IOT BASED- SMART WHEELCHAIR WITH HEALTH MONITORING SYSTEM
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Abstract : Internet of Things (IoT) is an environment where in things interact with each other intellectually to provide useful and meaningful information. The services provided by the IoT systems can widely be used for variety of applications related to health care, transportation, security, etc. This paper presents a report on the prototype design of Smart Wheelchair. The proposed application is designed for physically disabled peoples to facilitate and increase the handicapped and elderly people in their movement who are not able to move well because of their disabilities. IoT based system will help the guardian to control this wheelchair with the help of an android application. The guardian sitting in remote area can get connected with its patient’s wheelchair via mobile app. Moreover, user can control this wheelchair with the help of joystick provided on the chair. This system allows the user to robustly interact with the wheelchair at different levels of the control (left, right, forward, backward and stop) and also provide the health monitoring of user to its guardian simultaneously.

Keywords – Android App, Health Monitoring, Internet of Things (IOT), Physically Disabled, Smart Wheelchair, Sensors

I. INTRODUCTION

The population of disable people is increasing due to various reasons such as road accidents, premises fall, suicide cases, natural disasters like earthquakes, etc. There should be some means of machine that could help this population to make locomotion.

This population needs a support that is provided by wheelchair. The pushing wheelchair is the initial one in which the user has to push the chair with the hands. It gives stress on the user when travelling for a long distance. So with the help of technology and human efforts the idea of automatic wheelchair was evolved. An automated wheelchair is based on some input interfacing machine which gives input to the motor. The motor processes the input provided and takes the corresponding action accordingly (in terms of movement – move left, front, back, right). With the introduction of android Smartphone in the system, the working becomes less complex. The system becomes quite user-friendly to the user.

The Internet of Things (IOT) is the combination of uniquely identifiable embedded computing devices within the existing Internet infrastructure. Typically, IOT offers advanced connectivity of devices, systems, and services that provides machine-to-machine communications (M2M) and covers a variety of protocols, domains, and applications.

The Five movements of the wheelchair can be described as following:

1. Moving forward
2. Moving backward
3. Turning to the right
4. Turning to the left
5. Stop condition

This prototype is capable of detecting obstacle in all four direction of chair using IR sensor. In this paper we are presenting an IOT based system which will help disabled people to move the chair safely and efficiently.
II. LITERATURE SURVEY

Other authors have designed a prototype of automatic chair using ultrasonic sensor and Raspberry Pi which is used to execute all the commands. The motor driver L293D is used and HC05 Bluetooth module is used. The proposed system is developed by considering all aspects so that it will be useful to the people.

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. [6]

The paralyzed person gets restricted to wheelchair and become dependent on other humans for their movement and daily needs. Many attempts have been made to customize the wheelchair by adding extra equipment to it. The existing wheelchair in market like voice controlled wheelchair and head control wheelchair have few drawbacks such as environmental disturbances, mechanical issues or cost.

![Fig 1: Proportion of Disabled population in India (2001-2011) [6]](image)

The graph titled “Proportion of disabled population in India: 2001-11” describes percentage of disabled persons in India has increased both in rural and in urban areas during last decade. So in this paper we have made these people independent so that they are free to move on their own. The complexity is reduced to much higher level and hardware requirement is also less. [6]

III. DESIGN

The Android application provides the functionality of handling the movement of wheel chair and additional features like Emergency calling to the care taker and it can also send the emergency message to the intended person whose number is given when we start the application. We have used incremental model to design application because if we want to make any changes in future then it can be easily done.

