International Journal of Scientific Research & Engineering Trends
Volume 9, Issue 2, Mar-Apr-2023, ISSN (Online): 2395-566X

Smart Wheelchair to Disability person Using Arudino UNO

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Abstract-In the design of a smart, motorized, voice and app-controlled wheelchair using embedded system. Proposed design supports voice activation system for physically differently abled persons incorporating manual operation. The "Voice-controlled Wheel chair" for the physically differently abled person where the voice command controls the movements of the wheelchair. The voice command is given through a cellular device having Bluetooth and the command is transferred and converted to string by the BT Voice Control for Arduino and is transferred to the Bluetooth Module HC -05 connected to the Arduino board for the control of the Wheelchair. For example, when the user says „Go" then chair will move in forward direction and when he says „Back" then the chair will move in backward direction and similarly „Left", „Right" for rotating it in left and right directions respectively and „Stop" for making it stop. This system was designed and developed to save cost, time and energy of the patient. Ultrasonic sensor is also made a part of the design and it helps to detect obstacles lying ahead in the way of the wheelchair that can hinder the passage of the wheelchair. On addition to this an IOT device was integrated using NodeMCU where relay was connected to the microcontroller, using the application we can control the device using web application anywhere around the world.

Keywords-Arduino UNO, NodeMCU, Bluetooth, Relay, Ultrasonic Sensor, Motor Drive circuit, Battery & Robot Wheel Chair.

I. INTRODUCTION

This paperis conceived as an idea to ease the lives of those among us who are unfortunate enough to have lost the ability to move their legs due to a significant amount of paralysis, accident or due to old age. Many differently abled people usually depend on others in their daily life especially in moving from one place to another. For the wheelchair users, they need continuously someone to help them in getting the wheelchair moving. Their lives are made difficult by the fact that there is lack of an intuitive control system for their wheelchairs that allows moving independently. Using an electrical wheelchair leads to a large amount of independence for persons with a physical disability who can neither walk nor operate a mechanical wheelchair alone as it requires great effort and help of other people.

The problem is that in some cases the disability causes someone to lose the ability to use his hands, therefore in this case, the way of controlling a power wheelchair can be done using speech commands for hands-free patients leading to an interesting and promising outcome. But, still the availability of the smart wheelchair solutions is often limited due to the high costs and not-so-friendly operation. By the proposed approach, described in this paper, the low-cost, simple and friendly solution for the voice-controlled platform will be presented that is user friendly, fully-customizable according to the language spoken by the user and will help in enhancement of user's independent mobility. Using a Smartphone as the "brain" of a robot is already an active research field with several open opportunities and promising possibilities. Another recent and very successful technology, Bluetooth has changed how people use digital device at home or office, and has transferred traditional wired digital devices into wireless devices.

This research is based on Voice-controlled Wheelchair design based on mobile platforms, by means of Bluetooth technology, design and implementation of wireless remote-control solutions. The project also incorporates use of ultrasonic sensors to detect obstacles within range of 4 meters and notifies the system and stop the wheelchair till further command. In this work, Smart Wheelchair control using Arduino Uno microcontroller and Bluetooth Module via android application is presented.

II. STATEMENT OF PROBLEM

The wheelchairs available in market are too expensive and are beyond the reach of poor and middle-class families. Most of the Wheelchairs are single functioned either it will be operated with voice or joystick. We are designing a wheelchair that will be a low cost and multifunction. This project aims to make life easier for the disabled and elderly people who cannot move properly it will enable them to lead better lives without any problem.

III. SPECIFICATIONS OF PROPOSED SOLUTION

The objective of this project is to control the wheelchair movement using motor activated by voice recognition system, sensors and joystick through IOT. Voice recognition system will be more safe, accurate and faster than self-controlled wheel chair. This may reduce the risk of incidents. Our smart and safe wheelchair should be able to: Avoid collisions with walls or other fixed obstacles, because we are using sensors that will be additional feature. Change the direction of wheel chair through voice and joystick using IOT.

IV. HARDWARE COMPONENTS

- Arduino Uno – Micro Controller
- Node Mcu
- Bluetooth
- Relay
- Ultrasonic Senor
- Driver Circuit
- Battery
- Robot Model
- Led Light
- Dc Fan
- Connecting Wires
- Soldering Kit

