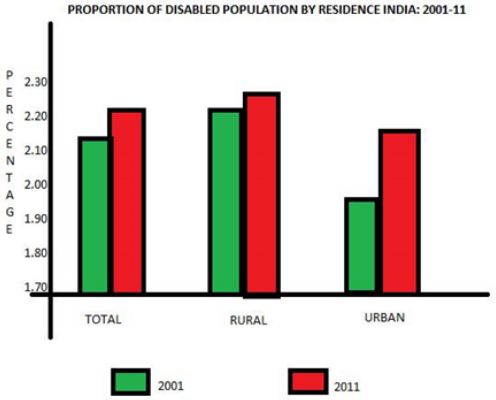
1.2 Methodology

The controlling of the wheelchair is through an android application which is connecting via Wi-Fi module and through a manual joystick which is fixed on the hands of the chair, using these two will decrease the dependency of user on another person. We have also equipped our chair with infrared sensors which will help to avoid accidents happening due to obstacles. Sensors will respond to the nearing obstacle and eventually commands will be forwarded to the microcontroller(ATMega328) enabling desired further motion. This system also includes a health monitoring system which monitors health of the user and forward that to the application.

2. LITERATURE SURVEY

Above explained detailed functionality speaks about our methods of preventing accidents, methods by which we can control the movement of chair and working of Health Monitoring System. Till now from our detailed survey and deep knowledge of problems our only motive is to prevent them from existing. If any way sum threat is detected, the functionality should be smart enough to stop the motion further and respond accordingly.

The 2011 census report states that there is an increase in country's disabled population by 22.4% between 2001 and 2011. In 2001 count of disabled was 2.19 crore in 2001, which has gone up to 2.68 crore in 2011 out of which 1.5 crore are males and 1.18 crore are females. Most of the disabled are those with physical disability, accounting for 20.3% for total disabled population. [2]



Graph -1: Proportion of Disabled population in India [2]

The graph which is labelled as "Proportion of Disabled population in India (2001-2011)" shows population of disabled people in India has dramatically increased both in rural as well as in urban area also, over the span of ten years. Hence, we have made an attempt to ease the living standard of these people.

3. SYSTEM ARCHITECTURE

The below figure gives you the detailed idea of various connections established between microcontroller and other sensors for proper functionality.

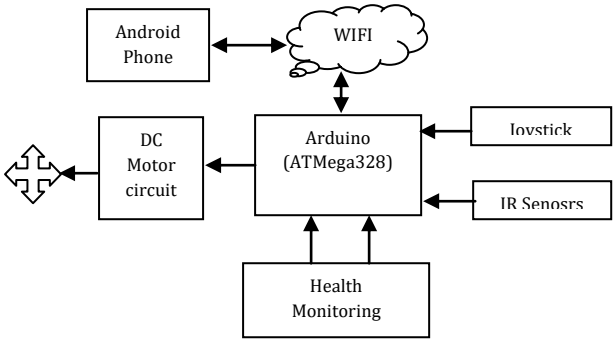


Fig -1: Block Diagram

A. Hardware

ATMega328 Microcontroller:

Fig -2: ATMega328 Microcontroller

The Atmel 8-bit AVR RISC-based microcontroller combines 32 kB ISP flash memory with read-while-write capabilities, 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines and 32 general purpose working registers. The device operates between 1.8-5.5 volts. ATmega328 is commonly used in many projects and autonomous systems where a simple, low-powered, low-cost micro-controller is needed. Perhaps the most common implementation of this chip is on the popular Arduino development platform, namely the Arduino Uno and Arduino Nano models.

LCD Module:

Fig -3: LCD Module

A 16X2 LCD is connected with Arduino at 7,8,9,10,11 and 12 pins to display the reading of various sensors.

WI-FI Module:

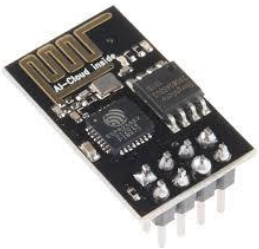


Fig -4: ESP8266

ESP8266 is an impressive, low cost Wi-Fi module suitable for adding Wi-Fi functionality to an existing microcontroller project via a UART serial connection. The module can even be reprogrammed to act as a standalone Wi-Fi connected device. It requires 3.3 V power. ESP8266 has features like 802.11 b/g/n protocol, Wi-Fi Direct (P2P), soft-AP and Integrated TCP/IP protocol stack.

Joystick:

Fig -5: Joystick Module

A joystick is an input device consisting of a stick that pivots on a base and reports its angle or direction to the device it is controlling. We are using dual axis XY joystick biaxial button PS2 module. This module combines two potentiometers and a pushbutton switch into a solid mechanical package with an ergonomic thumb dome. This joystick is perfect for controlling motors, servos, etc. When using the 5V power supply, the default analogue output for X, Y is 2.5V. With the direction of the arrow, the voltage goes up to 5V and the opposite direction it goes down to 0V.

Sensors:

Fig -6: IR Sensor

Sensors are the integral part of the system. Following sensors are also attached to the microcontroller:
IR Sensors: This helps to detect whether there is any obstacle present or not. Sensor detects obstacle by sending continuous signal from transmitter and if there is obstacle then it will stop the wheelchair immediately.
Health Monitoring Sensors: Sensors like Pulse detecting sensors and temperature sensors are used for continuous evaluation of the patient's health and to notify about the same to its guardian through the mobile app.

