SMART DOORBELL SYSTEM

The project report submitted to

Veermata Jijabai Technological Institute, Mumbai

For the award of

DIPLOMA IN ELECTRONICS ENGINEERING

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Soham Kale (194130030)
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Veermata Jijabai Technological Institute, Mumbai

Maharashtra, India

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ACKNOWLEDGEMENT

Veermata Jijabai Technological Institute, Mumbai

Department of Electronics Engineering

Approval of the Guide and the External Examiner

Certified on 8/01/2022, that the Project titled "Smart Doorbell System" submitted by following project group:
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to the Veermata Jijabai Technological Institute, Mumbai, for the award of DIPLOMA IN ELECTRONICS ENGINEERING and that the students have successfully examine in the viva voce examination held today.

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External Examiner:
Affiliation :

DECLARATION

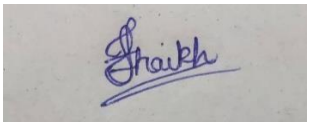
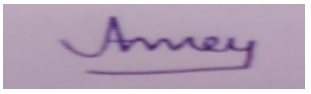
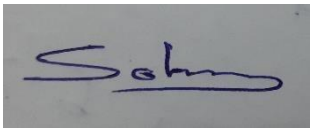
We certify that,

- The work contained in this report is original and has been done by us under the guidance of our guide.

- The work has not been submitted to any other Institute for the award of any diploma, or certificate.

- We have followed the guidelines of the Institute in preparing the thesis.

- Whenever we have used materials (data, theoretical analyses, figures, text, etc.) from other sources, we have given due credit to them by citing them in the text of the thesis and giving their details in the references.

Sr No	Name of student	Signature
1	Atharva R Jadhav	
2	Farhan Shaikh	
3	Amey Sonawadekar	
4	Soham Kale	

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LIST OF ABBREVIATIONS

OLED	ORGANIC LIGHT EMITTING DIODE
PCB	PRINTED CIRCUIT BOARD
I.E	THAT IS
NGO	NON-GOVERNMENT ORGANISATION
FM	FREQUENCY MODULATION
AC	ALTERNATING CURRENT
A	AMPERE
C	CURRENT
CM	CENTIMETER
USB	UNIVERSAL SERIAL BUS
PWM	PULSE WIDTH MODULATION
SRAM	STATIC RANDOM-ACCESS MEMORY
EEPROM	ELECTRONICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY
DC	DIRECT CURRENT
Vin	VOLTAGE INPUT
IOREF	INPUT OUTPUT VOLTAGE REFERENCE
GND	GROUND
MA	MILLIAMPERE
UART	UNIVERSAL ASYNCHRONOUS RECEIVER TRANSMITTER
TTL	TRANSISTOR-TRANSISTOR LOGIC
SS	SLAVE SELECT
MOSI	MASTER OUTPUT SLAVE INPUT
MISO	MASTER INPUT SLAVE OUTPUT
SCK/SCL	SERIAL CLOCK
SDA	SERIAL DATA
EN	ENABLE
I2C	INTER INTEGRATED CIRCUIT
FTDI	FUTURE TECHNOLOGY DEVICES INTERNATIONAL

CONTENTS

LIST OF CHAPTERS

CHAPTER 1: INTRODUCTION

1.1 Objective and Aim

The key objective of this project is to aid physically challenged people, particularly deaf through a low-cost device – Smart Doorbell System using Arduino Uno, Arduino Nano, Bluetooth Module (HC-05), Flat Vibrator motor and an OLED screen. How difficult it is live without one of the senses? This question alarms us to the profundity as well as causes us to see that they are so critical to the human body. Our day-to-day travel through the streets of Mumbai caused us to acknowledge one question that was, how terrible is it to live without hearing anything. The basic sounds in our daily life are what makes the day complete, without them one could not even imagine surviving in the hectic lifestyle especially in metro cities. These devices are basically helping the physically challenged people to overcome few of the basic difficulties encountered in their daily lives.

Coming to the main aim of this project, we aim to lend a helping hand to deaf and by providing them with a low cost, portable and easy to use "Smart Doorbell System". The use of easily available components reduces the manufacturing and maintenance costs. This makes the system an economical, appropriate and a low maintenance solution especially for places and people who cannot invest a large amount of money in this technology.

Figure 1.1: Deaf Person

1.2 Motivation

Imagine how difficult and unpleasant it would be to not able to hear anything, the morning birds chirping, the rain drops falling, the ringing of doorbell when the newspaper arrives in morning and many such things. It is quite disheartening and disturbing to even imagine such a situation for few minutes of our life, whereas some people have to deal with it all their life.

Shedding the light on different perspectives we see on deaf people. In the daily society people see deafness as an injury on a human. It separates “impaired” people from the “normal” people. And we, the-hearing-people will kind of feel sorrow for them, or if they “succeed” in the hearing world, we would admire them for conquering this injury. We think that sign language is a replacement for the “real” communication. We are assuming that deaf people are trying to become more of a non-injured person, but it’s our duty to make them feel like a normal person, hence we made a project to fulfil their desire of one of the basic sounds i.e. ‘doorbell ringing’.

CHAPTER 2: LITERATURE SURVEY

2.1 Hearing Disability

Deafness is usually the result of inner ear or nerve damage. It may be caused by a congenital defect, injury, disease, certain medication, exposure to loud noise or age-related wear and tear.

The chief symptom is an inability to hear sound.

For some, hearing may be possible with surgery or a hearing device. Lip-reading skills, written or printed text and sign language may help with communication.

