SMART WHEEL CHAIR WITH IN-BUILT HEALTH MONITORING SYSTEM

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Abstract: **Around the world we see many people who are physically challenged. One among them is those who use wheelchairs. This project is mainly useful for partially disabled people who can be able to move their hand by their own. In present situation a person on a wheel should have a caretaker who always looks after the person on the wheelchair. It is difficult for the caretaker to keep an eye on the patient all the time. If in case when the patient is resting and there is no one with him/her, suddenly an incident happens it will lead to risk of life of patient. This is major drawback of the wheelchairs that are in use currently. To overcome this problem, we have brought in a new concept and developed a smart wheelchair which monitors patient's Heartbeat and Temperature sensor. By using Accelerometer sensor based on the Hand gestures given by the disabled person respective action will be takes place for the movement of wheelchair. If there are any abnormal condition notices by using the GSM module the information will send to the patient caretaker.**

Keywords: Arduino Uno, GSM, Sensors, Accelerometer, patient vitals

1. INTRODUCTION

Smart wheelchair with inbuilt health monitoring system is an innovative assistive technology that aims to improve the mobility and health of individuals with physical disabilities or limited mobility. These systems provide real-time monitoring of vital signs, such as heart rate and Temperature. The problem with the traditional wheelchairs is that they require manual operation and assistance, which can be physically and mentally exhausting for both the user and their caretaker and lack the capability of monitoring the health status of the user which can result in delayed diagnosis of health issues. It is designed to address the challenges faced by individuals who use wheelchairs and their caretakers by incorporating health monitoring sensors that track vital signs in case there will be any inappropriate condition the collected data is transmitted to caretakers by using GSM module. Therefore, this paper is aims to provide a more convenient and efficient solution for individuals who need assistance with mobility and the system is used to navigate the patient vitals continuously more easily.

2. LITERATURE SURVEY

[1] The paper, titled "Arduino-based voice-controlled wheelchair," by Kian Hou, Yagasena and Chelladurai. The wheelchair is intended to assist individuals who have both upper and lower limb restrictions. This wheelchair prototype based on Arduino was effectively created and tested to respond to voice instructions. It will significantly enhance the lives of those with severe impairments. It was created utilising a commercially available manual wheelchair and the complete cost was kept low. The given command from the speech recognition module is processed by an Arduino microcontroller, which controls the motor movement. A Bluetooth module was also included to eliminate cumbersome wiring, and the design included an optional joystick command. This project's motors frequently stall, and the wheelchair struggles to move after coming to a complete stop or zero speed while carrying a

load weighing more than 65kg. [2] Deepak Kumar Lodhi et al., presented a paper, titled "Smart Electronic Wheelchair Using Arduino and Bluetooth Module". This proposed concept depicts the creation of a smart, motorised, voice-controlled wheelchair using an embedded system based on an Arduino Uno board, a Bluetooth Module, a Motor Driver, and an Android phone. In a single package, the processing units are directly linked to the wheelchair. The recognition rate of the speech recognizer was greater than 90%. Because the processing units are attached as a package, removing the entire package to troubleshoot the issue would be necessary. [3] ZannatulRajyan et al., presented a paper, titled "Design of an Arduino Based Voice-controlled Automated Wheelchair". A motor-controlled wheelchair built with an Arduino Mega, VR3 module, and SIM900A GSM module. The use of the VR3 module is a nice addition because it reduces the complexity of voice processing. The GSM module is included to send a message to the carer or doctor if there is an emergency involving the patient utilising the wheelchair. The Arduino Mega is utilised in this work since it has larger memory storage than the Arduino UNO, but the clock rates on the two development boards are the same. [4] PolashPratim Dutta et al., presented a paper, titled "Design and Development of Voice Controlled Wheelchair". The voice input is provided via an Android device and is routed to the Arduino UNO through the HC-05 Bluetooth module. In this scenario, the Bluetooth module's range, and the clarity of the voice from the android device's microphone are of particular interest.

