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WIRELESS SMART SENSOR BASED DEVICE WITH IOT

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ABSTRACT: *Nowadays, human's efforts are reduced due to the technological developments. Similarly, the physically disabled persons are suffering for their basic needs. For such reasons, Smart home system is developed which is more emerging technology which increases the security, comfort and also improves the quality of human's life. This article focuses a Multi sensor based wheelchair in a smart home monitoring and alerting system for physically disabled person is being proposed. This system provided a security and comfort for the elderly people and also persons with disability. This system consists of a microcontroller board with a several sensors to achieve monitoring motion and authorization etc. This system also has alerting system when these sensor values are exceeded the fixed threshold value, and the system should alert the user and should motivate required safety procedure. To improve a high Alerting capacity, the vibration sensor is placed on the door to detect if the vibration caused by theft. A security alarm system using low processing power chips using Internet of things (IoT) which helps to monitor and get alarms when motion is detected and sends image of the victim to a cloud server. Moreover, when motion is detected, an IoT based application can be used remotely to view the activity and get notifications. The picture of victim is sent directly to a cloud server when the cloud is not available then the data is stored locally on the Raspberry Pi. On Comparing with all other previous works, this system has a high security and takes immediate response for an every task of happenings. Ultrasonic sensors sense the movement of traveller on road if there may be a object or traveller crossing on road these sensors intimated the same and vibration sensor check the traveller proper position if the person met accident it send SMS alert to the caretaker and an GPS tracker linked through IoT monitoring the persons limited location of home place if the person moved beyond the message alert the family their ward crossing beyond their location and may be missed.*

Keywords: *Smart home automation, Smart wheelchair, Internet of things (IOT), Raspberry Pi*

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I. INTRODUCTION

Most disabled people have disabilities with their hands, foot, backs which can limit the person to perform regular tasks in a regular daily life. Population of disabled people is increasing day by day. There should be some means of machine so that people can move from one place to another. Disabled peoples are suffering from their illness cannot pay for servant for every time even to move for their basic needs. Nowadays a smart device helps the disabled persons to gain their access for home automation system. With the development of smart home automation system, it is possible solution to monitor the disabled person's surrounding status.

According to the survey of 2011 report states that there is a linear increase in a disabled population in the country by 22.4% between 2001 and 2011. In 2001, the count of disabled persons were 2.19 crore, but in the status of 2011, it has gone up to 2.68 crore which had a 1.5 crores of males and 1.18 crores of females. Many disabled persons are those with physically disabled, accounting for 20.3% for total disabled population.

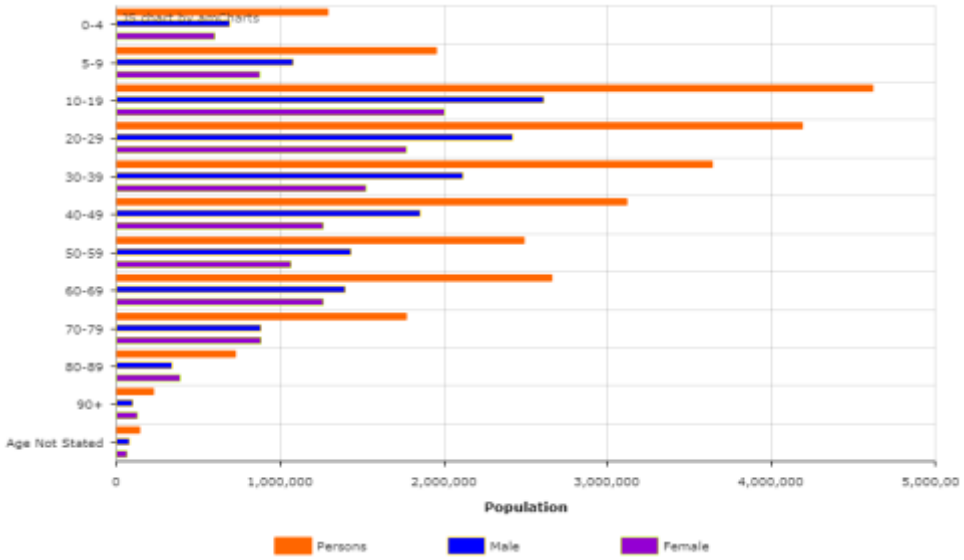


Fig. 1 disabled persons according to the age census of india from 2001 to 2011

Therefore, the total populations of disabled persons by age group in India- Census, 2011 is shown in fig 1. From the survey figure, it is clearly evident that the number of disabled persons is highest in the age group 10-19 years i.e., 46.2 lakhs. Whereas the 17% of the disabled population is in the age group of 10-19 years and 16% of disabled are in the age of 20-29 years respectively. Elderly (60+ years) disabled constituted 21% of the total disabled at all India level.

