# Automation of E-Wheelchair for Physically Challenged People

Monali Mundane[1], Nayan Garade[2], Vaishnavi Pawar[3], Vaishnavi Shete[4], Ujwal Shende[5], Dr. S.B. Warkad[6]

[1,2,3,4,5,6]*Department of Electrical Engineering, P.R. Pote (Patil) college of Engineering & Management, Amravati 444602, Maharashtra, India*

***Abstract*** **- Automation is the technique of making an apparatus, a process, or a system operate automatically. With respect to automation a smart idea is developed towards the handicapped people, and physically challenged people. This paper proposed an idea and model to ease those persons, who cannot perform hand movements in a way that can move a wheelchair. Several studies have shown that both children and adults benefit substantially from access to a means of independent mobility. This paper describes the design of a smart, motorized, voice-controlled wheelchair using embedded system. Proposed design supports voice activation system for physically disabled persons incorporating manual operation. This system consists of hand gesture-controlled wheelchair using image processing through web camera which not only recognizes hand gesture but also control the wheelchair according to the hand movement. It includes HSV shading space method to discover hand motion thought picture preparing. This paper utilized the raspberry pi board and sensors to detect obstacles lying ahead in the way of the wheelchair that can hinder the passage of the wheelchair. This designed wheelchair in prototype form is tested and get accurate output and efficient framework for the users with low power consumption.**

***Index Terms*** **- Wheelchair, Raspberry Pi, Image processing, IOT technology, Ultrasonic sensor**

## I.INTRODUCTION

Wheelchair based on electric power have become increasingly important an assistive technology and rehabilitation device and the number of users has grown considerably [1-2]. Hand signals are incredible human to human correspondence channel which pass on a significant piece of data move each life. Hand signals are the nonverbal correspondence media between individuals happens through hand development. Hand motion acknowledgment is an interaction of comprehension and grouping significant developments by the human hands. In this paper we present a methodology for a human PC collaboration (HCI), where we attempted to control the wheelchair development by utilizing hand signals. Hand signal procured utilizing a camera dependent on motion recognition strategy [3-4]. Our objective is to make a wheelchair development utilizing web camera to collaborate with the motion recognition in easier to use way that can be diminishes the social issues of the general public [5-7] from that Machine and Human interface is only the HMI show screen in the present market. In any case, it is essential to make the actual contact with the machine if client needs to work it. Gesture discovery is only recognition of the hand development as indicated by the clients. It needs to recognize constantly and to quantity of fingers. In this system wheelchair move remotely according to the information given by the client.

Utilization of ARM11 processor is feasible to distinguish the hand signal development and finger discovery likewise conceivable on Raspberry Pi with its on board GPU module. By identifying the finger, it is feasible to move the wheelchair explicit way like forward, opposite, left, right bearing. By utilizing distinctive calculation finger location and following it is feasible to move the wheelchair according to the commands. Considering the finger client needs to take the action. This system depends on to identify fingers of hand based on the better identification you can make the move. framework will plan for wheelchair control.

Development of wheelchair depends on the quantity of fingers will distinguish i.e. finger one is identify that will be appeared in the LED pointer at that point push the wheelchair ahead, turn around, left, right as per the

program code will be perform on the ARM11 processor on the Raspberry Pi board. This framework can play out the four or five wheelchair applications at the same time. This system is intended for the social application, for example, the disabled individual like paralyzed patients they can't move anyplace particularly intended for those people it can likewise be utilized in businesses for play out the four or five applications at the same time. Complete framework dependent on the hardware and programming with the utilization of ARM 11platform like Raspberry Pi and Web Cam interface. The connection among human and robot continually develop and receive various apparatuses and programming to build the solace of people. Planning for framework we need to utilize the Open CV software for coding reason. It is free and open-source library zeroed in on the ongoing picture preparing it can identify and perceive a huge assortment of objects, however this research concentrates to apply the strategies and techniques to distinguish and perceive the offers of human hand.

