SMART ASSISTANCE M.C.I DEVICE

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***Abstract*— Physically challenged people who have a variety of physical disabilities encounter numerous challenges in their day-to-day lives when it comes to commuting from one location to another, and they may even have to rely on others to get from one location to another. There have been many significant efforts over the past few years to develop devices that could enable the person for its ease of operation without any ambiguity. The main aim of our paper is to develop a device to make the life of physically challenged persons easier. This device consists of integration of Arduino UNO microcontroller with Bluetooth module HC-06, Wi-Fi module ESP8266, ultrasonic sensor HC-SR04 and motor driving circuit. This system offers automatic obstacle detection using Ultrasonic sensor, panic button for immediate help, a smartphone app has been developed for controlling the movement and notification service in case of emergency.**

Keywords—Arduino UNO, IoT, Smart phone, M.C.I device, Wi-Fi module, Bluetooth module

I. INTRODUCTION

The degradation of mobility is one of the major issues that debilitate the independent living ability of elderly/disabled people. They need assistance from caregivers for their daily activities. However, the gap between the supply and demand of caregivers is widening, and the development of devices that can support the elderly/disabled people in their day-to-day life has a great significance.

According to several studies that have been carried out previously, both children and adults get benefit from having access to a means of independent mobility. Independent mobility increases vocational and educational opportunities for people while reducing dependence on caregivers and promoting feelings of self-reliance. For children, independent mobility acts as the foundation for their early learning. Most commercially existing robotic wheelchairs are equipped with controlling interfaces like a joystick. However, human-friendly controlling interfaces are preferred by the people instead of low-level controlling interfaces with limited abilities because of their ability to maintain natural interaction with the users. Furthermore, people with restricted muscle movements may not be able to command the conventional joystick-controlled wheelchairs. Due to these reasons, the development of smart wheelchairs with human-friendly features and alternative controlling interfaces for conventional joystick has been a topic of many research projects in recent years. However, existing devices require improvements in their design and construction to provide sophisticated aid to the users.

IoT: The Internet of Things was defined as an expansion of Internet connectivity into physical devices and ordinary things as a result of the advancement of many technologies. The Internet of Things is enabled by technologies such as embedded systems, wireless sensor networks, control systems, and automation, including building and home automation. IoT ecosystem is made up of web-enabled smart devices with sensors, CPUs, and hardware that gather, share, and act on data collected from their surroundings. Although individuals can engage with these gadgets, the majority of them operate without human intervention — for example, by giving them instructions to gain access to data. The protocols used in web-enabled devices for networking, connectivity, and communication are determined by the IoT applications implemented.

The aim of this work was to develop a commercially viable smart M.C.I device with obstacle detection and fall detection alarm button. This system will reduce the physical and

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cognitive requirements of people with wide-ranging disabilities that limit their independent mobility. The obstacle detection is achieved with the use of an Ultrasonic sensor that can detect any obstacle within a distance of 10cm. Later, the M.C.I device needs to decide further action on whether it should turn left, right, or just walk straight when facing a certain obstacle to avoid them. The proposed system also has a fall detection system so that the user can turn on the alarm button when in need of help.

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II. LITERATURE SURVEY

Nasrin Aktar [7] proposed a voice recognition-based intelligent wheelchair system for physically handicapped people who are unable to drive the wheelchair by hand. The patient can operate the wheelchair-using voice commands, and the patient's location can be tracked using a GPS module in the wheelchair that tracks and sends the information to a smartphone application (app) via Firebase. The voice module V3 is used to record and recognize the patient's voice in order to follow the patient's commands. The vocal commands are converted to hexadecimal numbers, which are then sent to the Wi-Fi module to control the wheelchair. The motor driver IC is directed by the Wi-Fi module to move the wheels in the desired direction.

Foong Seew Hon [13] proposed an IoT-based wheelchair-person fall detection system that is both cost-effective and reliable in detecting falls and alerting the surrounding area to seek assistance. The system includes a gyroscope, GPS module, FSR pressure sensor, and microprocessor for fall detection. The gyroscope will be used to identify the wheelchair's location, while the FSR pressure sensor, which will be positioned on the wheelchair's seat pad, will be used to detect and recognize the user's gesture. Both works together to identify fall events, increasing fall detection accuracy.

Khagendra Joshi [1] proposed a smart wheelchair to help physically challenged people live more comfortably. Electric powered, voice control, line follower with obstacle avoidance, and other advanced technologies are included in this voice-controlled smart wheelchair. The integrated AVR microcontroller ATmega328 with Bluetooth module, GSM module SIM900, ultrasonic and infrared sensors, temperature sensor LM35, and a motor driving circuit for controlling motor speed make up the smart wheelchair control unit.

