Smart Wheelchair Using Medical Iot

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Abstract: The new proposed system is based on android phone-controlled wheelchair along with the use of manual joystick. The main objective of the system is to focus on people who are handicapped and the ones who are not able to move freely. Therefore, with the design of the smart wheelchair can be an asset for medical department. Moreover, user can control this wheelchair with the help of joystick. It will allow the user to interact with the wheelchair at different level of control. The different level of control can be left, right, forward, backward and stop.

I. INTRODUCTION

Internet of things (IoT) is an idea that move an arrangement of anything associated with each other and can share data through web. The Internet of things (IoT) is a system of physical items, machines, individuals, and different gadgets that empowers network and interchanges to trade information for smart applications and administrations. These gadgets comprise of cell phones, tablets, shopper hardware, vehicles, wearable and sensors that are equipped for IoT interchanges. The Internet of things empowers articles to be controlled remotely transversely finished existing framework system, making open entryways for facilitate joining between the physical and mechanized universes realizing upgraded capability, precision, and budgetary focal points.

A wheelchair is a machine that can be able to move using wheels which can help a disabled person to move around with less dependency to others. Most disabled people have disabilities with their hands, foot, backs which can limit the person to perform regular tasks in a regular daily life.

Population of disabled people is increasing day by day. The factors for increasing the population of disabled people are premises fall, suicide cases, natural disasters like earthquake etc. There should be some means of machine so that people can move from one place to another. So, the proposed system is called SMART WHEELCHAIR which helps the disabled ones to move from one place to another without pushing the chair. The proposed system is an automated wheelchair where no need to push the wheelchair, it can be simply controlled by the user using joystick.

The pushing wheelchair is the popular one which with the help of a user, it need to be pushed around using their hands. It gives a hard time to the user when travelling for a long distance. So, with the help of technology and engineers, an idea of a "smart wheelchair using IoT" is proposed. The smart wheelchair is controlled by an android app which gives input to the wheelchair motor. The android app and wheelchair can be connected via WIFI or Bluetooth technology. A manual joystick can be used to control left, right, forward, backward and stop movements. Also, with help of Infrared sensors this smart wheelchair can be used to detect obstacles from all movements (left, right, forward, backward). So, with this smart wheelchair will become user friendly to user and patient. The Internet of things (IoT) is the combination of computing devices with the Internet infrastructure. Internet of things (IoT) provides machine-to-machine communications (M2M) and provides a variety of protocols, domain and applications.

The Five developments of the wheelchair can be depicted as following:
1) Pushing ahead
2) Going in reverse
3) Swinging to one side
4) Swinging to one side
5) Stop condition.

This protocol is used for detecting obstacles in all four directions of chair using IR sensors.

II. PROBLEM STATEMENT AND OBJECTIVE

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A. Problem Statement

Nowadays, many people with disabilities need special kind of care done by the community and it result in different difficulties like human power and so on. Specifically using a wheelchair is sometimes overwhelming for people taking care of disabled people. In some cases, pushing wheelchair for a long distance can required a huge amount of power for people in charge of disabled people.

Through all these difficulties we can combine technology and healthcare to produce a new system called "Smart Wheelchair system using Medical IoT". The new system consists of a smart wheelchair, android app to control the wheelchair, a joystick to allow the disabled person to move around in different directions and sensors monitoring health of a patient.

B. Objective

1) It will allow disabled people to move freely using the joystick, this resulting in less human power for pushing the wheelchair.
2) It will allow user to remotely monitor health of the disabled person on his/her android app.
3) User will be allowed to fully control the wheelchair in terms of movement and direction (left, right, forward and backward) using Graphical User Interface provided in the app.

III. LITERATURE SURVEY

In other systems, a prototype of automatic chair using ultrasonic sensor and Raspberry Pi which is used to execute all the commands were designed. 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 enumeration report expresses that there is an expansion in nation's impaired populace by 22.4% in the vicinity of 2001 and 2011. In 2001 tally of impaired was 2.19 crore in 2001, which has gone up to 2.68 crore in 2011 out of which 1.5 crore are guys and 1.18 crore are females. The greater part of the debilitated are those with physical incapacity, representing 20.3% for add up to impaired populace. The deadened individual gets limited to wheelchair and end up reliant on different people for their development and day by day needs. Numerous endeavors have been made to modify the wheelchair by adding additional hardware to it. The current wheelchair in showcase like voice-controlled wheelchair and head control wheelchair have couple of disadvantages, for example, ecological unsettling influences, mechanical issues or cost.