Motor:

Fig -7: Motor Driver

Motors are arguably one of the most important parts of a mobile robotics platform. Overpowered motors cause inefficiency and waste the already limited supply of power from the on-board batteries, while undersized motors could be short on torque at critical times. The optimal rotation speed and the available speed range of the motor must also be taken into consideration. Too high of an output rpm from the motor shaft will cause the robot to operate at a fast, uncontrollable speed. Too low of an output and the robot will not be able to attain a suitable speed to meet the user's needs. Therefore, much consideration was put into the selection of the proper motor for the platform. DC motors are commonly used for small jobs and suited the purposes of the platform very well. We are using a 12V DC motor in our wheelchair with L293D motor driver.

Wheels:

Fig -8: Wheel

Wheelchair has four wheels, two rear wheels and two castor wheels, the two caster wheel are fixated in wheelchair base in front, all wheels have the same diameter. The drive wheels are in rear on either side of the base, allowing the chair to turn according to voice command, wheels engage directly to a gear train that transmit torque form motor to wheels by two grooves in each wheel and nut.

B. Software

Arduino:

Arduino is a single-board microcontroller designed to make the process of using electronics in multidisciplinary projects more accessible. The hardware consists of a simple open-source hardware board designed around an 8-bit Atmel AVR microcontroller, though a new model has been designed around a 32-bit Atmel ARM. The software consists of a standard programming language compiler and a boot loader that executes on the microcontroller.

The Arduino board is made up of an Atmel AVR microprocessor, a crystal or oscillator (a crude clock that sends time pulses at a specified frequency to enable it to operate at the correct speed) and a 5V voltage regulator.

To program the Arduino, the Arduino IDE is used which is free software that enables programming in the language that the Arduino understands. In the case of the Arduino, the language is based on C/C++ and can even be extended through C++ libraries.

C. Transmitter

The Android Mobile is used as input. The Application is developed on the Android platform. The graphical user interface provides the user with direction options and an SOS help section. When the user touches the virtual direction button at that time a string for that particular direction is passed and then transmitted from the transmission unit to the receiving section through WI-FI.

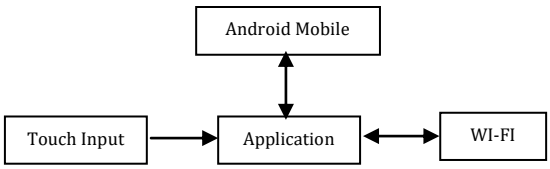


Fig -9: Transmitter Unit

D. Receiver

The microcontroller converts the string into ASCI code and then this code is decoded and according to it the motors are given supply and turned to have linear motion of the wheelchair. Wi-Fi module is used for wireless transmission of data, operated on 5V. Battery of 12V is used to drive the wheelchair. Battery is used for the purpose of mobility. DC motors are driven by L293D driver IC. L293D is a dual bridge IC. For forward movement the motors are moved forward and for reverse movement the motors are moved in backward direction. For left movement the left motor is stopped and right motor in forward direction and for right movement the right motor is stopped and left motors are moved in forward direction.

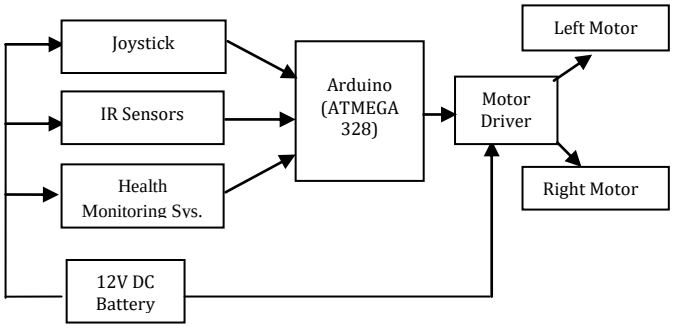


Fig -10: Receiver Unit

4. ADVANTAGES

- The multiple modes of driving the chair minimizes the effort of moving it around to a very low level.
- Number of IR sensors interfaced in the chair allows to prevent the accidents from happening and provide reliable safety as well.
- This system is economical and compact.
- Health monitoring system will send the real time health information on the android application.

5. FUTURE SCOPE

Further implementation of voice controlling system or IR sensor glasses for the movement of wheelchair can be installed in the existing prototype. These two will increase the mobility level of chair to a very high standard, which will be highly efficient and less dependent on other sources to move. Also, the implementation of gear box will increase the speed of chair and handling as well. We can also install solar power panel for promoting the eco-friendly charging of this chair. A detachable metallic stair-case can be attached to climb slopes and small hurdles. Hence, all these changes on a whole will prove to be a boon in medical field.

6. CONCLUSION

The desired completion of this project will enable a great ease in movement and socializing of disabled people with negligible human efforts. Also, it is easy to use and operate as the movement are just one touch away. The module is compact and economical; the various sensors present in the prototype along with the health monitoring system makes it a very enhanced module, which is very reliable and helpful.

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It gives us great honor and satisfaction in presenting this project on "IOT Based- Smart Wheelchair with Health-Monitoring System". We take great honor in presenting this idea to our Principal Dr. S. Shendokar. We will always be thankful to our project guide Prof. A.B. Wani for his advice and guidance in this work and his tireless support in ensuring its completion. We would also like to show our real concern for project members, staff and all our friends who have made it a scalable job by providing us the most modern and latest information.

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