Hearing disability is normally due to problem with the person who has a genetic disorder. This is something which cannot be cured easily. Another reason for hearing disability is due to constant presence of high sound. People who work in mines or places where there is loud noise, are prone to this disability. People with very old age can also suffer with this ability. But it can be restored by using various device like hearing aid machine as long as the sensitivity has not gone completely.

Fig 2.1 Ear diagram

2.2 Symptoms

Hearing disability can be different for various people, while some may be sensitive to hearing while others may not. Signs and symptoms of hearing loss may include:

- Muffling of speech and other sounds
- Difficulty understanding words, especially against background noise or in a crowd
- Trouble hearing consonants
- Frequently asking others to speak more slowly, clearly and loudly
- Needing to turn up the volume of the television or radio
- Withdrawal from conversations
- Avoidance of some social settings

FIG 2.2 PAIN IN EAR DUE TO CONSTANT NOISE

2.3 Prevention

The following steps can help you prevent noise-induced hearing loss and avoid worsening of age-related hearing loss:

- **Protect your ears.** Limiting the duration and intensity of your exposure to noise is the best protection. In the workplace, plastic earplugs or glycerin-filled earmuffs can help protect your ears from damaging noise.
- **Have your hearing tested.** Consider regular hearing tests if you work in a noisy environment. If you've lost some hearing, you can take steps to prevent further loss.
- **Avoid recreational risks.** Activities such as riding a snowmobile, hunting, using power tools or listening to rock concerts can damage your hearing over time. Wearing hearing protectors or taking breaks from the noise can protect your ears. Turning down the music volume is helpful too.

FIG 2.3 EAR PLUGS (FOR PROTECTION)

2.4 Impact

- Hearing loss can have a significant effect on your quality of life. Older adults with hearing loss may report feelings of depression.
- Because hearing loss can make conversation difficult, some people experience feelings of isolation.
- Hearing loss is also associated with cognitive impairment and decline.
- The mechanism of interaction between hearing loss, cognitive impairment, depression and isolation is being actively studied. Initial research suggests that treating hearing loss can have a positive effect on cognitive performance, especially memory.

- fewer educational and job opportunities due to impaired communication
- social withdrawal due to reduced access to services and difficulties communicating with others
- emotional problems caused by a drop in self-esteem and confidence.

FIG 2.4 SIGN LANGUAGE

2.5 Diagnosis of hearing disability

Tests to diagnose hearing loss may include:

- **Physical exam.** Your doctor will look in your ear for possible causes of your hearing loss, such as earwax or inflammation from an infection. Your doctor will also look for any structural causes of your hearing problems.
- **General screening tests.** Your doctor may use the whisper test, asking you to cover one ear at a time to see how well you hear words spoken at various volumes and how you respond to other sounds. Its accuracy can be limited.
- **App-based hearing tests.** Mobile apps are available that you can use by yourself on your tablet to screen for moderate hearing loss.
- **Tuning fork tests.** Tuning forks are two-pronged, metal instruments that produce sounds when struck. Simple tests with tuning forks can help your doctor detect hearing loss. This evaluation may also reveal where in your ear the damage has occurred.
- **Audiometer tests.** During these more-thorough tests conducted by an audiologist, you wear earphones and hear sounds and words directed to each ear. Each tone is repeated at faint levels to find the quietest sound you can hear.

FIG 2.5 EAR CLEANSING

CHAPTER 3: MARKET SURVEY

3.1 Hearing aid-

Fig 3.1 Hearing aid

A hearing aid is a battery-powered electronic device designed to improve your hearing. Small enough to wear in or behind your ear, they make some sounds louder. They may help you hear better when it's quiet and when it's noisy. Here's how they work:

- A microphone picks up sound around you.
- An amplifier makes the sound louder.
- A receiver sends these amplified sounds into your ear.

A hearing aid costs easily around Rs.25000/-. This is the minimum price after comparison multiple sites selling hearing aids.

3.2 Cochlear implant-

Fig 3.2 Cochlear implant

A cochlear implant is an electronic device that partially restores hearing. It can be an option for people who have severe hearing loss from inner-ear damage who are no longer helped by using hearing aids.

According to our market survey a cochlear implant costs a minimum of Rs.600000/- (6 lakhs). While some NGOs provide 3 implants for Rs.500000/- (5 lakhs).

3.3 FM system-

Fig 3.3 FM SYSTEM

A FM system is a special wireless device that helps people hear better in noisy listening situations. FM stands for frequency modulation and uses radio waves to transmit audio signals to the listener. The device is typically used in conjunction with hearing aids but can also be used alone in cases of normal hearing.

The cost of a FM system starts around Rs.10000/- and onwards.

3.4 Plug-in doorbell kit -

3.4 PLUG-IN DOORBELL KIT

A Plug-in doorbell is a doorbell with built-in strobe light is ideal for hearing impaired or noisy environments and can be plugged into any 120V AC wall outlet.

The price of a plug-in doorbell starts around Rs.5000 in India. Whereas in North America is costs around 60$.