## II.LITERATURE STUDY

When powered Electric wheelchair was innovated for the disabled and paralyzed patients they got propel and confidential life to live. The research and studies on Electrical wheelchair convey that wheelchair works with great efficiency on rechargeable battery and motor drive system rather than wheelchairs which was using fuel or any other source of electrical wheelchair [8-10]. By analyzing the study, we have preferred to use rechargeable battery for electrical supply to wheelchair to make an operation efficient. The advancement in the field of keen wheelchair innovation is at its pinnacle. A ton of work has been finished by the pioneers in the field of smart wheelchair innovation [11-13]. Wheelchair innovation has developed from manual wheelchairs to electric wheelchairs and afterward at long last to automated wheelchairs. The best control sign can be taken from the eyes, voice, tongue, hands, and cerebrum. Some of such techniques are reflected and shown progress in the field of smart wheelchair technology. [14] developed a wheelchair which recognizes the voice and then perform operation accordingly, but this system is not supported for all disable people and may not support in noisy environment. To permit wheelchair clients to move without caregiver's consideration, the vulnerabilities in the encompassing environment must be thought about where here comes the execution of both navigation system and deterrent avoidance system into this autonomous wheelchair. [15] provides advancement in the wheelchair by fusion from eye tracking and bci. Eye tracking technology varies from person to person, and this will not be usable to blind people, but it consists digital technology.

[2] proposed Hand gesture-based wheelchair movement control for disabled person. In this hand gesture data is collected and then accordingly controlling action is performed. In this an automated wheelchair controlled utilizing head motion. The model comprises of the digital system (an accelerometer and a microcontroller) and a mechanical actuator. The accelerometer assembles head motion information, and the microcontroller figures the information, which is utilized to situate the wheelchair joystick as per the client's head motion. The fundamental destinations in this paper are: The main target of this undertaking is to perform not just ongoing perception by the camera through catching a surge of pictures in milliseconds yet additionally performs image processing on that captured images to acquire result. The second is to provide navigation system which identifies sign boards, directions, road pits, and turns to permit the self-sufficient wheelchair to the disabled people. [16-17] proposed a wheelchair to respond as need as based on the situation to give alert signal to their loved ones or family members. The presented work is more innovative in it sense; it utilizes discourse acknowledgment framework to give bearing development control of the wheelchair. In this wheelchair no different discourse acknowledgment circuit is utilized since it is done by Raspberry Pi utilizing Speech recognition algorithms. The ultrasonic Sonar Sensor is utilized to distinguish inside scope of 6.45 meters. This will also offer protection breaks for security to the patient. Emergency signal in critical situation is achieved by utilizing the IOT technology. In this framework the Raspberry Pi is assuming a primary part of equipment part. For catching the picture typical web camera is utilized in our framework. The Raspberry gives the orders to the engine driver circuit, which is empower the GPIO pin to perform activity. For example, forward, left, right also, stop activity performed sensors are additionally mounted. Ultrasonic sensor is utilized for recognizing

the hindrance or any moving item before wheelchair. The sensor is straight forwardly associated with the Raspberry Pi board, it procured the information and estimating the distance among wheelchair and deterrent. In this newly designed system, we also use a battery, and IOT technology for getting their loved ones an emergency signal in case of accidental condition.

