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RESEARCH ARTICLE OPEN ACCESS

Health Guardian IOT Based Wheelchair

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Abstract-

Our Smart Wheelchair represents a pioneering assistive technology that redefines mobility and healthcare for users with physical challenges. Featuring intuitive voice and touch controls for seamless navigation, this wheelchair prioritizes user convenience. Beyond mobility, it integrates advanced health monitoring capabilities, including heart rate, SpO2 monitoring & temperature, ensuring user well-being. Safety is paramount, and the wheelchair incorporates obstacle detection technology for a protective journey. What sets it apart is its seamless integration with our dedicated mobile app. This app acts as a real-time health dashboard, collecting and analyzing health data for valuable insights. In addition to these features, our Smart Wheelchair incorporates GPS tracking, enhancing user safety and providing real-time location information. This comprehensive innovation offers increased independence, improved health management, and an elevated quality of life for individuals with mobility impairments. It is a leap forward in assistive technology, focusing on holistic well-being, ensuring a brighter and healthier future for users.

Keywords: - Microcontroller, touch sensor, voice, GPS, health, SpO2, heart rate, temperature

I. Introduction

The Voice and Touch Sensor Controlled Wheelchair represents a groundbreaking leap forward in mobility technology, aimed at empowering individuals with diverse mobility needs. By integrating cutting-edge voice recognition and touch sensor technology, this wheelchair offers an unparalleled user experience that is both intuitive and seamless. Gone are the days of cumbersome joystick controls; instead, users can navigate their surroundings with unprecedented ease using simple voice commands or gentle touches. This revolutionary approach to mobility opens up a world of possibilities for individuals seeking a more accessible and inclusive way to move through life. It's not just about getting from point A to point B; it's about reclaiming independence and freedom, redefining what it means to be mobile in today's world. Imagine the liberation of being able to effortlessly control your wheelchair with just your voice or a light touch. Whether you're manoeuvring through crowded spaces, traversing uneven terrain, or simply enjoying a leisurely stroll outdoors, this innovative wheelchair adapts to your needs, offering a level of convenience and flexibility never before thought possible. No longer do users have to struggle with complex controls or rely on assistance from others; with the Voice and Touch Sensor Controlled Wheelchair, independence is truly within reach. But the benefits of this revolutionary wheelchair extend far beyond its intuitive control system. Equipped with state-of-the-art safety features, including advanced obstacle detection and avoidance technology, users can enjoy a smoother and safer ride with greater peace of mind. Whether it's detecting obstacles in the wheelchair's path or alerting the user to potential hazards, these safety features ensure that every journey is as secure as it is convenient. Moreover, the customizable nature of the wheelchair's control system allows users to tailor their experience to their unique preferences. From adjusting voice commands to fine-tuning touch sensitivity settings, the wheelchair adapts to accommodate individual needs, making every movement a breeze. Whether you prefer a more responsive touch interface or rely heavily on voice commands, the choice is yours, ensuring a personalized experience that enhances your overall mobility and comfort. Join us on a journey where mobility meets technology, as we redefine what it means to be mobile in today's world. It's not just about getting from point A to point B; it's about reclaiming independence, fostering inclusivity, and empowering individuals to live life on their own terms. With the Voice and Touch Sensor Controlled Wheelchair, the future of mobility is here, and it's more accessible and inclusive than ever before.

II. Literature survey

This system offers a wheelchair that is intended to increase a person's independence who has a disability. We have studied the following research paper: -

1.**Intelligent Gesture Controlled Wireless Wheelchair for the Physically Handicappedby** ShreedeepGangopadhyay [1]: -

The Hand Gesture Navigation System, designed for physically handicapped individuals, utilizes RF transmitter-receiver modules for wireless control. Operated through hand gestures, it employs an Arduino microcontroller for locomotion commands. An accelerometer sensor, specifically the ADXL335, detects hand orientation by measuring accelerating forces and translating them into voltage readings. This low-cost solution facilitates independent navigation within the home environment. With scalability for broader implementation and affordability for wider accessibility, the system offers increased confidence through its wireless functionality. Overall, it represents a promising

solution to empower individuals with physical disabilities, enhancing their autonomy and mobility.