[5] AKMBahalulHaque et al., presented a paper, titled "A Novel Design of Gesture and Voice Controlled Solar-Powered Smart Wheelchair with Obstacle Detection". The approach for controlling the movement was established. The two control modes are present. The wheelchair's mobility was also controlled by hand gestures. In the worst-case scenario, the person may not even be able to lift their hand or speak; in these cases, another control is required. Solar energy was used to power the motors and their drivers. When it comes to solar energy applications, it is also great for storing the charge. [6] Ali A. Abed et al., presented a paper, titled "Design of Voice Controlled Smart Wheelchair". The goal of this project is to create Arduino-based speaker-dependent speech-controlled navigation systems. The voice recognition capability is tested in both noisy and silent conditions, and good accuracy is attained. Because the goal is voice recognition, it is best to train the model in both loud and silent environments. [7] Rashmi P et al., presented a paper, titled "Development of Electric Wheelchair for Smart Navigation and Health Monitoring System". Using an Arduino UNO and a Raspberry Pi to provide live broadcasting, the system offers a foundation for a smart, low-cost wheelchair for persons with disabilities that can be changed into a stretcher. The prototype connects Pi to the Android software blue dot, which analyses and stores data from the impaired person's pulse rate, heart rate, temperature, and ECG in the cloud. In the event of a medical emergency, an SMS alert will be issued to the carer. To construct and manage the health database. To build and manage the health database, the Thing Speak platform is used to store and keep health monitoring data. The pricing is one of the most common difficulties.[8] DivyaJennifer Dsouza et al., presented a paper, titled "IOT Based Smart Wheelchair for HealthCare". It provides remote health monitoring services by utilising Arduino and an IOT cloud platform. Physicians can use the web services to frequently record and monitor their patients' health, and patients can communicate directly with their doctors in the event of an emergency. The sensors are positioned at the armrest. Sensors measure pulse rate and blood oxygen levels, which are processed by Arduino and relayed to the cloud, which starts an SMS update in the event of an abnormality. Because disabled people cannot afford to travel, this technique allows them to receive healthcare remotely.

[9] Shwetha V et al., presented a paper, titled "Voice Controlled Wheelchair". The goal is to make it easier for people with physical restrictions to move around autonomously, as well as to make it easier for those who lack the ability to use a joystick by using a microphone. To

implement voice recognition on an Ubuntu system, the software leverages the CMU Sphinx Toolkit and the Portable Sphinx library. Python is used to write the voice recognition code. In this study, key phrase spotting and a sliding match filter are used and tested in a variety of test settings. When evaluated in various conditions with fine-tuning, the Key approach gives a mean accuracy of up to 75% and a maximum accuracy of 90% in a noisy environment. They employed visual processing to detect impediments and edges. [10] ManuelMazo et al., presented a paper, titled "Wheelchair For physically disabled people with voice, ultrasonic and infrared sensor control". Control of ultrasonic and infrared sensors: The system includes joystick, voice, and automated driving modes. The proposed system's integration of infrared and ultrasonic sensors aids in the avoidance of impediments such as stairs and holes. The disadvantage is that gridlines are widespread in homes, and the sensors are so sensitive that these grids are misinterpreted for holes. The system's cost will rise dramatically. The system's cost will rise dramatically. [11] Rajdeep Sarkar et al., presented a paper, titled "Smart Wheelchair with inbuilt health monitoring system". The wheelchair has four DPDT switches that allow the user to move the chair in any direction. The Bluetooth module on the wheelchair is linked to the DC Motors through an Arduino UNO. Both wired and wireless controls can be used at the same time. A heartbeat sensor is fitted to the wheelchair. With a 30 second delay, this sensor continuously measures the patient's pulse values. A GSM module sends a notification message to the doctor in charge, keeping them up to speed on the patient's health status 24 hours a day, seven days a week. In the event of an emergency, a message will be issued to all the contacts identified in the database, allowing them to take urgent action to save the patient. The motors in this model are powered by 12V rechargeable batteries, which must be charged. [12] LeandreNsengumuremyi et al., presented a paper, titled "Smart Wheelchair Using Medical IOT". It is built on an Android app and a joystick-controlled wheelchair. WIFI or Bluetooth technology connects the app to the wheelchair. The app provides input to the wheelchair, and the physical joystick may be used to control the left, right, forward, and backward moments, as well as stop. Obstacles are detected from all four directions using infrared sensors. It will allow the patient to move around without assistance and with the least amount of reliance by eliminating pushing the wheelchair and constant monitoring by the nurse, as well as ergonomics to provide comfort for the back rest and encourage proper posture. The fundamental disadvantage of these design principles was the high expense of maintenance and repair. The smart wheelchair will be substantially more expensive than a standard wheelchair.