3.5 OUR DOORBELL SYSTEM-

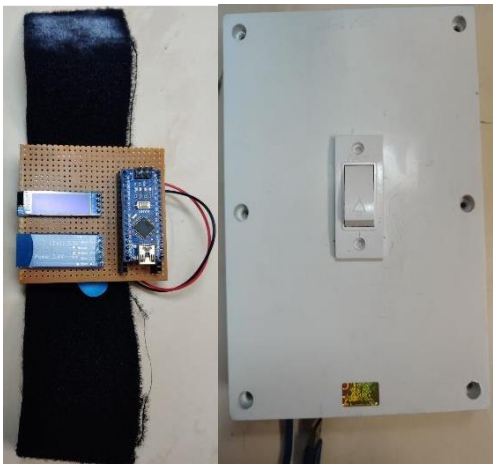

Fig 3.5 OUR DOORBELL SYSTEM

Our device combines a visual display and a vibrating alarm system into one single unit. In addition to this, the use of low cost Bluetooth module and Arduino microcontrollers (UNO & NANO) bring down the cost to Rs.1495. As we can see this is quite a low-cost device and also a user friendly one.

Components	Units	Price (In ₹)	Total (In ₹)
Arduino UNO	1	400	400
Arduino NANO	1	250	250
HC-05 (Bluetooth module)	2	250	500
OLED display (0.91 inch)	1	200	200
Flat vibration motor	1	40	40
Battery (9v)	1	15	15
Switch box	1	90	90
TOTAL	8		1495

CHAPTER 4: DESIGN OF EXPERIMENTAL SETUP

4.1 Block Diagrams

1. Doorbell system for deaf people

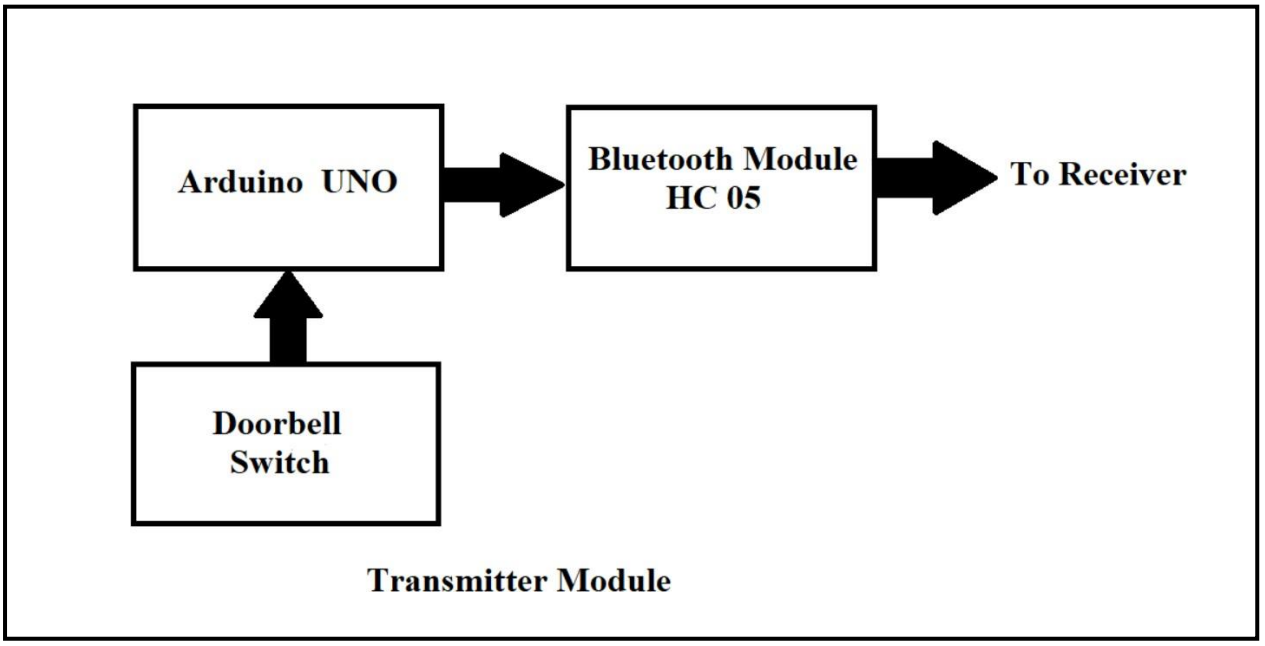

Fig 4.1

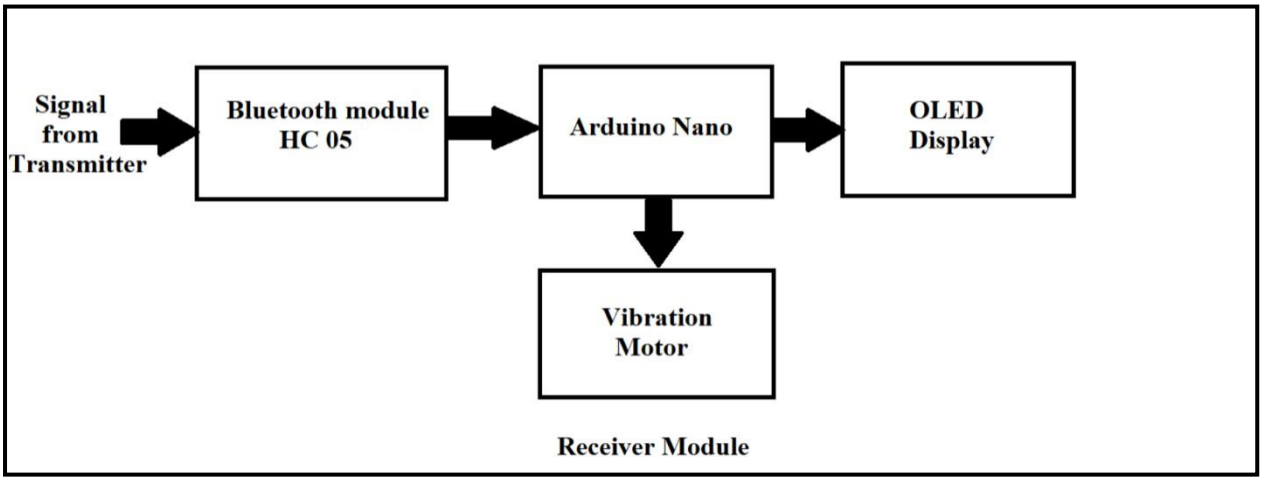

Fig 4.2

4.2 Approach/ proposed flow of techniques

1. **Door Bell System for Deaf people**

We have divided this project into 2 major segments each made up of 3-4 minor segments.