2.**Automatic Wheelchair with Essential Applications by** Akhila Aniyan [2]: -

The microcontroller unit orchestrates head movements and motor control in this comprehensive system. Utilizing a 12V DC power supply, it's adaptable to a 230V, 50Hz AC with an adapter. A voltage regulator ensures motor stability. An LED signifies power activation. Wireless communication, employing ASK or FSK modulation at 433MHz, facilitates command transmission via an encoder. Additionally, a magnetic sensor prevents accidents by detecting the main door's presence. Precision, security, comfort, and user-friendliness are paramount in this design. The circuit, featuring a PIC16F877A microcontroller, HT12E encoder, L293D motor driver, and various sensors, operates seamlessly with a 12V motor supply and 5V for other components. Crystal oscillation at 12MHz drives the microcontroller's clocking mechanism, enabling efficient control over home appliances via wireless transmission.

3.**Tongue Motion Controlled Wheelchair by** Moe Myint Aung [3]**:** -

The tongue motion control wheelchair utilizes wireless technology to aid individuals disabled by spinal cord injuries or repetitive strain injuries. Divided into transmitter and receiver sections, the transmitter includes a magnet, hall effect sensor, ATMega328 microcontroller, and RF transmitter to sense tongue movements and transmit data. If the RF transmitter model isn't received, the motor stops. The receiver section comprises an RF receiver, microcontroller, 2-channel relay module, and motor. Tongue movements are detected bythe microcontroller, which then operates the wheelchair's movement via the motor. This innovative system provides independence and mobility to those with limited mobility due to physical impairments.

III. System Design

a) Problem Statement

The overarching goal is to create an automated wheelchair system that significantly improves the mobility and independence of individuals with physical disabilities while ensuring that the solution remains cost-effective. This entails designing, developing, and producing a wheelchair that integrates automation technology to enhance ease of movement, accessibility, and user-friendliness. The primary focus is on making this technology-driven solution economically viable for a wide range of users, including those who may have limited financial resources.

b) Objective

The objective is to design, develop, and produce a technologically advanced wheelchair that incorporates touch and voice control for intuitive navigation, GPS for real-time location tracking and route planning, heart rate and SpO2 monitoring for continuous health assessment, and obstacle detection for enhanced user safety. The primary aim is to maximize convenience by providing a user-friendly interface and customization options while ensuring cost-effectiveness through efficient design, manufacturing processes, and affordability, making this innovative mobility solution accessible to a wide range of users with diverse needs and budgets.