The agenda of this article is to provide an inexpensive smart wheel chair by integrating an IoT based Smart Home Monitoring System and also to alert in the case of any accidents happened in their surroundings. This system is used to detect any abnormality in an environment and also alerts through the wireless system IOT. Internet of things (IoT) is a technology that moves a planning of associated anything with each other and can share all the information through an internet. An IoT is a collection of physical stuffs, machines, individuals, and different devices that allows network and exchanges to share information for smart applications and

administrations. These devices consist of tablets, cell phones, vehicles, shopper hardware, wearable and sensors that are capable for IoT interchanges. The IoT allows all the devices to be controlled remotely crosswise finished existing framework system, making open entryways for facilitate joining between the physical and mechanized universes realizing upgraded capability, precision, and budgetary focal points.

In this article, the proposed system of SMART WHEELCHAIR USING IoT is presented which helps the disabled ones to move from one place to another without pushing the chair. The proposed wheelchair is an automated where no need to push it which can be simply controlled by the user using microcontroller devices. The smart wheelchair can be connected via WIFI or GSM with internet. A manual controlling of left, right, forward, backward and stop movements is placed with relays and motors. Also, with help of Ultrasonic sensors this smart wheelchair can be used to detect obstacles from all movements (left, right, forward, backward). So, with this smart wheelchair will become user friendly to user and patient. The Internet of things (IoT) is the combination of computing devices with the Internet infrastructure. Internet of things (IoT) provides machine-to-machine communications (M2M) and provides a variety of protocols, domain and applications.

The rest of the papers are illustrated with the several sections as follows. The section II explained the problem statement of the disabled persons. The section III explained the previous method of the related work of disabled persons. In the section IV, the proposed framework of the system has been illustrated. In the section V and IV, the hardware description and an experimental result for a proposed framework has been given. Finally our work is concluded with the conclusion in section VI respectively.

According to the ongoing Census of the Employment of Persons with Disabilities by Sector, New Delhi detailed us different kinds of disabilities,Seeing,Hearing,Speech,Movement,Mental Retardation,Mental Illness and different sorts from 2011-16 recorded above table. In current evaluation we need to realize that the males have more rate in Mental hindrance, Speech and Movement when contrasted with Females, similar to that females were seeing and hearing impeded more when contrasted with males. This is appeared in the figures 1 to 5.Table 1 shows statistical rate of disable peoples .On considering some of the impact factors based on these issues, the proposed system is implemented to handle some of their inconveniency based on the personal and social factors in the section IV.

II. STATISTICAL ANALYSIS OF DISABLE:

Table 1: Disabled Population by Type of Disability (%) India: 2011-16

Proportion of Disabled Population by Type of DisabilityIndia : 2011-16			
Type of Disability	Persons	Males	Females

Total	100.0	100.0	100.0
In Seeing	18.8	17.6	20.2
In Hearing	18.9	17.9	20.2
In Speech	7.5	7.5	7.4
In Movement	20.3	22.5	17.5
Mental Retardation	5.6	5.8	5.4
Mental Illness	2.7	2.8	2.6
Any Other	18.4	18.2	18.6
Multiple Disability	7.9	7.8	8.1

Figure Seeing disabilities

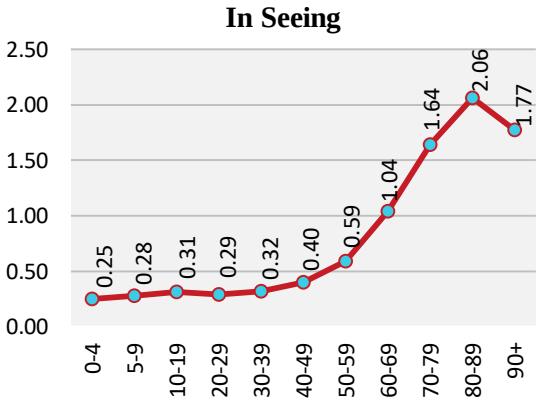
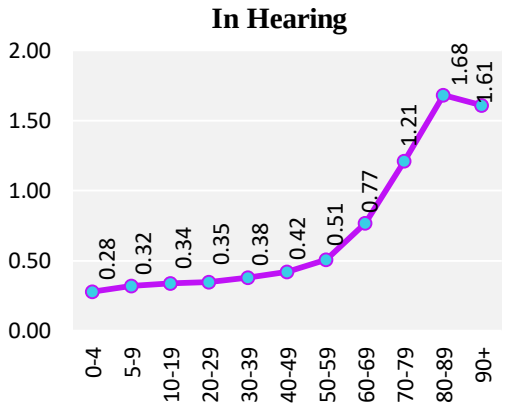
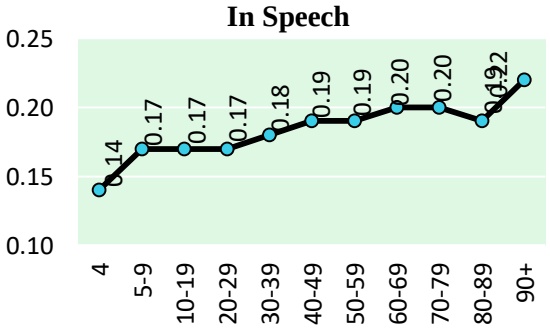