Soniya D Makwana [19] proposed Prototype Buildout of GUI Based Multifaceted Automated Wheelchair System. There are a number of health issues that limit upper and torso movement. In such instances, using a joystick or a self-propelled wheelchair may be impractical. In order to solve this problem, a one-touch operation might be used. Less pressure is applied, resulting in a smoother functioning. Additional characteristics Wi-Fi emergency notification is implemented using ESP8266 w, obstacle detection, and cardiac monitoring are just a few examples. The importance of efficiency and technical innovation cannot be overstated. We built the framework of our model based on our study. Hardware needs were assessed and incorporated. To achieve a set of features, software programming is used. Among the features of the prototype are the ease with which it moves and the consistency with which it moves. Compared to current systems, it has a low operating cost.

III. DESIGN AND IMPLEMENTATION

This device consists of Arduino UNO microcontroller with Bluetooth module HC-06, Wi-Fi module ESP8266, ultrasonic sensor HC-SR04 and motor driving circuit for controlling motor's speed. This system offers obstacle detection automatically using Ultrasonic sensor, panic button for immediate help, a smartphone application has been developed for controlling the movement and notification service in case of emergency.

Fig 1 is showing the block diagram of the proposed model. The control is clubbed with android smart phone. This application software forward commands to the microcontroller pairs with Bluetooth Serial Modules and sends in the recognized data as a string. While android device is paired with microcontroller via Bluetooth we can give input like forward, left, right, back.

Microcontroller section also have Bluetooth device to receive the data string transmitted by android phone. Microcontroller executes these string inputs and gives output at motor direction ports. These pins can be used to run DC motors. Here we are using only four pins to drive DC motor driver circuits which will drive motor subsequently.

There are 2 available push buttons for user to send emergency notification one in offline mode that is by buzzer sound and the other way is using ESP8266 when button is pressed the ESP 8266 activate and connection is made through IFTTT the data is passed as string which reaches trough IFTTT applet then a notification is send to the linked mobile number.

Ultra-sonic sensor is used for anti-obstacle collision, US sensor always send the distance to Arduino which takes this data and when the value goes below the threshold the microcontroller send data to motor driver circuit then it make's motor to stop to prevent further movement.

We used Arduino IDE with embedded "C" programming for controller to implement the proposed task. As there are two motors so we used two separate motor drivers, one for each. Along with this we have used 12V battery as power source.

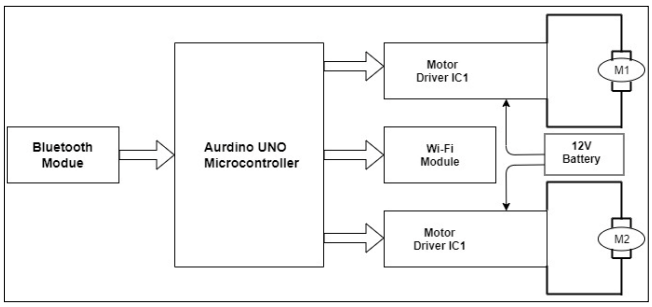


Fig. 1: Block Diagram

BLOCK DIAGRAM DESCRIPTION

The Arduino Uno microcontroller board is based on the ATmega328P microcontroller. There are 14 digital input/output pins, six analogue inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button on the board.

A. Bluetooth Module HC-06

The HC-06 Bluetooth module is a wireless serial communication slave Bluetooth module. It is a slave module, which means it may receive serial data when a master Bluetooth device sends out serial data (device able to send serial data through the air: smart phones, PC). When the module receives wireless data, it sends it out over the serial interface in the same format as it was received. In the Arduino chip, no source code related to the Bluetooth module is required. An app on the phone sends inputs to the module, which accepts them and then sends them to the Arduino. As indicated in the original code, the Arduino and actuators reply in kind. When the module is not associated with the app on the phone, the LED blinks frequently, however when the module is paired with the app on the phone, the LED is a continuous red.

B. Wi-Fi Module – ESP8266

The ESP8266 Wi-Fi Module is a self-contained SOC with an inbuilt TCP/IP protocol stack that can provide access to your Wi-Fi network to any microcontroller. The ESP8266 may either host an application or offload all Wi-Fi networking functionality to a separate application processor. Each ESP8266 module comes pre-programmed with AT command set firmware, so you can just plug it into your Arduino and get about as much Wi-Fi functionality as a Wi-Fi Shield (right out of the box)! The ESP8266 module is a low-cost board with a large, and rapidly increasing, community.

C. Ultrasonic sensor – HC – SR04

The HC-SR04 ultrasonic sensor, like bats, employs SONAR to estimate the distance of an object. From 2 cm to 400 cm (1" to 13 feet), it provides outstanding non-contact range detection with high precision and reliable readings in an easy-to-use design.