3. COMPONENTS USED IN OUR SYSTEM

Pulse sensor:

A Pulse sensor is a device that is used to detect the change in the volume of the blood vessel that occurs when the heart pumps blood. The pulse sensor is connected to the Arduino Uno. The range of this sensor is +5V or +3.3V. The length and width of the sensor is 0.625 and 0.125 respectively. This sensor is fixed to the fingertip.

FIG 1: PULSE SENSOR

Temperature sensor:

A LM35 Temperature sensor is a device that is used to measure body temperature. This sensor is connected to the Arduino Uno. The operating voltage is from 4V to 30V. It consumes 60 uA current. The typical accuracy is ±0.5°C at room temperature and ±1°C for a full −55°C to +155°C temperature range.

FIG 2: LM35 TEMPERATURE SENSOR

GSM Module:

`Global System for Mobile communication (GSM) module is a wireless device connected to the Arduino Uno and it is widely used for mobile communication system. It can be able to receive the serial data from radiation monitoring devices and transmits the data as a text message to hosts server.

FIG 3: GSM MODULE

Accelerometer sensor:

ADXL335 Accelerometer sensor is the device that can be measure acceleration force. When acceleration is applied then the capacitance inside the sensor will be changed. The output values range of sensor is approximately 0v at -3G to 3.3v at +3G.

FIG 4: ACCELEROMETER SENSOR

L293D Motor Drive:

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. It is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It works on the concept of H-bridge. It receives signals from the microprocessor and transmits the relative signal to the DC motors.

FIG 5: L293D MOTOR DRIVE

Arduino Uno:

Arduino Uno is a microcontroller board based on the microchip ATmega328P microcontroller. It consists of 14 digital input/output pins and 6 analog pins. The operating voltage is 5V and input voltage range is 7-12V. Arduino Uno is used as brain of the project.

FIG 6: ARDUINO UNO

4. PROPOSED SYSTEM

Proposed system will be able to move the wheelchair and send alert to the guardian whenever any abnormal condition occurs. The System we made is the lower cost than others and very easy to use. The system uses the Arduino as main controller of the system other than that we use three axis accelerometers to find direction, temperature sensor and Pulse sensor for monitoring user health condition. Block diagram for the proposed system shown in Figure 7.

