

Smart Wheelchair Using Internet of Things

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Article Info

Volume 83

Page Number: 5329-5332

Publication Issue:

May-June 2020

Abstract

Internet of things (IOT) technologies has transformed the way we interact with the digital devices. IOT can applied across various domains. However it is more beneficial when applied to monitor the health for old and disabled people. This paper presents an IOT based healthcare monitoring system for wheelchair users. Wheelchair users are mostly physically disabled and elderly people who require medical attention. They require a lot of human help to move even in their own home. This paper focuses to design and build a wireless healthcare monitoring system and a wheelchair controlling system. Healthcare monitoring system generates alerts based on pulse sensor, temperature sensor and a camera module attached to the wheel chair. The wheelchair controlling system controls the movement of wheel using an android remote controller, voice controller and a joystick controller. Our IOT based smart wheel chair extends a helping hand for the disabled /old people and their families.

Article History

Article Received: 19 November 2019

Revised: 27 January 2020

Accepted: 24 February 2020

Publication: 16 May 2020

Keywords: Internet of things; wheelchair users; healthcare monitoring system)

1. Introduction

Mobility and healthcare are an essential part of every human being. People who are physically challenged or paralyzed cannot have the same freedom as others, because of their incapability of mobility. It is very difficult to handle a basic wheelchair for this kind of people, due to a lot of physical stress on their hands. For such people a voice-controlled and an android remote-controlled wheelchair is introduced.

In a basic wheelchair muscular force is used to move, but it is very strain-full and consume a lot of energy to handle. In an automatic wheelchair, the wheels are driven by the electric motor according to user commands given by voice or android remote. Also, in an automatic wheelchair obstetrical detection sensor are used to stop and avoid collisions.

Health Monitoring is crucial for patients who have lost their limbs due to nervous system disorder or paralysis. As these patients need to have a regular checkup, a pulse rate and temperature monitoring systems are introduced in the automatic wheelchair which uses IOT technology and also it is cost-efficient.

In this paper we study various intelligent models which implement the concept of voice and android remote-controlled wheelchair along with the healthcare

system, discuss their making and focus on their merits and demerits. Towards the end, we propose a model, which will try to enhance the merits and minimize the demerits of the models discussed.

2. Literature Survey

Being able to ensure safe traveling of an assistive power wheelchair requires several preconditions to be met. First, the importance of safety issues has to be accepted and rigorously taken into account during system design. Second, methods to satisfy the safety requirements have to be found[1].

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.

A camera module on the wheelchair is helpful to take-career for checking the condition of the wheelchair user[2]. An plus sensor that is embedded into the wheelchair is used for taking the pulse reading of the wheelchair user[3].

Using the technology we can send the readings of the pulse sensor and temperature sensor to a database, and that can be accessed by the take-career or the doctor[4].

3. Methodology

The proposed system contains a module that is attached to a regular wheelchair. The Wheelchair module is divided into two main functionalities that is Health monitoring system and Wheelchair controller. The block diagram is depicted in the *Figure 1*.

A. Health Monitoring System:

The health monitoring system is crucial for a Wheelchair to monitor the condition of the user. The system is equipped with a pulse sensor, temperature sensor, Wi-Fi module and a camera module. All these sensors are connected to the cloud with the help of Wi-Fi and IoT technology. The reading of the sensors is stored in the AWS Database. The camera is used for monitoring the condition of the patient or the wheelchair user. When there is a sudden change in the readings of the sensors an alert message sent to the caretaker and to the doctor.

B. Wheelchair Controller:

The wheelchair controller is equipped with a motor drive, Bluetooth module, joystick, battery, motors, obstacle detection sensor and an android app that has voice and remote joystick controller. Except for the android app, all the other components are connected to the Arduino. The wheelchair module is attached with a joystick to control the wheelchair directly. The Bluetooth module is used to connect with the android app, the app has a joystick and a voice recognizer to send the commands to the module and control the moment of the wheelchair. The obstacle detection sensor is used to stop the wheelchair from collisions.

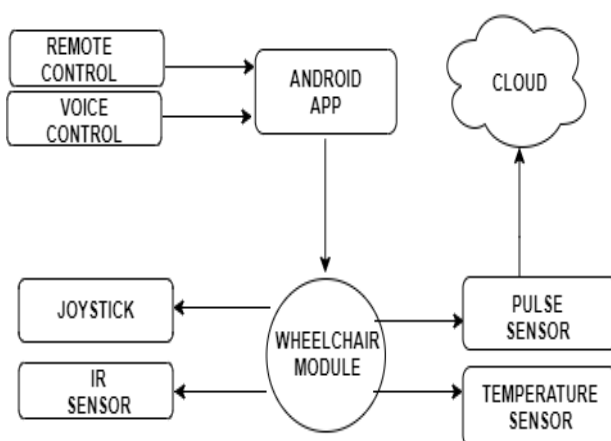


Figure 1: Block Diagram

C. Components:

The following components used in our module are specified below.