IV. Hardware Implementation

a) Block Diagram of Purposed System

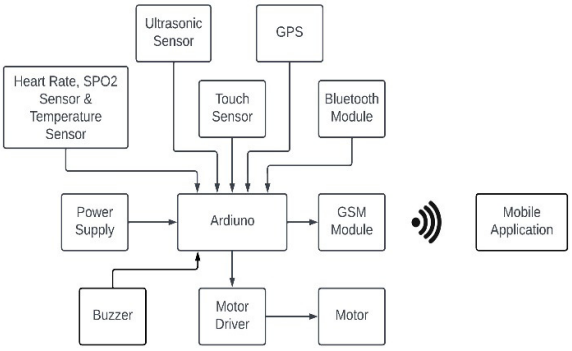

Fig. (1)Block Diagram of Purposed System

As shown in figure 1 the block diagram consists of following components: -

1. **Arduino Mega:** This serves as the main controller. It receives inputs from various sensors, processes the data, and controls the motor and other modules.
2. **GSM Module:** The GSM module is used to send the health related data to mobile application wirelessly.
3. **Motor Driver:** This controls the motors that drive the wheelchair. Arduino sends signals to the motor driver to control the speed and direction of the motor.
4.**Motor:** The motor physically drives the wheelchair, allowing it to move in different directions based on the signals from the motor driver.
5. **Power Supply:** This block provides the necessary power to all components of the wheelchair.
6. **Heart Rate and SpO2 Sensor:** These sensors can monitor the user's heart rate and blood oxygen levels, which can be crucial for healthcare purposes.
7. Temperature sensor DS18b20: This sensor is used to measure the body temperature.
8. **Touch Sensor:** A touch sensor can be used for user interface, allowing the user to control certain functions or provide input.
9. **Bluetooth Module:** This module can enable wireless communication with other devices like smartphones for control or data transfer.
10. **Ultrasonic Sensor:** Ultrasonic sensors can be used for obstacle detection, helping the wheelchair avoid collisions.
11. **GPS:** The GPS module can provide location data, which can be used for tracking the user location.

b) Circuit Diagram

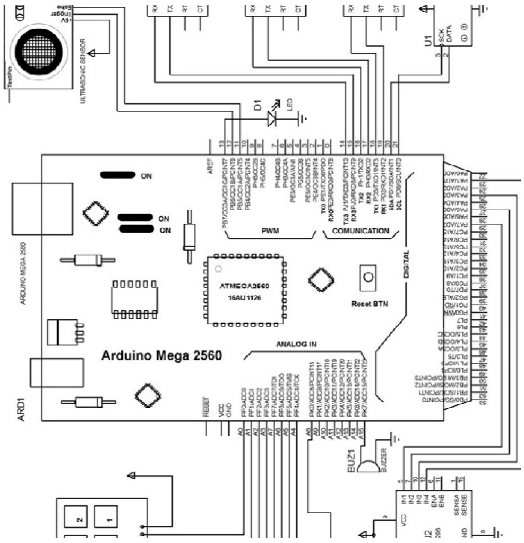

Fig. (2) Circuit Diagram

c) Circuit Description: -

As Shown in fig. 2 the Arduino Mega is used here as main microcontroller board. It will read sensor output, process it and also control the wheelchair. All the sensors and modules are connected to it.

HC-SR-04 Ultrasonic sensor is used to detect obstacle in front of wheelchair. It has four pins namely vcc, gnd, echo and trigg. The VCC and ground pins are connected to supply of arduino. The echo pin is connected to pin 12. The trigger pin is connected to pin 11 of arduino.

HC-05 Bluetooth module is used to receive command from android app. It has four pins namely vcc, gnd, tx and rx. The VCC and ground pins are connected to supply of arduino. The tx pin is connected to RX1 pin. The rx pin is connected to TX1 pin of arduino.

SIM800 GSM module is used to send alert message and access the internet. It has four pins namely vcc, gnd, tx and rx. The VCC and ground pins are connected to supply of arduino. The tx pin is connected to RX2 pin. The rx pin is connected to TX2 pin of arduino.

Neo-6M GPS module is used to get the latitude and longitude co-ordinate of map position. It has four pins namely vcc, gnd, tx and rx. The VCC and ground pins are connected to supply of arduino. The tx pin is connected to RX3 pin. The rx pin is connected to TX3 pin of arduino.

MAX30100 SpO2 module is used to measure the oxygen level and heart rate of person. It uses optical sensor to measure the parameters. . It has four pins namely vcc, gnd, sck and data. The VCC and ground pins are connected to supply of arduino. The sck pin is connected to SCL pin. The data pin is connected to SDA pin of arduino.

DS18B20 sensor is used to measure the body temperature of person. Its output is in digital format. It has three pins namely vcc, gnd, output. The vcc and ground pins are connected to supply of arduino. The output pin of sensor is connected to pin A8 of arduino.

DC gear motors are used to move the wheelchair. We used two motors. One is attached to left side wheel and other is attached to right side wheel. These motors are driven by motor driver module. Right side motor is connected to out1 and out2 of motor driver. Left side motor is connected to out3 and out4 of motor driver.