## III METHODOLOGY

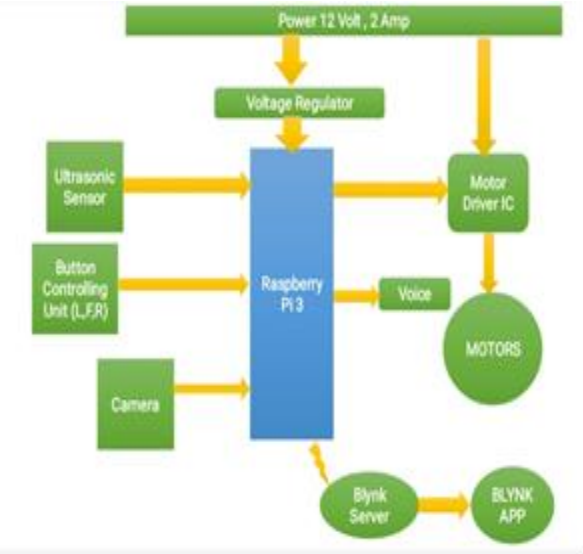


Fig 1. Shows the Block Diagram of E-Wheelchair

The above figure-1 shows the block diagram of E-Wheelchair. In this figure, the Raspberry Pi work on this principle inputs i.e. ultrasonic sensor, camera, button. Ultrasonic sensors work on ultrasound (SC05). Ultrasonic sensor identifies the Obstacles come in way of patients and convey a message to the Voice Module through Raspberry Pi to speak with handicapped person setting on wheelchair. In a same way it has Button which perform function like right, left, reverse, forward etc. By using this button wheelchair can move in any direction. In emergency this button gives an alert signal to the patient family or their loved once. These is done by means of BLINK App. In this design module image processing is also done with the help of Raspberry Pi. The system approaches the vision-based methodology. Web camera detects the different signs boards which is present on the roadside according to that wheelchair for mobility.

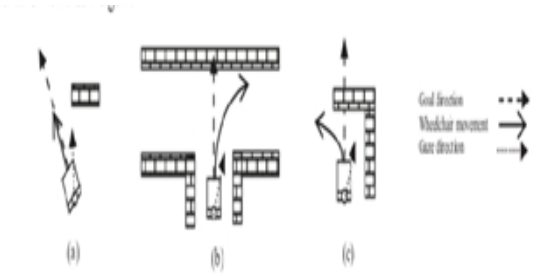


Fig 2. Show Possible Occurrence During Navigation

(a) free Man over (b) T- Intersection (c) Avoiding


Fig 3. Flowchart

1.Raspberry Pi

Raspberry Pi is ready PC that can do all that you anticipate from a personal computer. Like internet, playing recordings game and many fascinating things. This visa size PC has two USB Port, Ethernet, Wi - Fi, Audio yield and HDMI Display. Discourse Recognition, Speech Synthesis and Obstacle Location is finished by utilizing Raspberry Pi. The Raspberry Pi 3+ utilizes a Broadcom BCM2837B0 SoC with a 1.4 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KB shared L2 reserve. the Raspberry Pi 3 have 1 GB of RAM due to the generally minimal expense of the Raspberry Pi; this has gotten a mainstream and efficient option in contrast to the more costly business arrangements. It works proficiently with numerous pictures business arrangements. It

works effectively with various pictures furnished by the web camera associated with the Raspberry Pi board. The camera interfaces to the board utilizing the UV4L driver. In this work, the applications, yet in addition the framework execution is viewed as Hence, a 720P video design camera is utilized as an equilibrium among the memory cost, preparing pace, and acknowledgment precision. The engine driving circuit, L293D, is associated with the Raspberry Pi, the engines, and the hand-off for controlling the engine driving coordinated circuit. The Raspberry Pi focus ceaselessly creates order signs to empower the GPIO sticks and plays out the activities of left, right, forward, and stop. The Raspberry Pi has its own working framework Raspbian. It runs python programs on Linux where it tends to be related with essential board. The Pin32 plate imager programming is utilized in this work to boot a Raspberry picture record. While putting a bootable memory gadget on Raspberry Pi board, it can get to the Raspbian straight forwardly. The principle some portion of the picture handling calculations is finished with the help of the OpenCV 3.0.0 library.

2. Internet of Things (IOT)

IOT is a methodology which interfaces protests remotely. Quantities of sensors, labels, actuators and so on can associate with the articles utilizing special location plans. IOT is utilized in different fields like homegrown, corporate, medical care, shrewd urban communities, mechanical technology, living creatures, business, coordination, and numerous different applications. RFID (Radio Frequency Identification) labels are utilized to furnish association with the objects since they don't need outside power. These labels have singular property and that can be implemented to any article (either individual or animal). RFID labels can detect ongoing articles in genuine time without help of view, so that planning of real item into the virtual article can be conceivable. IOT is chipping away at a head of recognizable proof, detecting and correspondence advancements. A few progressed organizations and associations ought to present some IOT regular principles with the goal that everybody can chip away at a typical stage. Right now, a couple of affiliations like International Telecommunication Union (ITU), European Committee for Electro-specific Standardization, and IEEE, China Electronics Standardization Institute, and American National Standards Institute are trying to make a couple of guidelines for the improvement of IOT. When wheelchair is associated with the IOT, it empowers various administrations like checking, alert, correspondence, unsurpassed network, administration help, route, particularly as crisis help and so on Individual with handicap can send alert by utilizing IOT to their family in the event that they are enduring issue.