Sunlight and black materials have little effect on the functioning, while soft materials like cloth can be difficult to detect acoustically. It includes an ultrasonic transmitter as well as a receiver module.

D. Motor Driver IC – L298N

The L298N Motor Driver Module is a high-performance motor driver for DC and Stepper Motors. An L298 motor driver IC and a 78M05 5V regulator make up this module. Up to four DC motors can be controlled by the L298N Module, or two DC motors with directional and speed control.

In an integrated circuit, the L298N Motor Driver module contains an L298 Motor Driver IC, a 78M05 Voltage Regulator, resistors, capacitors, a Power LED, and a 5V jumper. Only when the jumper is inserted will the 78M05 Voltage Regulator be enabled. The internal circuitry will be powered by the voltage regulator when the power source is less than or equal to 12V, and the 5V pin can be utilized as an output pin to power the microcontroller. When the power supply is greater than 12V, the jumper should be removed and a separate 5V should be provided through the 5V connector to power the internal circuitry.

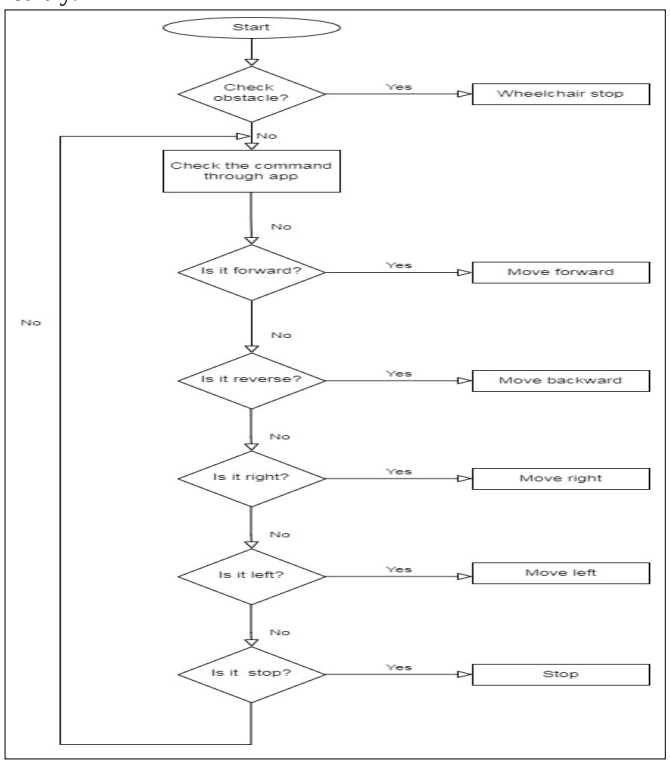


Fig 2 Flowchart of motor driver

IV. CIRCUIT DIAGRAM

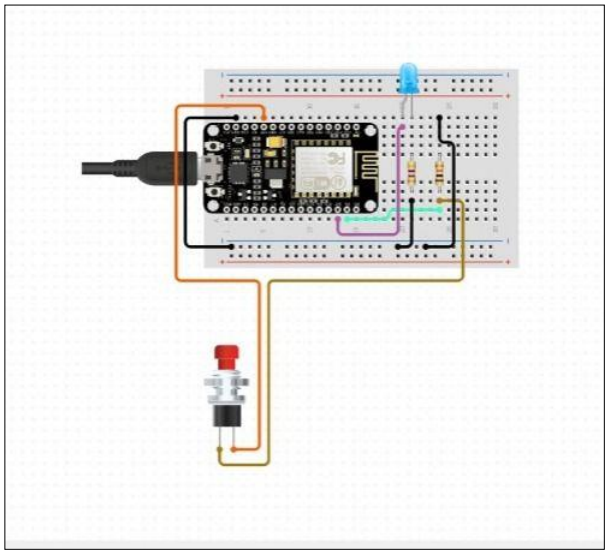


Fig 3 Circuit diagram of Emergency Notification using NodeMCU

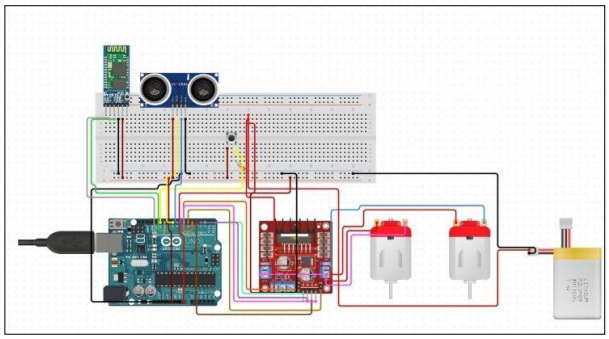


Fig 4 Circuit diagram of the Device

The smart M.C.I Device consists of integration of Arduino UNO version 3 with Bluetooth module, Wi-Fi module, ultrasonic sensor, and motor driving circuit. Fig. 3 and Fig.4 are combinedly presenting the circuit diagram of smart wheelchair system.