- **Transmitter**

The transmitter segment is mainly divided into 3 main blocks namely the Doorbell switch, Arduino UNO and the HC05 Bluetooth module.

The first block is the doorbell switch, that would be placed near the door of the house. It is a simple bounce-back switch that changes it state when presses by a user and returns to its original state after it.

The second block is the Arduino UNO which acts like the brain of the entire circuit controlling and using all the other devices interfaced with it. The doorbell switch is connected to the Arduino which reads its state when the button is pressed by the user. Also, the Bluetooth module is connected to the Arduino so that it can send data wirelessly.

The third block is the HC05 Bluetooth module which transmits the data from the Arduino wirelessly to another HC05 module and Arduino connected on the receiver side of the circuit.

The Arduino UNO here is powered using a 9v, 1A wall adapter and rest of the devices connected take power from the Arduino 5v output pins.

- **Receiver**

The receiver here is made up of 4 blocks namely the HC05 Bluetooth Module, Arduino Nano, Vibration Motor and the OLED Display.

The HC05 module does the work of receiving the signals which are wirelessly transmitted by the HC05 module on the transmitter side.

The Arduino Nano processes the signals coming from the transmitter and does the work of controlling the vibration motor and OLED display connected to it.

The Vibration motor turns on as soon the Arduino Nano instructs it to do so through on of its digital pins i.e., it starts vibrating upon the receival of signal from the transmitter.

The functioning of the OLED display is similar to the vibration motor it just displays text “OPEN !!“on the arrival of signal from the transmitter i.e., on the press of doorbell switch on the transmitter side.

The Arduino Nano here is powered using a 9-v battery and the rest of the modules and devices take power from the Arduino Nano 5v output pin.