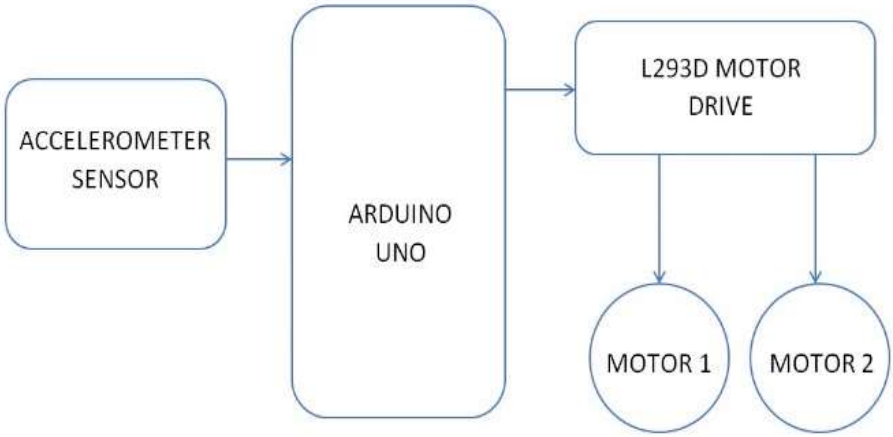

FIG 7.1: BLOCK DIAGRAM FOR WHEEL CHAIR

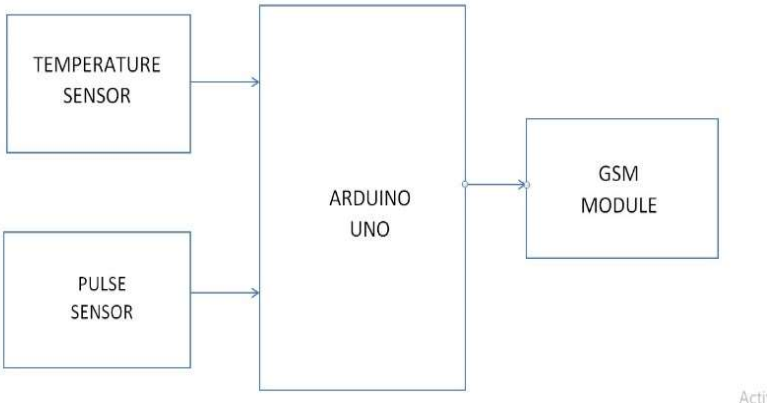

FIG 7.2: BLOCK DIAGRAM FOR HEALTH MONITORING SYSTEM

5. WORKING PROCEDURE

Whenever the user wants to move to desired location, he/she must tilt his/her hand, the accelerometer sensor detects the tilt angle and sends data to Arduino. Arduino process the data and it identify the direction and move the wheelchair according to user instructions. Our system also comes with health monitoring system. The health monitoring system continues monitoring the user health and sends alert to guardian whenever any abnormal situation arises. Here we are monitoring user body temperature and heartbeat using temperature and pulse sensor. Flow chart for proposed system is shown in Fig 8.

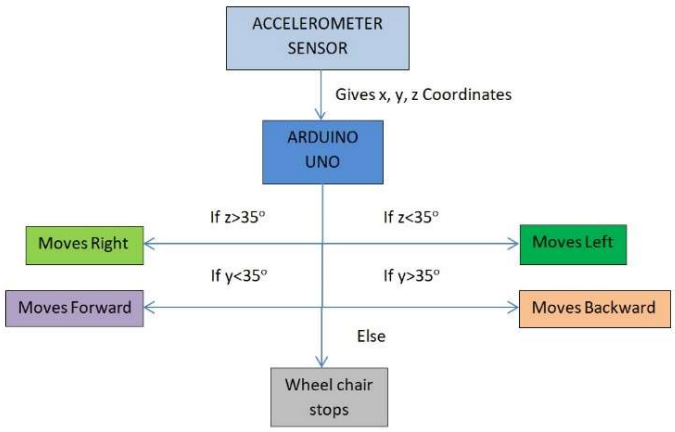

FIG 8.1: FLOW CHART FOR WHEEL CHAIR

PALM MOVEMENT	FUNCTION	ACTION
Upward	back()	Chair moves backward
Downward	Front()	Chair moves forward
Right	Right()	Chair moves right
Left	Left()	Chair moves left
Horizontal	Stop()	Chair stops