Figure 2 Hearing disabilities





Movement disabilities 3

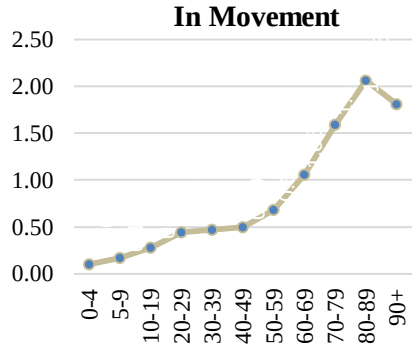


Figure 4 Speech disabilities

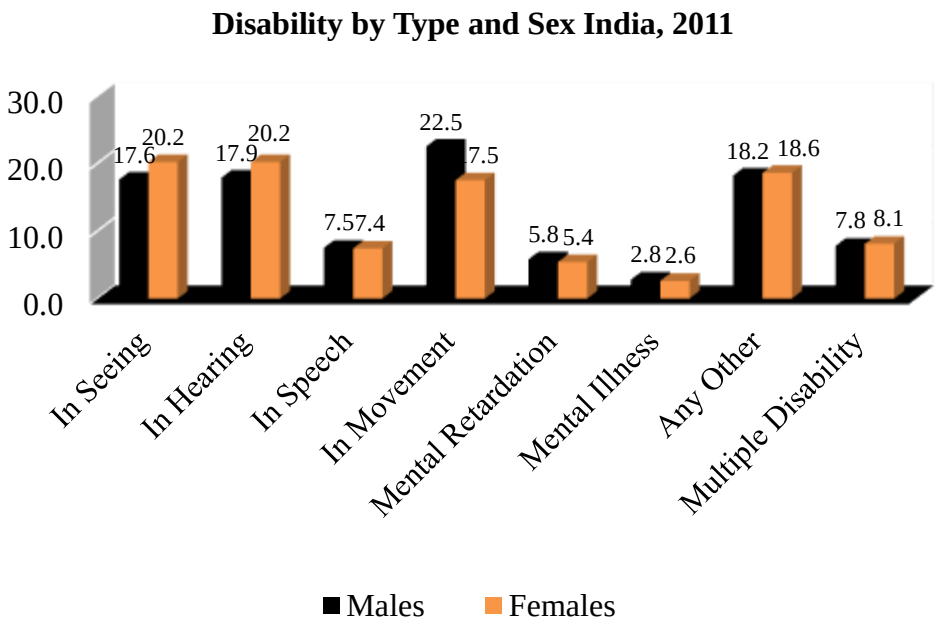


Figure 5 Disability **by Type and Sex India, 2011**

III. PREVIOUS METHOD

Since the smart wheelchair can take a technology at a fair speed with minimum efforts. There are different types of wheelchairs which is a traditional methods and that are used in a till date which are discussed below.

Manual Wheelchairs [1]: It consists of three types of manual wheelchairs namely self-propelled, attendant propelled, and wheelbase. A single-arm drive is a wheelchair that enables the disabled persons to turn either left or right while the two-armed drive would support the disable persons to move forward or backward on a straight line. A lever-drive wheelchair is another type of wheelchair which enables the disabled persons to move forward by pumping the lever back and forth.

Electric Wheelchairs [1]: An electric wheelchair/power chair can be used by a person who hasn't got the dexterity or mobility, perhaps, to force a mobility scooter due to arm, hand, shoulder or more general disabling conditions, and do not have the leg strength to propel a manual chair with their feet. This kind of wheelchair could offer various powered facilities such as tilt, recline, leg elevation, seat elevation, and others useful or necessary to health function.