In Incremental model the whole requirement is sub-divided into various builds, Multiple development cycles take place here, making life cycle a “Multi-waterfall” cycle. Cycle are divided up into smaller, more easily managed module passed through requirements, design, implementation and testing phases A running version of software is produced during the first module. So we get working software early on during the Software life cycle. Each further stage of module adds function to previous stage. The process continues till the complete system is achieved. Incremental model is more flexible and less costly to change scope and requirements. In this model it is easy to test and debug during a smaller iteration.
IV. PROPOSED SYSTEM

4.1 Architecture

In this proposed system wheelchair is connected to an android application using interfacing of wifi module with Arduino microcontroller (IC ATMEGA328). For the movement of the wheelchair IC L293D motor driver circuitry is used. For obstacle detection IR sensors are used in all the four directions to help the patient/user getting aware of obstacle around. Health Monitoring system is also built using various sensors like pulse detecting sensor, temperature sensor etc. The whole system is mainly divided in four modules:

1. Mobile Application Module
2. Microcontroller receiver module
3. Wheelchair driving module
4. Health Monitoring Module

![Fig 2: Block Diagram of Proposed System](image)

Above figure shows the system architecture which defines the actual working of system. Joystick is implemented on wheelchair to provide an on board control of the wheelchair’s movement to the user. For detecting any obstacle in the direction of wheelchair’s motion and to avoid the accidents IR sensors are used. A health monitoring system is attached to microcontroller for monitoring the real time health of the patient/user. Information about patient’s health can be transmitted to its guardian implementing the concept of IoT. We have used 12V DC battery as power supply which helps to accommodate large distance.

4.2 Hardware Requirement

4.2.1 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.

4.2.2 Wifi Module

ESP8266 is an impressive, low cost WiFi module suitable for adding WiFi functionality to an existing microcontroller project via a UART serial connection. The module can even be reprogrammed to act as a standalone WiFi 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.

4.2.3 Motors

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.

4.2.4 Joystick

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.

4.2.5 Sensors

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.

4.2.6 Wheels

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.

4.3 Transmitter Unit

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 the Wifi.

![Transmitting Unit Diagram](image)

Fig 3: Transmitting Unit

4.4 Receiver Unit

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. Wifi 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.

![Diagram of the system](image)

**Fig 4: Receiving Unit**

### V. ACKNOWLEDGEMENT

It gives us great honour and satisfaction in presenting this project on “IOT Based- Smart Wheelchair with Health-Monitoring System”. We take great honour 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.

### VI. CONCLUSION

From the prototype proposed, it is noticed that the touch screen control has high accuracy when compared to voice recognition system. This paper presents a system which is driven by the touch input to mobile app or via joystick movements. Major objective of this system was to provide a system so that the blind and physically disabled population can easily use it in their daily use. The system is very efficient for the general population as well. Guardians require a mobile device to communicate with the wheelchair and get patients health status. This project implementation will help all the people who are dependent on wheelchair for their basic needs. Wheelchair is simple to operate and does not need any external help. All common man can reach out for this wheelchair to become independent if they hold a smart phone.

### VII. FUTURE SCOPE

**Power Source:** Another source of power can be solar panel roof which will be an alternative power source also it will act as a protective layer from rain and sun.

**Artificial intelligence and image processing:** Artificial intelligence (AI) is an advanced technology and a branch of computer science that studies and develops intelligent machines and software. Major AI researchers and textbooks define the field as "the study and design of intelligent agents", where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success. The same can be implemented to increase the efficiency level of mobility.

**Mind control:** Controlling wheelchair by electric signal coming from brain. As our brain contains thousands of neuron, there is certain potential difference between each neuron. When we think something neuron emits 0 to 50 HZ electric signal. By interpreting the signal by modulation/demodulation, we can control the chair, implementing such technology will cover almost all type of disabilities.
**Gearbox System:** Using gear box we can produce a high speed moving wheelchair. PWM modulation can also increase the speed.

**Accelerometer:** Accelerometer for those people who cannot handle wheel chair movement by their hand. We can mount mobile on the head of paraplegic person and according to the movement of the head of that person the wheel chair will move. Innovating such things will help to move the chair easily by giving small gestures.

**REFERENCES**