FIG 8.2: FUNCTIONAL TABLE FOR WHEEL CHAIR

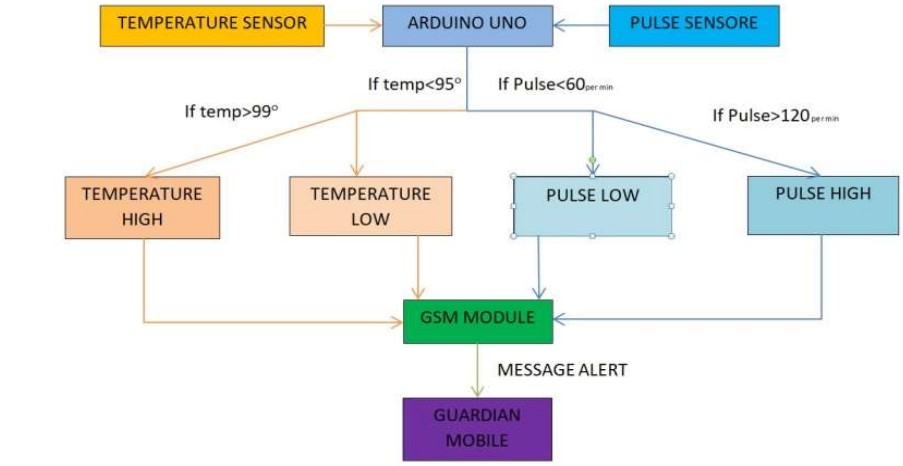

FIG 8.3: FLOW CHART FOR HEALTH MONITORING SYSTEM

6. EXPERIMENTAL RESULTS

Hardware Setup

A Prototype was developed for the Smart wheelchair and Health Monitoring System. The figure 9.1 and figure 9.2 shows the pictorial representation of the developed hardware.

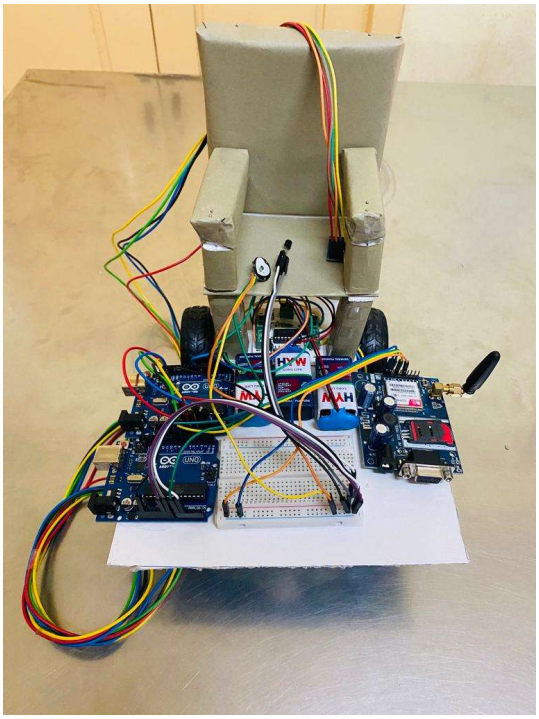

FIG 9.1: SMART WHEEL-CHAIR

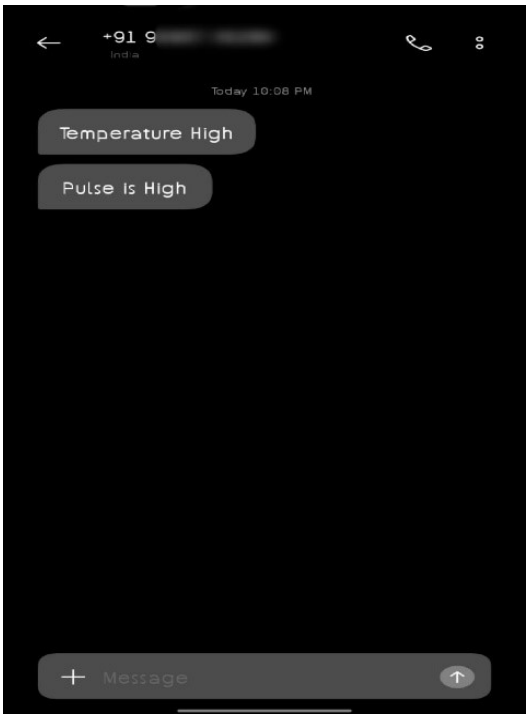

FIG 9.2: MESSAGE RECEIVED FROM GSM MODULE

The wheelchair will move based on the hand gesture given by the paralysed person and if there is any change in the Patient health condition the system monitors the temperature and Heartbeat based on the sensors provided to it and message will send to their guardian through GSM Module.

7. CONCLUSION

Smart wheelchairs with inbuilt health monitoring systems are a promising solution for wheelchair users who require constant monitoring of their health. These systems offer numerous benefits, including real-time monitoring of vital signs, and greater independence. This system can also help to provide emergency assistance when required. The developed system can be further improved by incorporating additional sensors and devices to monitor other health parameters. The future of smart wheelchairs with inbuilt health monitoring systems is bright, and they have the potential to revolutionize the lives of wheelchair users.

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