Standing Wheelchairs [2]: It is also known as 'Redman power chair' which is the world's highest quality standing wheelchair. People with spinal cord injury can reap the health benefits of standing wheelchair. Physical benefits of standing wheelchairs are reduces urinary tract infection problem, Improves bodies

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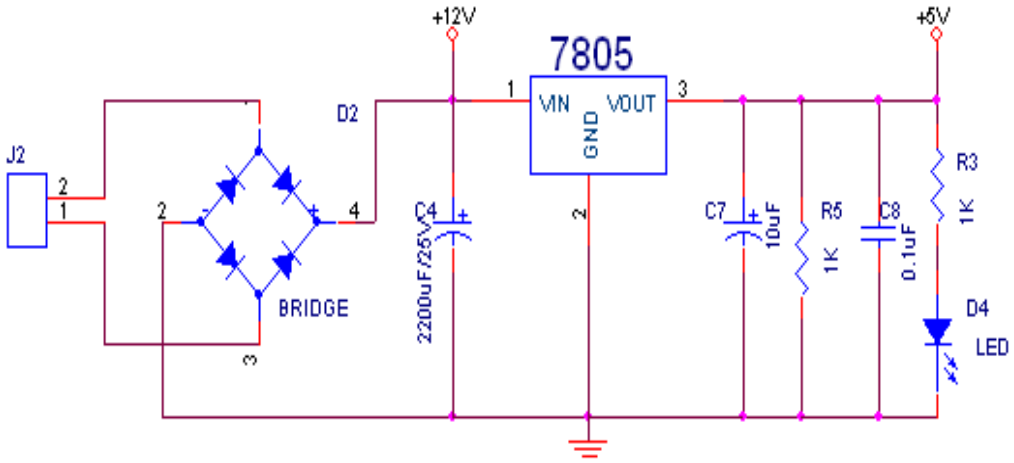
blood circulation, greatly improves bowl function, distribute weight and improve healing bed sores, increases bone density and reduces the amount of muscle stiffness.

Stair climbing wheelchair [4]: The stair-climbing wheelchair can be grouped into 3 categories namely continuous stair climbing wheelchair, intermittent-stair climbing wheelchair and auxiliary stair climbing wheelchair. Continuous stair climbing wheelchair has only one set of supporting device which relies on this supporting device for continuous motions. Secondly, an intermittent stair climbing wheelchair walking stair climbing wheelchair is the process of climbing stairs of is similar to the people climbing up and down stairs. In auxiliary stair climbing wheelchair is the process of attachments relies on another device installed on the wheelchair. Stair lift requires wide stair way which is highly expensive.

IV. SYSTEM DESCRIPTION

Power Supply:

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.



A 230v, 50Hz Single phase AC power supply is given to a step down transformer to get 12v supply. This voltage is converted to DC voltage using a Bridge Rectifier. The converted pulsating DC voltage is filtered by a 2200uf capacitor and then given to 7805 voltage regulator to obtain constant 5v supply. This 5v supply is given to all the components in the circuit. A RC time constant circuit is added to discharge all the capacitors quickly. To ensure the power supply a LED is connected for indication purpose.

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PIC micro controller

PIC16F877A is a Harvard Architecture which is an 8-bit microcontroller and has 40 pin DIP. The name PIC stands for Peripheral Interface Controller and also F for flash memory. The features of PIC16F877A has 256 bytes of EEPROM data memory, self-programming, an LCD, 2 Comparators, 8 channels of 10-bit Analogue -to-Digital converter, 2 capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface for the 2-wire Inter-Integrated Circuit bus and a Universal Asynchronous Receiver Transmitter. These features made it successful for more A/D applications in automotive, industrial, appliances and consumer applications respectively.

Vibration sensor

The vibration sensors or a piezoelectric sensors are flexible devices which are used for measuring the changes within acceleration, pressure, temperature, force otherwise strain by changing to an electrical charge. This sensor is also used for deciding fragrances within the air by immediately measuring capacitance as well as quality.

Relay

Relays are the primary protection as well as switching devices in most of the control processes or equipments. All the relays respond to one or more electrical quantities like voltage or current such that they open or close the contacts or circuits. A relay is a switching device as it works to isolate or change the state of an electric circuit from one state to another.

GSM

A GSM modem is a wireless which is like a dial-up modem. The major difference between GSM modem is that a dial-up modem communicates data through a fixed telephone line but GSM modem sends and receives data through radio waves. It can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM

modem is coupled to a PC through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop/computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop/computer. The GSM modem requires a SIM card from a wireless carrier in order to access the data. Computers use AT commands to control modems which supports a common set of standard AT commands.