CHAPTER 5: DEVELOPMENT OF EXPERIMENTAL SETUP

5.1 Circuit Development

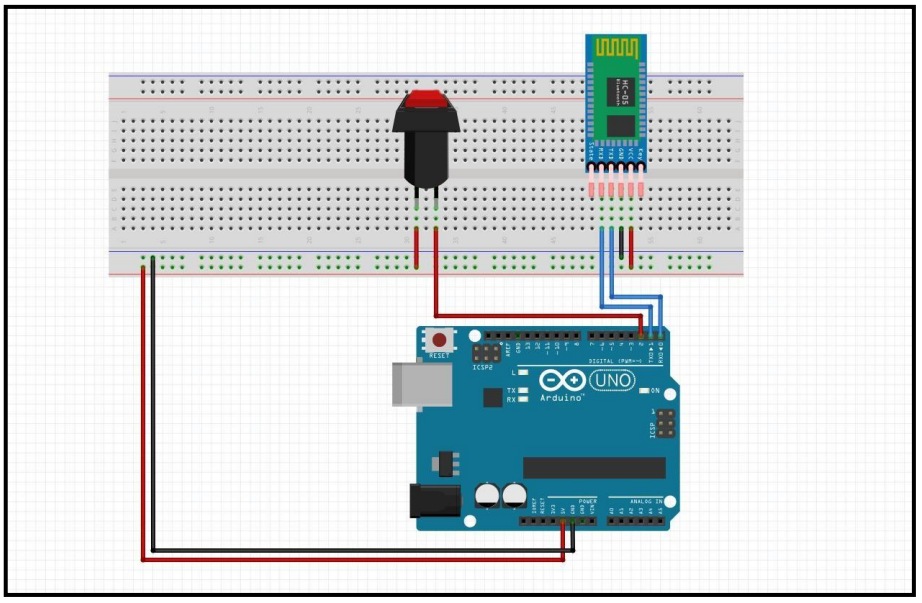

Figure 5.1: Circuit Diagram of Transmitter

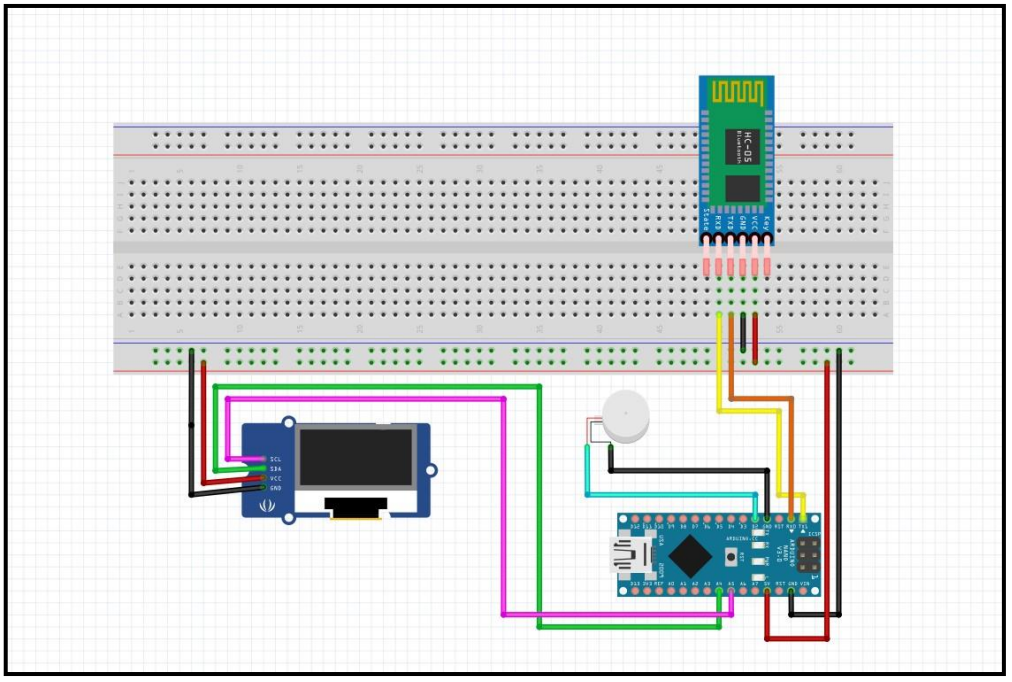

Figure 5.2: Circuit Diagram of Receiver

5.2 Circuit Components and Design

For the transmitter circuit, we have used an electrical switch box with the dimensions **20 x 15 x 5 cm** so that all the components can be placed inside it. We made a appropriate slot onto the front side of the box in order to fix the doorbell switch. All the connections between the various components are made with the help of male-to-male and male-to-female jumper wires of proper length. Another hole is made at the bottom of the switch box for routing the power cable out of the box. Turning on/off the ac adapter switch would turn the circuit on/off.

The receiver circuit is made by arranging two perf boards placed on top each other in a sandwich-like design. The Arduino Nano is mounted on the top perf board with the help of female headers soldered onto the perf board. Also, the HC05 Bluetooth module and the OLED display is mounted onto the top perf board. The 9v battery is placed between the two perf boards and acts as a support to the whole structure. The vibration motor is mounted onto the inner side of the bottom perf board so that it remains close to the user's wrist. This entire structure is attached to a strap made up of Velcro bands which helps to clip the circuit to the user's hand.

CHAPTER 6: COMPONENTS SPECIFICATION AND DESCRIPTION

Main components and software specifications

Main components of our project are as follows:

- Arduino Uno
- Arduino Nano
- Bluetooth Module: HC05
- Flat Vibrator Motor
- OLED Screen

Smart

6.1 Arduino Uno

The Arduino Uno is an open-source board based on the ***Microchip ATmega328P*** microcontroller and developed by ***Arduino.cc.*** The board is equipped with sets of digital and analog ***input/output*** (I/O) pins that may be interfaced to various ***expansion boards*** (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the ***Arduino IDE*** (Integrated Development Environment) via a type B ***USB cable.*** It can be powered by the USB cable or by an external ***9-volt battery,*** though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

Technical specifications:

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- *Flash Memory:* 32 KB of whic*h 0.5 KB used by boot loader*
- SRAM: 2 KB
- EEPROM*:* 1 KB
- Clock Speed: 16 MHz
- Length: 68.6 mm
- Width: 53.4 mm
- Weight: 25 g

Pins:

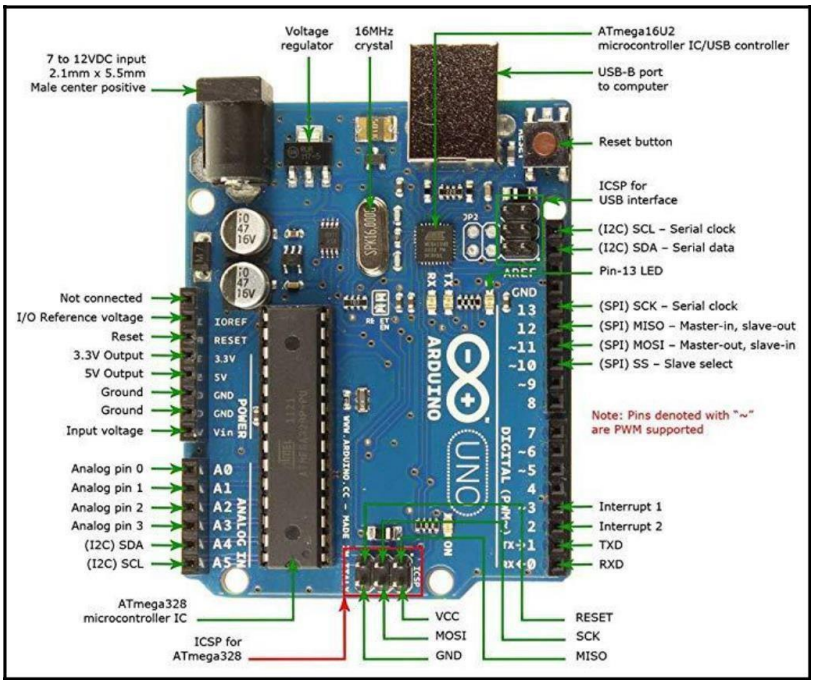

Figure 6.1: Pin Diagram of Arduino UNO

General pin functions

- LED: There is a built-in LED powered by digital pin 13. When the pin is high value, the LED is on. When it is digital low value, the LED is off.
- VIN: The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- 5V: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
- 3V3: A 3.3 volt supply generated by the on-board regulator. Maximum current drawn is 50 mA.
- GND: Ground pins.