L298N motor driver module is used to drive the wheelchair motors. Motors are connected to out pins of module. The input pins of module IN1, IN2, IN3, IN4 are connected to pin 23, 25, 27, 29 of arduino.

TTP226 8-channel Touch Pad Sensor is used to send command to arduino for control the wheelchair. It has 10 pins. Two pins for vcc and ground which is connected to arduino supply. Remaining 8 pins for each touch pad. These pins are connected to A0 to A7 pins of arduino.

The buzzer is used to indicate the emergency alert. It has two pins namely + and -. The – pin of buzzer is connected to gnd of arduino. + pin of buzzer is connected to A15 pin of arduino.

The total system is powered by 6V/2.5A lead acid battery.

d) Working

The system works in two modes namely controlling wheelchair and monitoring health.

i) Wheelchair controlling mode:

When supply is turned on, the arduino mega send the initialization command to GSM module to activate the internet connection. After this system is in the controlling mode. To select controlling mode manually, we use pad number 7 on the touchpad. When this pad is touch by the user, out7 pin of touchpad becomes high. This will send to arduino. When arduino detect that pad number 7 is touch by user it will shift the mode on controlling.

In this mode wheelchair is controlled by two ways one(as shown in fig 3) is by touch pad: -

Touch Pad Key No.	Key Specified for
4	forward direction
3	backwarddirection
2	right direction
6	leftdirection
7	controlling mode
8	monitoring mode

Fig. (3) Touch pad Command

We use android app and bluetooth for voice command. In this app firstly the bluetooth module is connected with mobile bluetooth. After this the voice command given to the app is converted in the text format and sent to the bluetooth module which will further received by arduino. In this way voice command will be received to Arduino.

Voice Command	Action
Forward	Move forward
Backward	Movebackward
Right	Moveright
Left	Moveleft
Stop	Stop Moving
Health	Switch to monitoring mode

Fig. (4) Voice Command

ii) Health Monitoring and tracking mode: -

To select controlling mode manually, we use pad number 8 on the touchpad. When this pad is touch by the user, out8 pin of touchpad becomes high. This will send to arduino. When arduino detect that pad number 8 is touch by user it will shift the mode on monitoring.
In this mode arduino read Spo2 sensor output. It will give the values of SpO2 and heart rate. For this purpose, the sensor will be placed on the fingertip. Also, we used ds18b20 temperature sensor. It will give the body temperature.
The GPS module is used to get latitude and longitude co-ordinate of the wheelchair location. Arduino read these co-ordinates continuously.
Arduino read all the above parameters. Then it sends values of these parameters to Ubidots account through the internet. After this we can see SpO2, heart rate, temperature and location on the Ubidots dashboard that we are added already. In this way we monitor the health and track the wheelchair through the internet.If any parameter crosses its set limit, then arduino turn on the buzzer and sends the SMS to stored mobile numbers