Raspberry pi board

The Raspberry pi board has a processor of 900 MHz CPU and 1GB RAM which acts like a minimized computer. The NOOBS is installed in the memory card used for the board. With the help of NOOBS, the raspberry pi is booted with several operating systems. A LINUX based operating system can be booted which is named as Raspbian OS. It contains a 40 GPIO pins that can be used as digital input, digital output pins and pins to control and interface with multiple devices in the real time environment, 4 USB ports, 1 HDMI port, 1 Ethernet port, 1 3.5mm Audio jack and a micro USB power supply port. It also has ports for connecting a camera and a display to it which really makes it a multipurpose and multiuse board.

Camera

The camera module is used in this system to capture a live video of the person standing outside the front door of the house. It is a 5 Megapixel fixed-focus CMOS camera which can be used to take High-definition videos.

Voice board

The APR9600 experimental board is an assembled PCB board consisting of an APR9600 IC, an electrets microphone, support components and necessary switches to allow users to explore all functions of the APR9600 chip is a voice sensor [4-12,19-20] to ignite announcement. The oscillation resistor is chosen so that the total recording period is 60 seconds with a sampling rate of 4.2 kHz.

LCD (16×2):

LCD represents fluid precious presentation. They come in numerous sizes 8x1 , 8x2 , 10x2 , 16x1 , 16x2 , 16x4 , 20x2 , 20x4 ,24x2 , 30x2 , 32x2 , 40x2 and so on . Numerous worldwide organizations like Philips Hitachi Panasonic make their own uncommon sort of LCD'S to be utilized in their items.

All the LCD'S plays out similar capacities (show characters numbers unique characters ASCII characters etc).Their writing computer programs is likewise same and they all have same 14 pins (0-13) or 16 pins (0 to 15).

Alphanumeric presentations are utilized in a wide scope of uses, including palmtop PCs, word processors, printers, retail location terminals, medicinal instruments, mobile phones, and so forth.

DC MOTOR:

A direct-current motor is a shunt-wound motor in which the field windings and the armature might be associated in equal over a steady voltage supply.

Each DC motor has six fundamental parts - hub, rotor, armature, stator, commutator, field magnet(s), and brushes. In most basic DC motors, the outside attractive field is created by high-quality lasting magnets

The stator is the stationary piece of the motor, this incorporates the motor packaging, just as at least two lasting magnet shaft pieces.

The rotor (together with the pivot and appended commutator) turn as for the stator. The rotor comprises of windings (for the most part on a center), the windings being electrically associated with the commutator.

V. PROPOSED METHODLOGY

A smart wheelchair with a smart home automation system is proposed in order to support safe mobility for disabled or elderly people with various impairments. This paper presented the design of low cost solar powered wheel chair for physically disabled people with the Internet of Thighs (IoT) implementation. This model is affordable to the low income people of countries and also wheelchair is cost effective and user friendly. The Smart home with multi sensor enabled wheelchair system is getting more importance as it increases the security, comfort and improves the quality of physically challenged peoples life.

In this paper, a smart wheelchair monitoring and alerting system with IoT devices for disabled person is being proposed. This system gives security, and comfort for the elderly people and persons with disability. The proposed model is shown in Fig.2 which consists of PIC16F877A microcontroller board that is used to achieve monitoring of motion and authorized entry and controlling different electrical appliances like motor and LCD If the sensor value exceeds the threshold value, the system should alert the disabled person through voice and should trigger the required safety alert which is programmed in PIC controller or it may be Raspberry Pi. Using an IoT technology, alerting functions are processed and also the SMS may send to the respected guardian/authority. Using this system, the disabled person can monitor the home from anywhere and anytime using internet compatible devices. This system included the theft identification facilities by placing a camera and vibration in the door and intimates to the respected guardian/authority. Further we included Parking framework when a person enter to a confined area by getting authorization that time after the assigned time the parking framework send SMS to the person .So the person consequently left the area where they are in temporarily allowed.