3. Image processing

Computerized picture preparing is the utilization of an advanced PC to handle computerized pictures through a calculation. As a subcategory or field of advanced sign preparing, computerized picture handling enjoys numerous upper hands over simple picture preparing. It permits a lot more extensive scope of calculations to be applied to the information and can stay away from issues, for example, the development of commotion and contortion during preparing. Since pictures are characterized more than two measurements (maybe more) computerized picture handling might be displayed as multidimensional system.

## III A. HARDWARE REHALIZATION FOR DEVELOPMENT OF E - WHEELCHAIR

1. Sound output Module

There are two kinds of voice acknowledgment framework. one is speaker - reliant and another is speaker autonomous. speaker subordinate frameworks are worked simply by the individual whose voice is prepared in the framework. While speaker - free system can be worked for any individual just the works should have been prepared in the framework. In our framework we utilized voice acknowledgment module v3 which is speaker-subordinate gadget. This module can record greatest 80 voice orders, with each 1500ms prior to utilizing this module, the client needs to prepare his/her voices so the gadget can perceive the voice of the client. we have prepared our orders by utilizing Arduino IDE programming orders, for example, forward, reverse, right, left, stop, low and high have been recorded in our framework to accomplish our objective. The preparation should be possible in any of the language that is agreeable for the client.

2. Motor Drive

DC engines are utilized to genuinely drive the application according to the necessity gave in programming. The dc engines work on 12V to drive a dc engine. we need a dc engine driver called L293D. This dc engine driver is fit for driving 4 dc engines all at once. To shield a dc engine from back emf produced by the dc engine while altering the course of turn. The dc engine driver has a interior assurance suit, we can likewise give back emf security suit by interfacing 4 diode setups across every dc engine.

3. Ultrasonic sensor

In this proposed project ultrasonic sensor is utilized to identify impediments in the way of wheelchair. Any snag is identified microcontroller is zero and bell is initiated the reach through time stretch between conveying trigger message and getting reverberation signal. The HC - SR04 ultrasonic sensor is an entirely reasonable nearness/distance sensor that has been utilized primarily for object evasion in different mechanical technology projects.

4. Web Camera

A picture sensor or imager is a sensor that distinguishes and passes on data used to take a picture. It does as such by changing over the variable weakening of light waves (as they go through or reflect off objects) into signals, little eruptions of current that pass on the data. The waves can be light or other electromagnetic radiation. Picture sensors are utilized in electronic imaging gadgets of both simple and computerized types, which incorporate advanced cameras, camera modules, camera telephones, optical mouse devices, clinical imaging equipment, night vision gear like warm imaging gadgets, radar, sonar, and others. As innovation changes, electronic and computerized imaging will in general supplant compound and simple imaging what's more, CMOS sensors dependent on MOSFET (MOS field-impact semiconductor) speakers. Simple sensors for undetectable radiation will in general include vacuum containers of different sorts, while computerized sensors incorporate level board locators The two main types of digital image sensors are the charge-coupled device (CCD) and the active-pixel sensor (CMOS sensor), fabricated in complementary MOS (CMOS) or N-type MOS (NMOS or Live MOS) technologies. Both CCD and CMOS sensors are based on MOS technology,[4] with MOS capacitors being the building blocks of a CCD, and MOSFET amplifiers being the building blocks of a CMOS sensor. Cameras integrated in small consumer products generally use CMOS sensors, which are usually cheaper and have lower power consumption in battery powered devices than CCDs. CCD sensors are used for high end broadcast quality video cameras, and CMOS sensors dominate in still photography and consumer goods where overall cost is a major concern. Both types of sensors accomplish the same task of capturing light and converting it into electrical signals. Each cell of a CCD image sensor is an analog device. When light strikes the chip, it is held as a small electrical charge in each photo sensor. The charges in the line of pixels nearest to the (one or more) output amplifiers are amplified and output.