- IOREF: This pin on the Arduino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.
- Reset: Typically used to add a reset button to shields which block the one on the board. Special pin functions
- Each of the 14 digital pins and 6 analog pins on the Uno can be used as an input or output, using pinMode (), digitalWrite (), and digitalRead () functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.
- The Uno has 6 analog inputs, labelled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference () function.

In addition, some pins have specialized functions:

- Serial / ***UART:*** pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL serial chip.
- External interrupts: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- ***PWM*** (pulse-width modulation): 3, 5, 6, 9, 10, and 11. Can provide 8-bit PWM output with the analogWrite () function.
- ***SPI*** (Serial Peripheral Interface): 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.
- TWI (two-wire interface) / ***I²C:*** A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.
- AREF (analog reference): Reference voltage for the analog inputs.

6.2 Bluetooth Module (HC-05)

Figure 6.2:
Bluetooth Module

- HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration.
- It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications.
- It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions.
- It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (***PAN***). It uses frequency-hopping spread spectrum (***FHSS***) radio technology to send data over air.
- It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (UART).

Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth.

It has 6 pins,

1. **Key/EN:** It is used to bring Bluetooth module in AT commands mode. If Key/EN pin is set to high, then this module will work in command mode. Otherwise by default it is in data mode. The default baud rate of HC-05 in command mode is 38400bps and 9600 in data mode.

HC-05 module has two modes,

1. **Data mode:** Exchange of data between devices.
2. **Command mode:** It uses AT commands which are used to change setting of HC-05. To send these commands to module serial (USART) port is used.

2. **VCC:** Connect 5 V or 3.3 V to this Pin.
3. **GND:** Ground Pin of module.
4. **TXD**: Transmit Serial data (wirelessly received data by Bluetooth module transmitted out serially on TXD pin)
5. **RXD:** Receive data serially (received data will be transmitted wirelessly by Bluetooth module).
6. **State:** It tells whether module is connected or not.

6.3 Arduino Nano

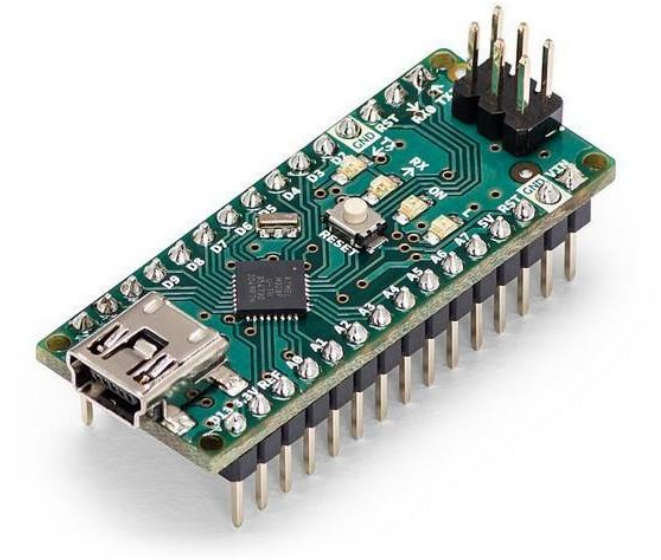

Figure 6.3:

Arduino Nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

The Arduino Nano has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provide UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An FTDI FT232RL on the board channels this serial communication over USB and the FTDI drivers (included with the Arduino software) provide a virtual com port to software on the computer. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the FTDI chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Nano's digital pins. The ATmega328 also support I2C (TWI) and SPI communication.

SPECIFICATIONS:

MICROCONTROLLER	ATmega328
ARCHITECTURE	AVR
OPERATING VOLTAGE	5 V
FLASH MEMORY	32 KB of which 2 KB used by bootloader
SRAM	2 KB
CLOCK SPEED	16 MHz
ANALOG IN PINS	8
EEPROM	1 KB
DC CURRENT PER I/O PINS	40 mA (I/O Pins)
INPUT VOLTAGE	7-12V
DIGITAL I/O PINS	22 (6 of which are PWM)
PWM OUTPUT	6
POWER CONSUMPTION	19 mA
PCB SIZE	18 x 45 mm
WEIGHT	7 g
PRODUCT CODE	A000005