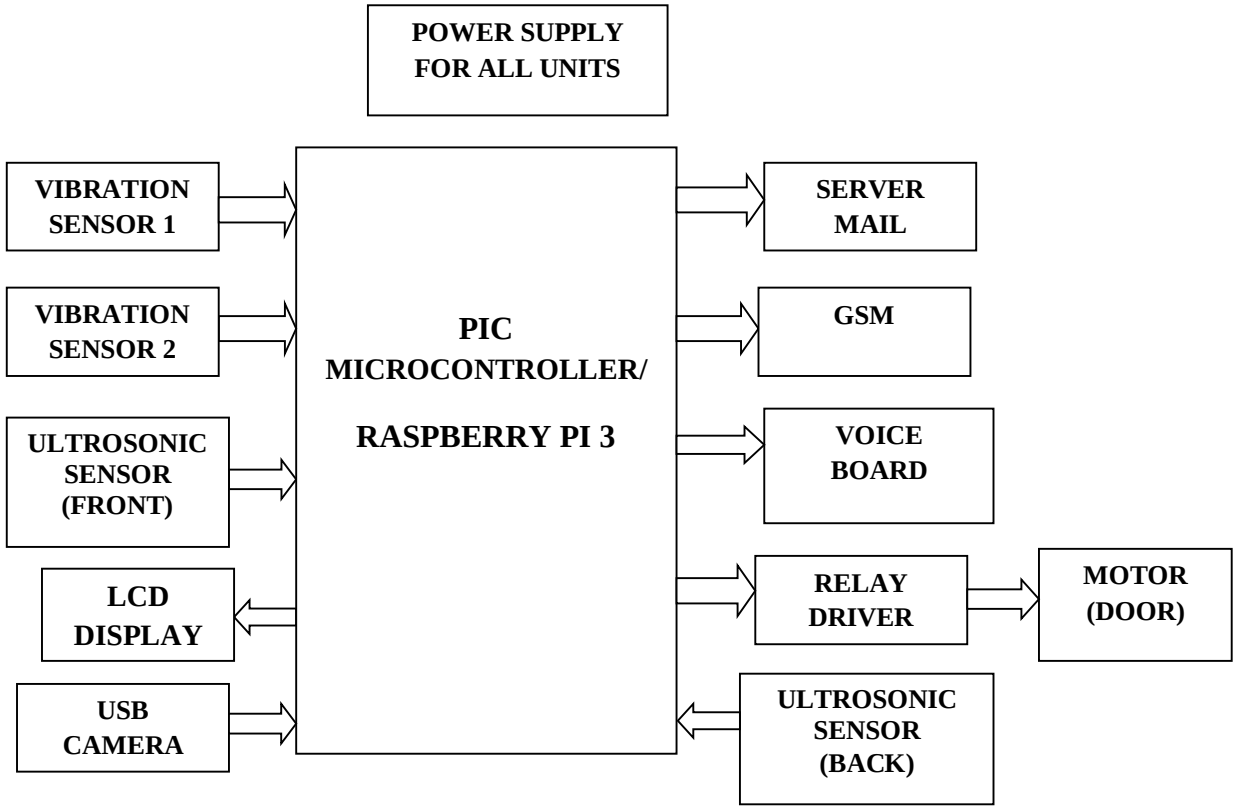

Fig.2 Proposed Block Diagram

Working principle

In this system, the renewable source is used to generate a power sources and that is stored in battery. In this proposed system, it consists of much technology by using a multiple sensors in a single system which is explained in the following.

(I) Theft identifying system

This proposed technology seeks to increase the independence of people with disabilities and improve their quality of life by making the most of each individual's abilities using camera, vibration sensor and the GSM modules. From the Fig. 2, it clears that the camera and vibration sensor is used which is placed in the door. When the door is vibrated above the threshold limit, the camera captures the image of the victim who caused the vibration and updated in the cloud server. The vibration sensor holds the door and it makes the theft to not open the door easily. The SMS and the E-mail notification with a victim image will send to security office and the respected guardian using an IoT.

From the proposed smart wheel chair model, the system is highly safe and secured for the disabled/elderly care person. They can feel free to move anywhere and anytime whole heartedly which has IoT alert and provides a sudden response for the every abnormal actions occurred.

II) Ultrasonic Sensor:

The Ultrasonic Sensor HC-SR04 is one of the most commonly used distance measuring ultrasonic sensors and works extremely well with Arduino.

- Operating Voltage: 5V
- Static current: 2mA max
- Induction Angle: 15°
- Detection Range: 2 – 200cm
- High precision up to 3mm

Description

This module has 4 pins- Vcc (5V), Trig, Echo, GND. Trig (trigger) is used to send out an ultrasonic high level pulse for at least 10μs and the Echo pin then automatically detects the returning pulse.