5. Emergency Button

These modules are utilized to in the framework to assist the client with packaging crisis, where in we convey the crisis circumstance to the family members of the client of the framework or emergency vehicle and so forth This is accomplished by sending the area boundaries to as a SMS here when the client provides the order as crisis, we quickly catch the GPS boundaries, for example, longitude and scope and send them as a SMS utilizing SIM 900 to the over any pre referenced contact numbers, these numbers are pre-customized into the product.

B. PROTOTYPE MODEL DEVELOPEMENT

The below Fig-5 shows the Robotization of E-Wheelchair. In this the Raspberry Pi work on three inputs i.e., ultrasonic sensor, camera, button. Ultrasonic sensors work online of pixels shifts its charges one line closer to the amplifiers, filling the empty line closest to the amplifiers. This process is then repeated until all the lines of pixels have their charge amplified and output. There are numerous boundaries that can be utilized to assess the presentation of a picture sensor, including dynamic reach, signal-to-commotion proportion, and low-light affectability. For sensors of equivalent kinds, the sign to-commotion proportion and dynamic reach improve as the size increments. ultrasound (SC05). Ultrasonic sensor identifies the obstacles come in way of patients and convey a message to the Voice Module through Raspberry Pi to speak with handicapped person setting on wheelchair. In a same way it has button which

perform function like right, left, reverse, forward etc. By using this button as shown in Fig.-6

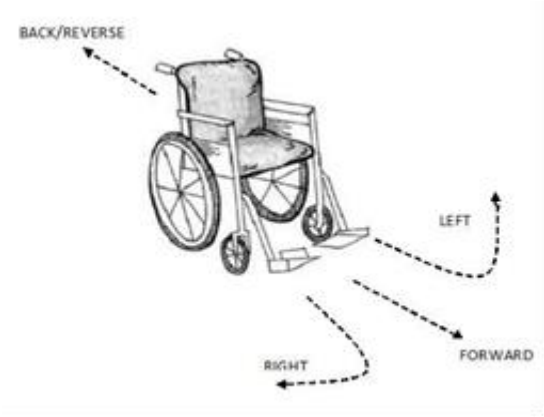


Fig 5. E- Wheelchair Movement Paths

Fig-6 Front View of Proposed Model

## IV RESULTS

This designed wheelchair is test with all the features which is present on it like emergency signal using IOT, controlling of wheelchair with drive, voice recognition, image processing, etc. we get accurate output and efficient framework for the patients with low power consumption and no wastage of fuel. It is an overall implementation of the proposed hardware system. we have successfully designed and made a prototype of the proposed design. The figure shows the front view of the wheelchair.

The figure-6 shows the front view of the E-Wheelchair and Table-1 Shows Output Results

Result Output Table -1

| Application | Input | Command/ Controlling action | Output |
|---|---|---|---|
| Obstacle detection / recognition present in the way. (Ultrasonic Sensor) | Recognition of obstacle present in the way through ultrasound by using ultrasonic sensor | Raspberry Pi technology will process the input as per the flow chart. | Sound output module indication to handicapped person |
| Emergency signal in critical situation. (Emergency Button) | By pressing emergency button. | With these emergency button IOT will process the input with the help flow chart. | Signal or notification to the family members |
| Image processing for recognize the sign board, road pits e.t.c present in the path. (Web Camera) | Web camera will capture the image. | Raspberry Pi and Open CV process the image captured through web camera and it is done with the help of coding in Raspberry Pi | Sound output module indication to handicapped person |
| Directions and turns of wheelchair. (Direction Button) | By pressing the directions buttons. | With the help of coding directions and turns actuate. | Turning wheelchair left, right, and forward. |

## V.CONCLUSION

In this paper, Automation of wheelchair, with voice control, obstacle detection, image processing and emergency signal is developed. The wheelchair model developed is more useful for the patient who are paralyzed from waist down and even can't move. This wheelchair can be controlled in many languages with any prior training and there is not limitation of number of commands. Aim behind this product is to develop a cost effective and user-friendly wheelchair so maximum patient can use this and make their life easy.

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