FIG 6.3.1

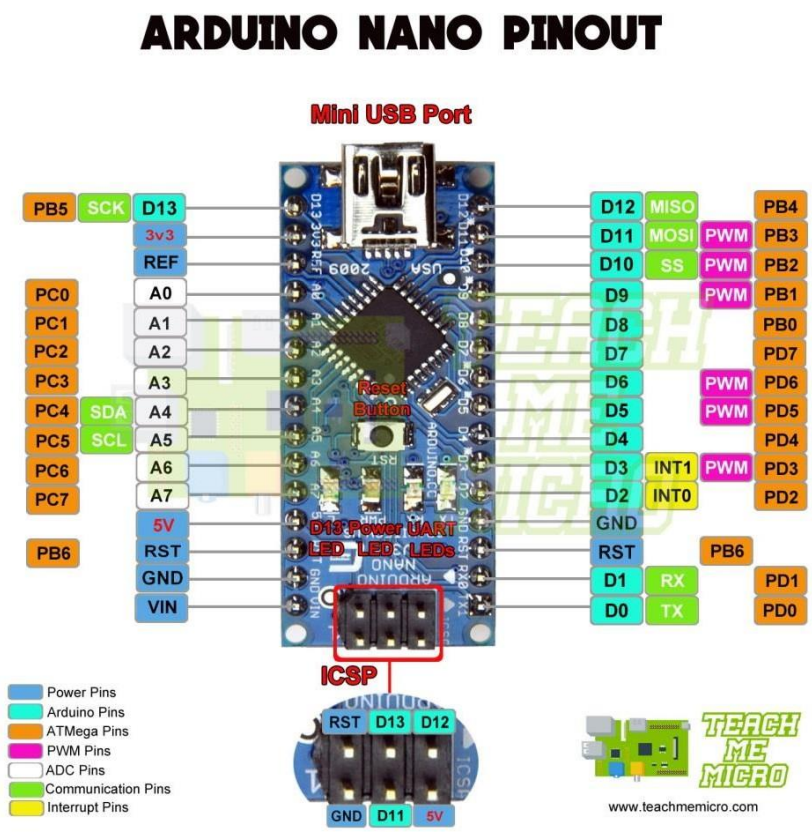

Figure 6.3.2: Arduino Nano Pin Diagram

6.4 OLED Screen

Figure 6.4: OLED Screen

2.32 cm (0.91 inch) I2C/IIC 128x32 OLED Display Module - Blue Color offers 128×32 pixel resolution. They are featuring much less thickness than LCD displays with good brightness and also produce better and true colours.

OLED's are the future of displays, as they possess some of the greatest advantages over both conventional display technologies of LCD's and LED's.

The most attractive thing about using the OLED displays is that they do not need a back-light like conventional LCD/LED screens. The organic material itself has a property known as Electroluminescence (EL), which causes the material to "glow" when stimulated by a current or an electric field. Best energy saving displays ever!!!

This OLED Display Module is very compact and will add a great ever user interface experience to your Arduino project. The connection of this display with Arduino is made through the I2C (also called as IIC) serial interface.

The 2.32 cm (0.91 inch) I2C/IIC 128x32 OLED Display Module - Blue Color produces blue text on black background with very good contrast when supplied with DC 2.8V supply. The OLED Display Modules also offers a very wide viewing angle.

Pin Description of 2.32 cm (0.91 inch) I2C/IIC 128x32 OLED Display Module: -

GND: Power Ground

VCC: Power + (DC 3.3 ~5v)

SCL: Clock Line

SDA: Data Line

Features of 2.32 cm (0.91 inch) I2C/IIC 128x32 OLED Display Module: -

- Work perfectly well without the need of back light.
- 128*32 high resolution, ultra-wide viewing angle
- The display is self-illuminating

- Power requirement is low
- Fully compatible with multiple controlling chips including Arduino and more.
- Better performance characteristics than traditional LCD and LED displays.

Specifications of 2.32 cm (0.91 inch) I2C/IIC 128x32 OLED Display Module: -

- OLED Driver IC: SSD1306
- Operating Voltage: 3.3-5V
- Resolution: 128 x 32
- Text Colour: Blue
- Background Colour: Black
- Full Compatible with Arduino
- Working temperature: -30°C ~ 70°C
- Interface: I2C

6.5 Flat Vibrator Motor

Figure 6.5: Flat Vibrator Motor

This Flat 1034 Mobile Phone Vibrator Motor is a shaft-less vibration motor that is fully-enclosed with no exposed moving parts. Its small size (10 mm diameter, 3.4 mm height) and shaft-less design mean you can mount it on a PCB or even place it in a pocket to add quiet, haptic feedback to your project.

The motor has a 3M adhesive backing on it for easy mounting and 1.5 leads for making quick connections. Polarity is not important; the motor can run CW or CCW.

This tiny, button-type, vibrating motor shakes with a vibration amplitude of 0.75g and draws approximately 60mA when 3V is applied to its leads.

Specifications: -

Type	1034
Rated Voltage(V)	3
Operating Voltage (VDC)	2.5 to 4
Operating Temperature (C)	-20 to 60
Min. Rated Speed (RPM)	9000
Max. Rated Current(mA)	90
Max. Starting Current(mA)	120
Cable Length	20 cm

FIG 6.5.1

CHAPTER 7: EXPERIMENTAL OBSERVATIONS

7.1 Circuit Output

The Doorbell Switch connected to the power supply via an adapter turns the Arduino and the Bluetooth Module ON. The Bluetooth module here acts as the master and goes in Data mode. Similarly, The Assistant Band on the subject's hand is turned ON by a 9v battery, which includes a Bluetooth module, a vibration motor and an OLED Screen. The Bluetooth module over here is in Data mode too but acting as a slave. So, both the Transmitter, i.e., Doorbell and the Receiver, i.e., Assistant Band are now ON but not connected or communicating with each other. After a few seconds the Master Bluetooth module detects the Slave and now the Transmitter and the Receiver are connected to each other wirelessly.

The Doorbell which is connected outside the home is now paired with the Assistant Band on the Subject's Hand and the OLED Screen has a dotted line across it. Whenever a person now rings the Bell, the subject wherever he might be gets an alert on the Assistant Band. This Alarming signal is of 2 types:

1. The OLED Screen displays "OPEN" text.
2. The Vibration Motor also vibrates for a time span of 5-8 Seconds.

The range is up to 10m and these Signals are quite visible and accurate for the Deaf subject to know that someone has arrived at the door. Therefore, by using this simple technique of Bluetooth technology we have come up with a cheap, user friendly and a compact device for the Deaf people to help them feel like a normal human in their homes by getting a feel of one of the basic sounds, i.e., the doorbell sound.