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.

IV. PROPOSED SYSTEM

IoT-based human services frameworks can be connected to a differing cluster of fields, including tend to pediatric and elderly patients, the supervision of incessant maladies, and the administration of private wellbeing and wellness, among others. It can be noticed that administrations are utilized to create applications, while applications are specifically utilized by clients and patients. Notwithstanding applications shrouded in this segment, different devices, wearables, and other human services gadgets as of now accessible in the market are examined. These items can be seen as IoT developments that can prompt different social insurance arrangements. Here we talk about some of IoT-based medicinal services applications.
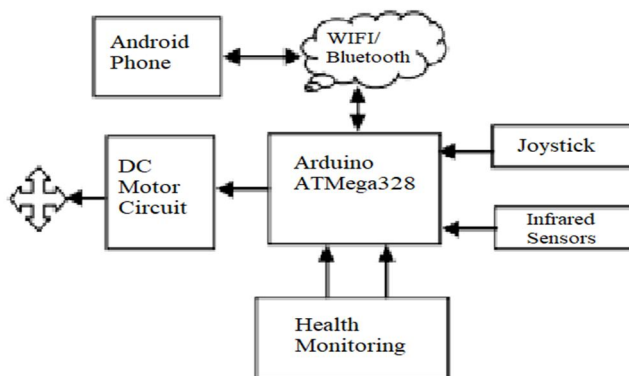
A. System Architecture

Figure 1 System Architecture

The above figure illustrates the system architecture which defines the working system. In the 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.

B. Hardware Requirements

1) Joystick

Figure 2 Joystick

A joystick is a data contraption including a stick that turns on a base and reports its edge or bearing to the device it is controlling. We are using twofold center XY joystick biaxial catch PS2 module. This module merges two potentiometers and a push get switch into a solid mechanical package with an ergonomic thumb curve. This joystick is perfect for controlling motors, servos, etc.

2) Sensors

a) *Infrared Sensor:* it is used to detect if there are any obstacles in any direction depending on which direction you are traveling to. When the sensor detects an obstacle, it sends continuous signal from transmitter and immediately stops the wheelchair.

b) *Health monitoring sensor:* This sensor is attached to the microcontroller for monitoring the real time health of patient. This information is then sent to the user of the wheelchair through the mobile app. Some of the sensors can be pulse detecting sensor or temperature sensor.

3) Motor

Figure 3 Motor

Motors are apparently a champion among the most indispensable parts of a flexible mechanical self-sufficiency organize. Over controlled motors cause inefficiency and waste the formally compelled supply of vitality from the introduced batteries, while undersized motors could be short on torque at fundamental conditions. The perfect rotate speed and the open speed extent of the motor ought to in like manner be considered. Too high of a yield rpm from the motor shaft will influence the wheelchair to work at a brisk, wild speed. Too low of a yield and the robot won't have the ability to achieve a sensible speed to address the customer's issues. Along these lines, much idea was put into the decision of the right motor for the stage. DC motors are ordinarily used for little occupations and suited the explanations behind the stage outstandingly well. We are using a 12V DC motor in our wheelchair with L293D motor driver.

4) Wheels

Figure 4 Wheels

Motors are clearly a champion among the most essential parts of an adaptable mechanical innovation organize. Wheelchair has four wheels, two back deals caster wheels, the two caster wheels are engaged in wheelchair base in front which help to advance toward any way depending upon raise wheels. The drive wheels are in raise on either side of the base, empowering the seat to swing according to customer rules, wheels attract direct to a gear prepare that transmit torque outline motor to wheels by two wrinkles in each deal.

5) ATMega328 Microcontroller

Figure 5 ATMega328 Microcontroller

The Atmel 8-bit AVR RISC-based microcontroller joins 32 kB ISP streak memory with read-while-create limits, 1kB EEPROM, 2kB SRAM, 23 all around valuable I/O lines and 32 comprehensively helpful working registers. The device works between 1.8-5.5 volts. ATmega328 is by and large used as a piece of various endeavours and self-decision structures where an essential, low-energized, insignificant exertion scaled down scale controller is required. Maybe the most widely recognized usage of this chip is on the well-known Arduino improvement stage, in particular the Arduino Uno and Arduino Nano models.