• Arduino UNO:



Figure 2: Arduino Uno

Figure 2 is the 8bit pin board which combines 32kb flash memory with read write capabilities, 23 general purpose i/o lines, it operates between 1.8-5.5 volts .it is commonly used in many projects .which helps in connecting many sensors and devices easily.

• LCD Display:



Figure 3: LCD Display

A 16x2 LCD display is being used in this project is shown in *Figure 3*. It is connected to the Arduino uno at 9,8,7,6,5,4 pins to display the readings of the various sensors and to display the direction of the wheel chair

• Wifi module:



Figure 4: Wi-Fi Module

Figure 4 is an super cost friendly module which is suitable for adding Wi-fi functionality to an existing Arduino. It requires 3.3 volts of power .it has features like integrated TCP/IP protocol.

• IR Sensor:



Figure 5: IR Sensor

IR sensor is used to detect the obstacles present is shown in *Figure 5*. It detects the obstacles by sending continuous signals from transmitter and stops immediately the wheel chair.

- **Heartbeat Sensor:**

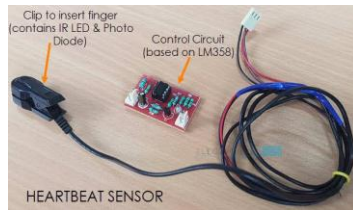


Figure 6: Heart beat sensor

Heartbeat sensor helps us to continuously monitor on the pulse of the patient and gives the information to the doctor through cloud is shown in Figure 6.

- **Temperature sensor:**



Figure 7: Temperature Sensor

Temperature sensor is used to constantly monitor the temperature of the patient and give the information to doctors is shown in Figure 7.

- **Motor driver:**

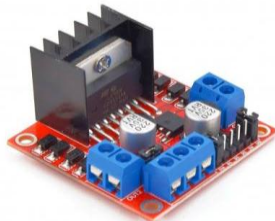


Figure 8: Motor Driver

Motor driver is used to connect the motors indirectly to the Arduino and is one of the major part in mobile robotics platform is shown in Figure 8. Overpowered supply causes inefficiency in the limited supply of power from the on board batteries . The optimal rotation speed and the available speed range of the motor should also be taken into consideration . DC motors are commonly used for the small jobs and is suitable perfectly. We are using 12v DC motor and L298N motor driver in our wheel chair

- **Voice Controlling System:**

The wheel chair can be controlled through voice .here we are using Bluetooth module for connecting the voice controlling android app which helps in moving in certain direction as needed.

- **Camera Module:**

It is used to monitor the patient by the care taker and respond immediately if there is an emergency

4. Results

The results of Wheel chair monitoring system and Health Monitoring system are depicted below

A. Wheelchair Monitoring System:

The Wheelchair controller is equipped with a motor drive, Bluetooth module, joystick, battery, motors, obstacle detection sensor and an android app that has voice and remote joystick controller. The Complete Wheelchair Module is depicted in Figure 9. The android app code snippet is shown in Figure 12 and the voice based commands for direction are provided to the wheel chair and are displaced on LCD as shown in Figure 10 and Figure 11



Figure 9: Wheelchair Module



Figure 10: Direction display



Figure 11: Direction display

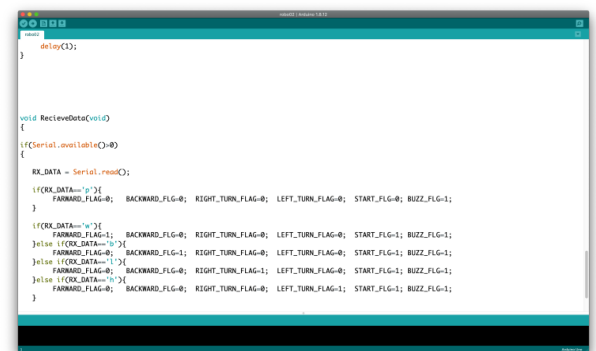


Figure 12: Code snippet

B. Health Monitoring System:

The health monitoring system is equipped with a pulse sensor, temperature sensor, Wi-Fi module and a camera module. All these sensors are connected to the cloud with the help of Wi-Fi and IoT technology. Figure 13 tests the temperature and pulse sensors of a patient whose readings are depicted in Figure 14



Figure 13: Temperature and Pulse sensor



Figure 14: Readings of pulse

5. Conclusion and Future Scope

The proposed prototype will enable a great ease in movement and socializing of disabled people with very negligible human intervention. It is easy to use and operate as the movements are just one touch away. The various sensors present in the system along with health monitoring system makes it a very enhanced module which is very reliable and helpful to wide range of users.

As a future scope, the following enhancements can be added i) the implementation of gear box that helps in controlling speed of wheel chair. ii) a solar panel can be installed for charging the wheel chair which is eco-friendly iii) Applying Big Data Technologies and artificial intelligence in analysing the data collected from various sensors will increase the reliability of wheel chair iv) Adding GPS to the wheelchair in order to incorporate outdoor positioning system in the wheelchair.

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