V. SOFTWARE USED

- Arduino IDE
- Embedded C
- PHP - MYSQL

VI. SYSTEM ARCHITECTURE

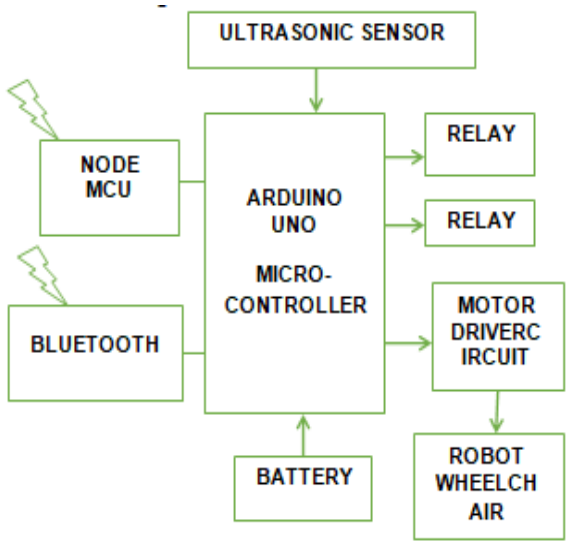

Fig 1. Block Diagram.

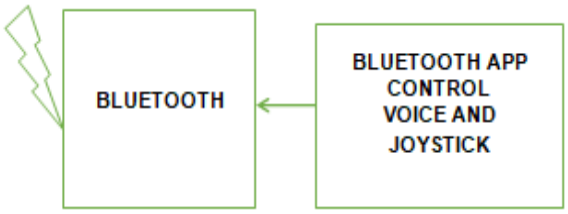

Fig 2. Wheelchair Voice Control.

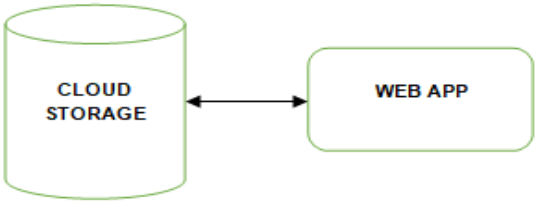

Fig 3. IOT Home Appliance Control.

VII. RELATED WORK

- Sensor Integration
- Bluetooth & Robot Integrating with Microcontroller
- IOT Configuration
- Integrating home appliance Control
- Final Testing and Debug

1. Sensor Integration:
An integrated sensor is the core technology of a sensor without the package. It allows for multiple sensor technologies to be combined or "integrated" into a single plug-and-play assembly. Integrating as little as 3 sensors can reduce leak points by 75%, reduce footprint by up to 80% and while also reducing the complexity and optimizing the end-user's experience.

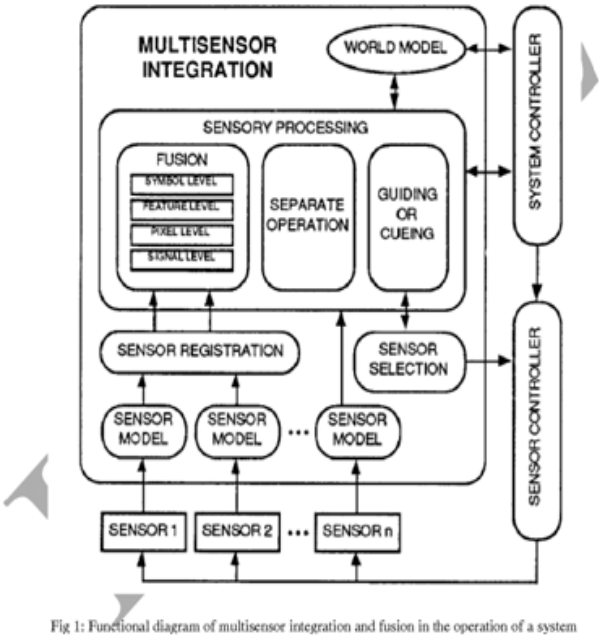

Fig 1: Functional diagram of multisensor integration and fusion in the operation of a system

Fig 4. Integrated sensor

2. Bluetooth & Robot Integrating with Microcontroller: Bluetooth Controlled Robot: This**project** is used to control **robot** motion using**Bluetooth**and android application. User sends control commands from android app to Bluetooth which is connected with **pic microcontroller**. Microcontroller receives commands from Bluetooth and takes respective actions to drive two motor. These two motors are connected with microcontroller through motor driver integrated circuit called L298N. Bluetooth Controlled Robot involved building a robot that can receive commands via Bluetooth and then execute those commands. An Android app was used to send the commands via Bluetooth. Commands were received by Bluetooth module connected to microcontroller and the microcontroller then executed those commands.

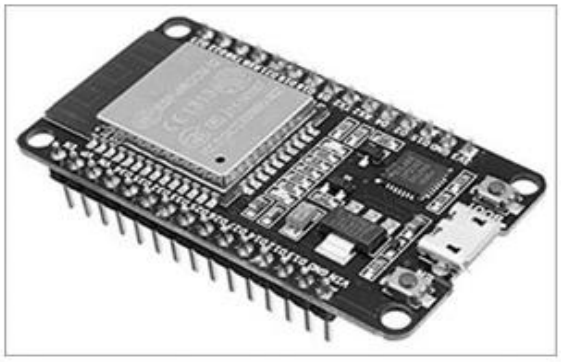

Fig 5. Bluetooth & Robot Integrating.