6) WIFI Module

Figure 6 ESP8266

ESP8266 is a stunning, insignificant exertion Wi-Fi module suitable for adding Wi-Fi helpfulness to a current microcontroller wander by methods for a UART serial affiliation. The module can even be recreated to go about as an autonomous Wi-Fi related device. It requires 3.3V power. ESP8266 has features like 802.11 b/g/n tradition, Wi-Fi Direct (P2P), sensitive AP and Integrated TCP/IP tradition stack.
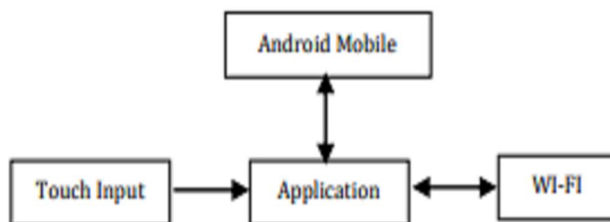
C. Transmitter Unit

Figure 7 Transmitter Unit

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The Android portable holding android application is utilized as information where it's realistic UI enables the client to move the wheelchair toward any path, SOS help, and wellbeing screen contingent upon wellbeing sensor utilized. At the point when the client addresses the virtual bearing catch gave on the application GUI, the summon is transmitted from transmission unit to getting segment through WIFI or Bluetooth.
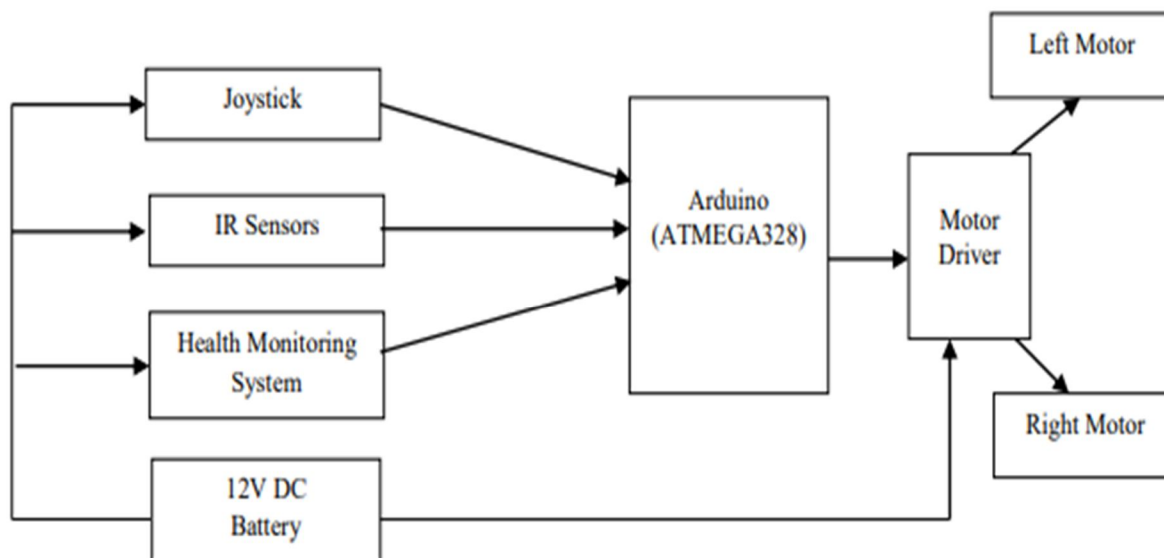
D. Receiver Unit