Measuring Distance

The time it takes the sound wave to be sent, hit the object and return back to the sensor is measured. This time is then multiplied by the speed of sound (343m/sec = 0.0343cm/μs = [1/29.1] cm/μs approx.) to give the total distance traveled by the ultrasonic wave, which is then divided by 2 (to account for the fact that the wave was sent, hit the object, and then returned back to the sensor, hence covering twice the distance to the object) Distance = (Time for wave to return * Speed of sound) / 2.Open up your serial monitor after uploading the code and test out the limits of the sensor. It can detect up to 200cm (2m), but sometimes maybe able to detect even further. Then use these limits to print out the distance values only when the value is within these limits.

Possible area applications:

This sensor can be used in any robot that needs to know the distances to objects in front of it. This sensor can be used with Chineduino Uno Rev3 Magician Robot Controller Board Mini Driver Robot Controller or Spider Robot Controller. This sensor can also be mounted on a Pan Tilt Kit to detect objects in a wider area. A few example uses are:

1.Object Detecting Robot 2.Line Follower with Object Detecting Robot

Pin Number	Pin Name	Description
1	Vcc	The Vcc pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

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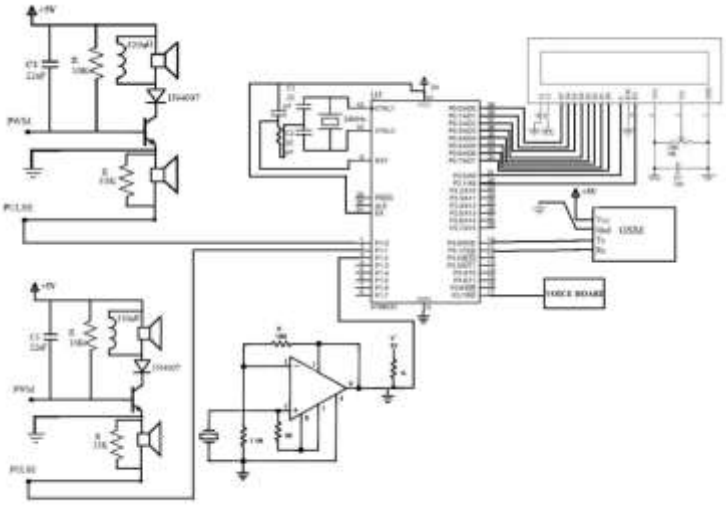

Ultrasonic Sensor circuit

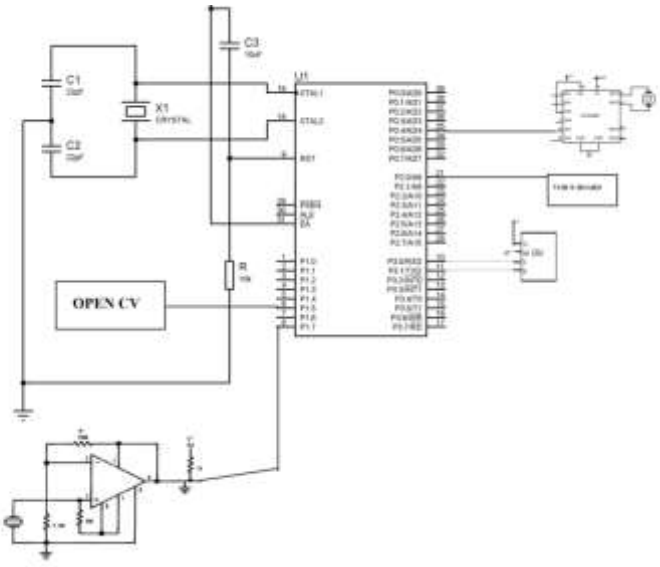

Image processing circuit diagram

VI. RESULT AND DISCUSSION

In this section, the results of the proposed device are explained. This system considered the Safety and Security of disabled person with the combination of fire prediction system in Fig.3, Gas leakage detection in Fig.4, smart home automation in Fig.5 and the theft identification system in Fig.6 and 7 respectively. Finally the overall experimental setup of hardware is shown in the Fig.8 which is shown the multiple sensors in it

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Fig. 6 Ultrasonic sensor detecting object distance