V. Software Implementation

a) Flow Chart

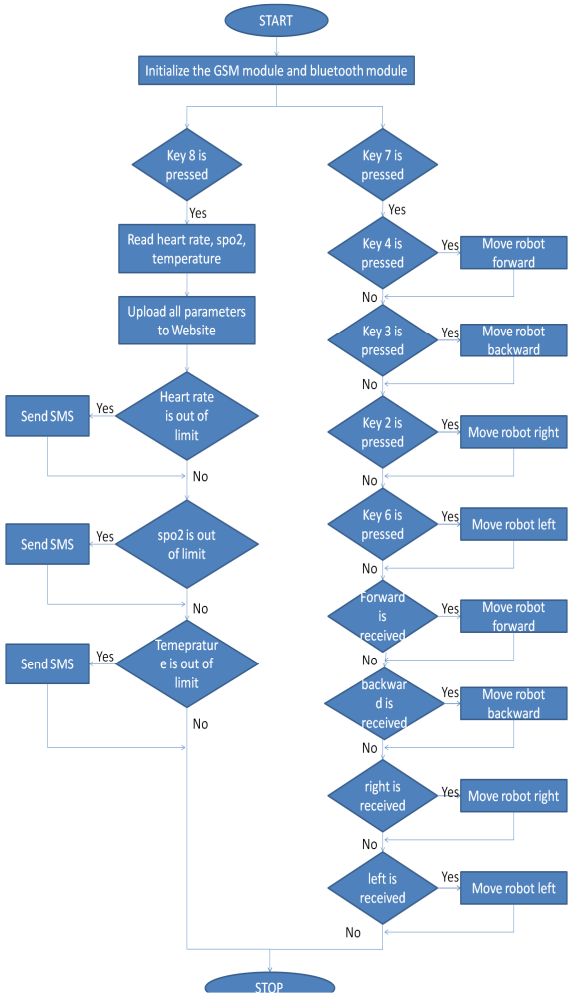

Fig. (5) Flow Chart

b) Resources

Sr.No.	Resources Used
1	Arduino IDE
2	Ubidots
3	Windows 10
4	Google

Fig. (6) Resources

VI. Result

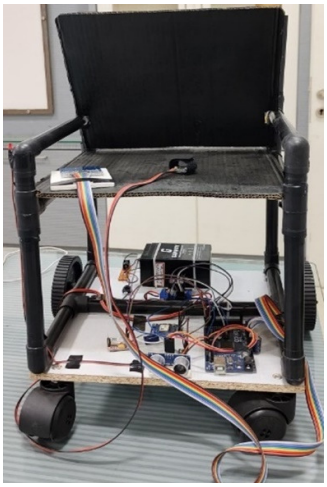

Fig (7) Proposed Model of Wheelchair

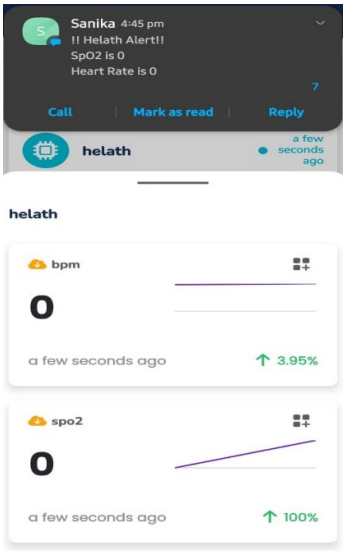

Fig (8) Health Alert SMS

Here fig (8) Shows that health alert SMS is sent to mobile number provided byUser

When health parameters are abnormal and the parameter which are abnormal

Only that parameters SMS is sent with it value

For example,

Sp02 is zero and heart rate is zero

and we get a : -

!!Health alert !!

Sp02 is zero

Heart rate is zero

SMS is sent to the mobile number provided by user.

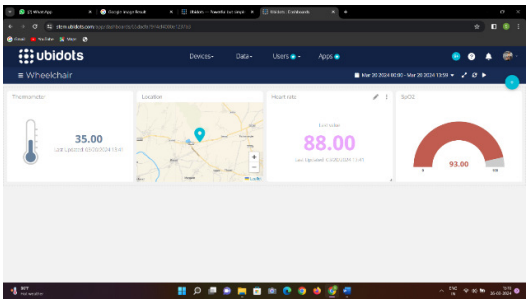

Fig (9) Health Parameters on Website

Health parameters such as SPo2, heartrate, temperature and location can be observed on the website from anywhere.

VII. Conclusion

The pursuit of creating a cutting-edge wheelchair with touch and voice control, GPS, heart rate and SpO2 monitoring, and obstacle detection while maintaining a strong focus on convenience and cost-effectiveness represents a significant step forward in assistive technology. This endeavor is not only a testament to human ingenuity but also a profound commitment to enhancing the lives of individuals with mobility challenges. The combination of advanced technology and affordability ensures that this innovative wheelchair will not only empower users with newfound freedom and control but also become an inclusive and widely accessible solution in the realm of assistive devices, positively impacting the lives of many.

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