Figure 8 Receiver Unit

The microcontroller changes over the string into ASCI code and after that this code is decoded and as indicated by it the engines are given supply and swung to have straight movement of the wheelchair. Wi-Fi module is utilized for remote transmission of information, worked on 5V. Battery of 12V is utilized to drive the wheelchair. Battery is utilized with the end goal of versatility. DC engines are driven by L293D driver IC. L293D is a double scaffold IC. For forward development the engines are pushed ahead and for turnaround development the engines are moved in reverse heading. For left development the left engine is halted and right engine forward way and for right development the correct engine is ceased and left engines are moved forward way.
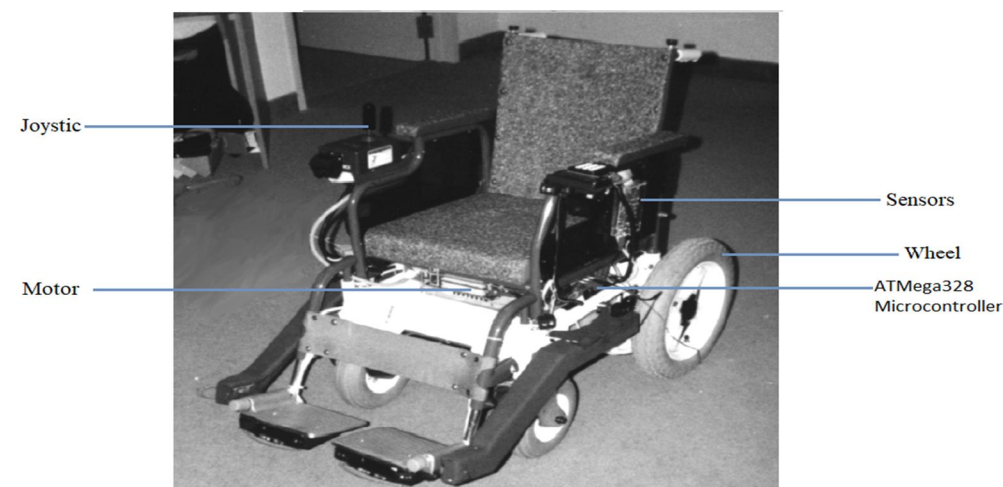
E. System Design

Figure 9 System Design

This is how the proposed smart wheelchair will look like. The proposed system will help the disabled people improve their posture, track their activity, shows their falling alert and many more.

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F. Advantages and Disadvantages of Smart Wheelchair system

1) Advantages of Smart Wheelchair

a) The proposed system will allow mobility to the patient to move around anywhere without any help.

b) It will allow independence to the patient resulting to move around without any help of pushing the wheelchair and constantly the nurse being around the patient all the time.

c) It will provide comfort for your back to encourage a good posture.

2) Disadvantages of Smart Wheelchair

a) Maintenance and repair will cost much

b) Battery power may not be sufficient for the patient.

c) Smart wheelchair will cost much more than normal wheelchair.

G. Challenges of Smart Wheelchair

The Smart Wheelchair aim to allow disabled people to move around without the help of a person to push them around, help monitor the health and secure their medical data.

We have listed a few major challenges of the Smart Wheelchair, the following are;

1) Connectivity issues: The smart wheelchair will need to connect through WIFI module on the wheelchair to the android app developed specifically for the wheelchair. Sometimes this connection may fail resulting the app that won't work properly.

2) Manpower: As the patient using the smart wheelchair, using the joystick to move around may be tiring after sometime. And again, the Smart Wheelchair may stop functioning and require some maintenance, then the patient need someone to help moving around.

3) Security breach: As the Smart Wheelchair contain medical information of the patient who is using it, potential hackers may attach the wheelchair to get that information. Also, hackers may remote control the wheelchair for sudden movements.

4) Cost: As the Smart Wheelchair is not a normal wheelchair, there will be increase of its cost.

V. CONCLUSION

Researchers over the world have started to explore diverse mechanical responses for enhance human administrations course of action in a way that supplements existing organizations by amassing the capacity of the IoT. The proposed structure gives unmistakable research practices concerning how the IoT can address pediatric and elderly care, unremitting ailment supervision, private prosperity, and health organization. To better appreciate IoT social protection security, we considered diverse security requirements to propose a model that can lighten related security risks. In whole, the results of the survey are depended upon to be useful for researchers, engineers, prosperity specialists, and policymakers working in the zone of the IoT and social protection developments.

The proposed system will help disabled people to move freely and independently and facilitating the people in charge of taking care of the disabled people to use less power for pushing the patients also user can control the wheelchair and monitor health of the disabled person from his/her android phone with android app developed to control the wheelchair. Basically, the wheelchair will provide basic needs for disabled people such as moving around without being pushed around by users also user can control and monitor health status of patient.

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