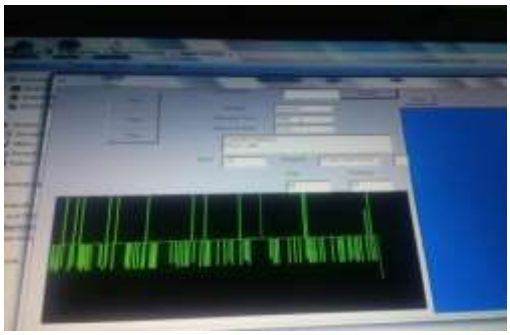


Fig. 6 Ultrasonic sensor pulse transmission to detect object

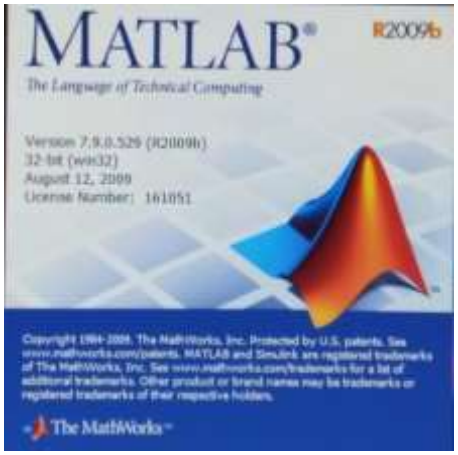
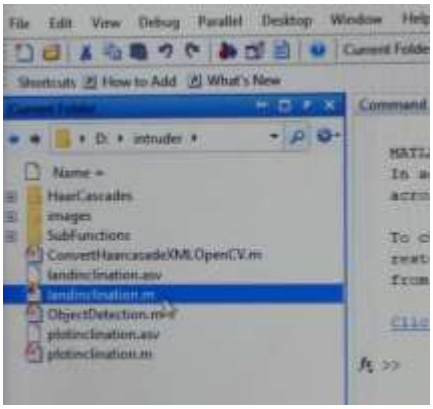
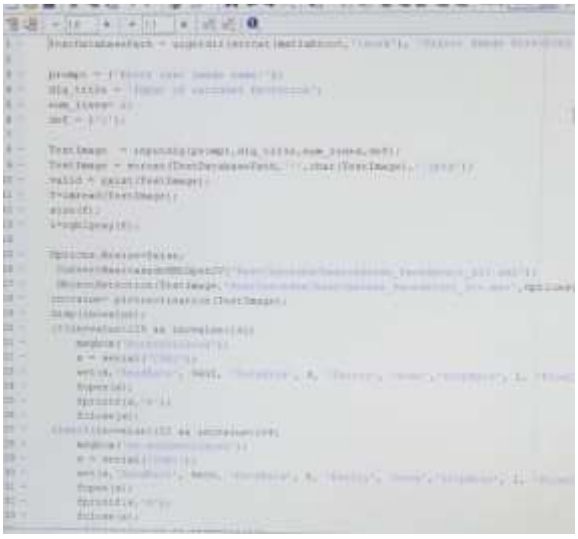


Image processing Software selection

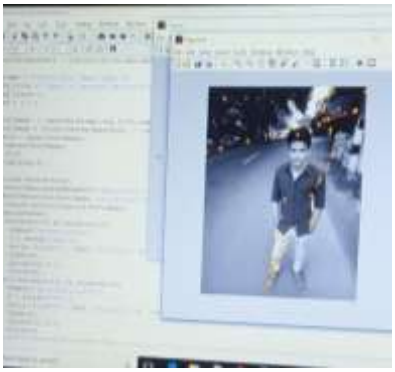


Open the software icon



MATLAB program running

Image data input 1 given for sample



Un- Authorized

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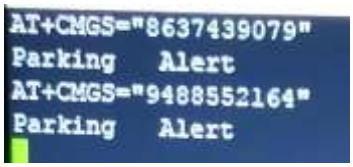

Parking System

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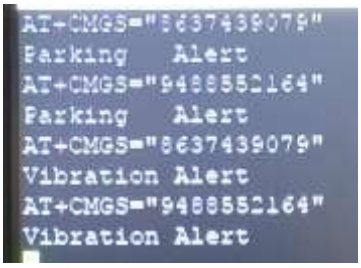

Vibration detected

VII. CONCLUSION

In recent years, the Researchers from over the world have started to discover diverse mechanical responses for enhance disable persons possibility in a way that supplements existing organizations by amassing the capacity. The proposed system presented a unique method by concerning the safety and security of physically disabled person and elderly care. To better appreciate a smart home protection security, this system considered alert for security requirements to propose a model that can lighten related security risks. By this proposed system, it also included the accident safety alert system which helps the disabled people to move freely and independently and facilitating the people in charge of taking care of the disabled people. It also included with the theft detection method with the knowledge of motion in doors and alert to the authority. Finally, the proposed smart wheelchair provided all the basic needs for disabled people such as moving around without any human support and also provided the efficient safety and security among all the existing methods. **Ultrasonic sensors sense the movement of voyager on street if there might be an item or voyager going across on street these sensors intimated the same and vibration sensor check the voyager position if the individual met accident it send SMS alert to the guardian and a GPS tracker connected through IoT.**

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