3. IOT Configuration:

Internet of Things (IoT) devices communicate is dozens of different ways, using hundreds of different protocols. That's because how they communicate depends on what they are, where they are, what other devices and systems they need to talk to, and what they have to say. There's no single best protocol, which is essentially the common "language" used to route messages from one IoT device to another. The right choice always depends on the application's specific needs.

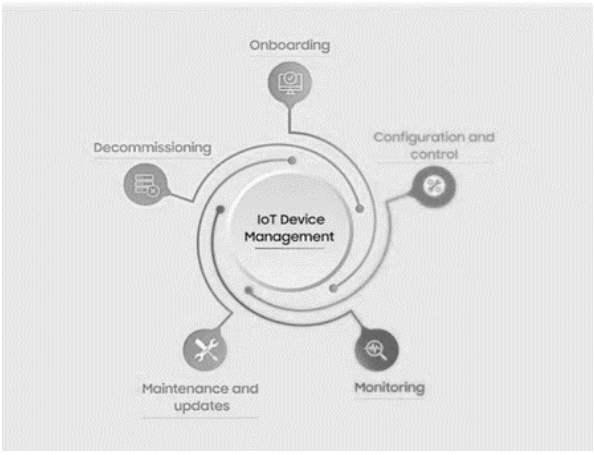

Fig 6. IOT Configuration:

4. Integrating home appliance Control:

This project aims to incorporate android phone control over electrical appliances. We use Bluetooth communication between Android phone and a Receiver (control unit) that is connected to the appliances. Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices and building personal area networks (PANs).

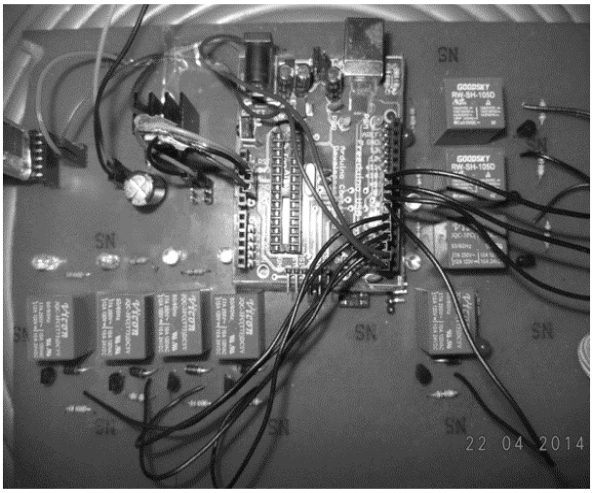

Fig 7.Integrating home appliance Control.

Invented by telecom vendor Ericsson in 1994, it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization. HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. It contains 6 pins that are labelled on the back but most modules only have 4 of those populated with pogo pins. KEY & STATE are not required, as KEY is used for flashing the device and STATE simply indicates whether the device is awake or not. So that leaves only GND, VCC, TXD, and RXD.

5. Final Testing and Debug:

5.1 Testing: Testing is the process of verifying and validating that a software or application is bug free, meets the technical requirements as guided by its design and development and meets the user requirements effectively and efficiently with handling all the exceptional and boundary cases.

5.2 Debugging: Debugging is the process of fixing a bug in the software. It can define as the identifying, analyzing and removing errors. This activity begins after the software fails to execute properly and concludes by solving the problem and successfully testing the software. It is considered to be an extremely complex and tedious task because errors need to be resolved at all stages of debugging.

VIII. APPLICATIONS

- In hospitals for handicapped patients.
- It can be used by an elderly or physically challenged person to move inside the home without any difficulty.
- In Bus Stops, Railway Stations, Airports etc.

IX. ADVANTAGES

- Less expensive than the congenital automatic wheel chairs.
- Capable of controlling the wheelchair motion for disabled people using hand gesture.
- Front wheel drive provides high maneuverability.

X. CONCLUSION

This project elaborates the design and construction of Smart Electronic Wheelchair with the help of Bluetooth Module and IOT. The circuit works properly to move as the command given by the user. After designing the circuit that enables physically disabled to control their wheel using an android application in their smartphones and it has also been tested and validated. The detection of any obstacle is successfully controlled by the microcontroller.

As the person switches on the circuit and starts moving, any obstacle which is expected to lie within a range of 4 meters will be detected by the Ultrasonic sensor. This proposed system contributes to the self-dependency of differently abled and older people.

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