V. RESULT/OBSERVATIONS

1. HARDWRE DESIGN

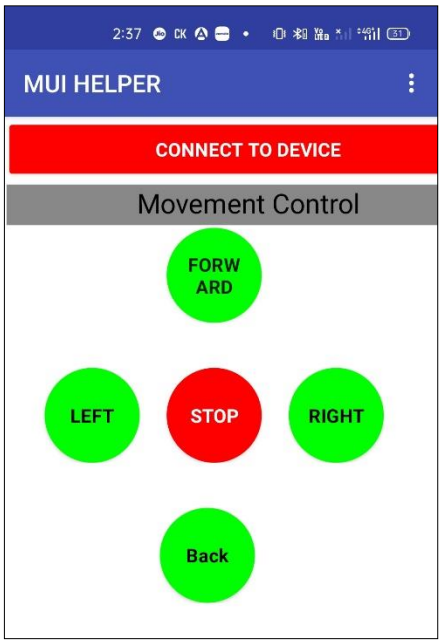
Fig 5 Prototype

The features of smart M.C.I device are as follows: -

- Notification in case of emergency through mobile
- Movement controlled using App
- Obstacle detection
- Smooth speed variations for patient comfort
- Panic button in case of emergency
- Soft start & Soft Stop
- Emergency STOP
- Collision avoidance

2. SOFTWARE DESIGN

Fig 6 shows the GUI design of the application MUI helper that controls the movement of the M.C.I device. The GUI has six buttons. One for establishing connection to the device. Stop button to stop the device and four movement specific buttons for direction – forward, left, right and back.



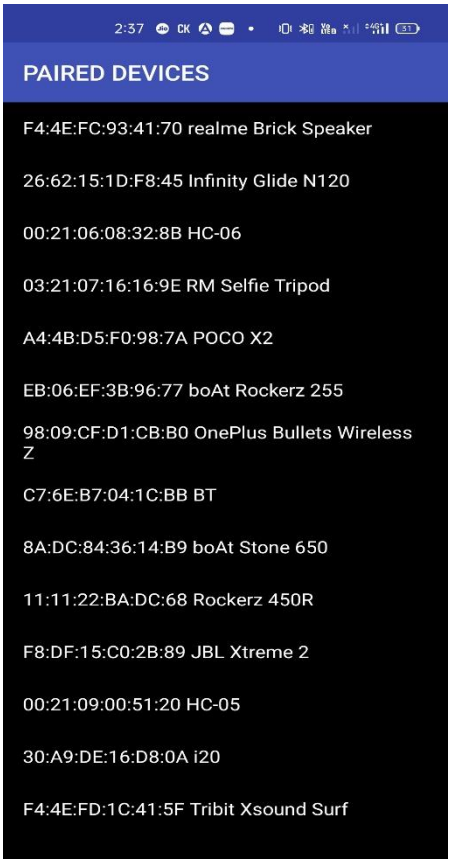


Fig 6 User Interface

3. GRAPH OF ULTRASONIC SENSOR

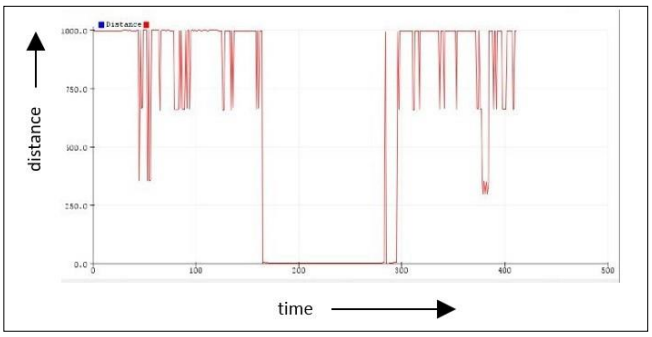


Fig 7 Graph showing relationship between distance and time

In the above graph (Fig 7), X-axis represents the time in milliseconds and Y-axis represents distance in centimeter. The ultrasonic sensor continuously senses any objects or obstacles within a particular distance. The distance are the inputs for the sensor. When these input values are plotted along with time, we get the above graph.

VI. CONCLUSION

Our proposed smart assistance M.C.I device provides a safe and reliable system with the presence of obstacle detector. It provides an easily accessible and a variety of functionalities. In this paper, we developed a device which includes ultrasonic sensors to automatically detects the obstacles in the path along with a little intelligence of taking proper care to avoid the accidental mishaps, where we got the desired results. Thus, the user can be self-reliable, safe and independent with the help of this easily controllable device. Further improvement to the above implemented system can be done by providing additional sensors to make the system more user friendly and avoid accidents.

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