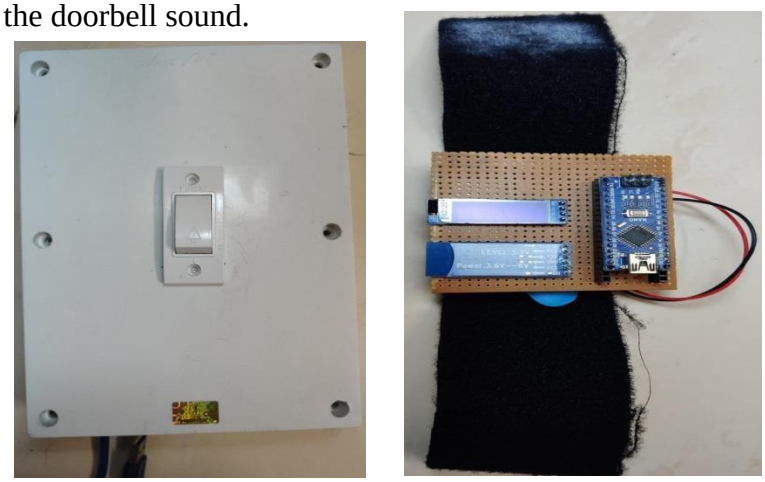

Figure 7.1: Transmitter and Receiver

CHAPTER 8: RESULTS AND DISCUSSION

8.1 Result

Thus, after pressing the doorbell, we get the desired output at the receiver, i.e. The Assistance Band. We get both the alarming signals:

1. “OPEN” Text on the OLED Screen
2. Vibration for a few seconds

A very short delay is observed (can be considered negligible) and the distance covered is up to 10m which is quite good. It was also observed that the Bluetooth signals are able to penetrate the walls and cross obstacles placed between transmitter and receiver. Therefore, we have completed our aim of providing the deaf person with the sense of one of the basic daily sounds, i.e., Doorbell sound.

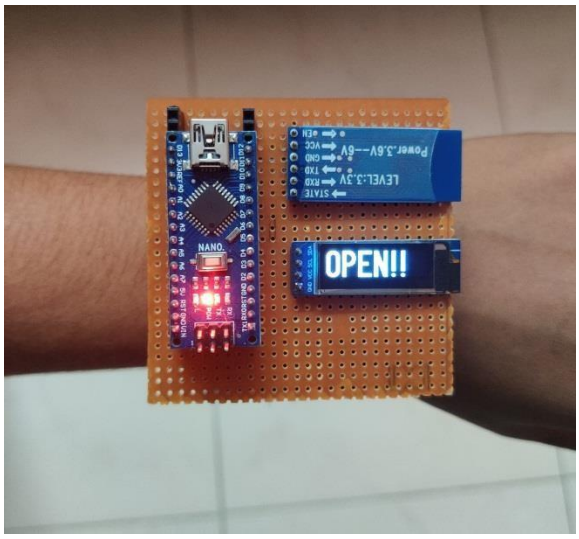

Figure 8.1: Assistance Band displaying “OPEN” Text when doorbell is pressed

CHAPTER 9: SUMMARY AND CONCLUSIONS

9.1 SUMMARY

The proposed Smart Doorbell system is cost effective, user friendly, compact and low maintenance. It helps a deaf human realize there is someone waiting outside the door, because even though sign language is devised, one person needs to have the visual of the hand and person while communicating whereas in the scenario of doorbell we don't get the visual of the person nor everyone knows sign language. Hence, this system is perfect and simple for situations like this and it can be developed more (refer to chapter 10). The novelty of the solution is its simplicity and how it is inexpensive. To better understand what we mean, we can say that this Doorbell and the Assistance Band does not require professional assistance.

While promoting this system we would like to emphasize on the following 3 points:

- The first is to encourage people to treat the deaf and abled people normally or at least make them feel normal.
- The second is to help the specially abled, i.e. not only deaf but all kinds of abled people like blind, mute, etc.
- The third is to make the disabled people aware of the governmental help they can get, like scholarships, medical benefits, etc.

Without all three of these behaviours occurring, the service will not achieve its intended individual objective and the aim which we created the project.

9.2 Advantages

1. **Cheap**: The Smart Doorbell System is much cheaper than other alternatives available in the market.
2. **Portable**: The device (Assistance Band) is portable and can be easily carried around.
3. **Simplicity of implementation and ease of usage**: The device is extremely easy to use and does not require assistance.
4. **Cost effective**: The Smart Doorbell system is cost effective and functions in the desired way.
5. **Reliable:** The device is very reliable as Bluetooth connects extremely fast and there is almost negligible delay and sufficient distance range.

9.3 Disadvantages

1. **Noise:** Can be susceptible to Noise sometimes
2. **Finishing:** In prototype stage
3. **Comfortability:** Can be uncomfortable for some people (for example – small children as their hand is small to fit the band)

CHAPTER 10: SCOPE FOR FUTURE WORK

In Future, we can integrate various elements to the existing system to make the project more advanced and a complete product. The modifications/updates can be as follows:

1. **Alternate LED Strip** – The Bluetooth ranges only up to 10m so if the home is big or the subject is sitting far away with too many obstacles in between the transmitter and receiver, the signal can fade away or the Bluetooth modules can get disconnected. Therefore, an alternate LED Strip can be fitted in the rooms which can either be connected with an intermediate Bluetooth module or directly the Doorbell.

2. **Video Doorbell system** – We can also make the system more advanced by integrating a camera at the doorbell and also a video screen on the Assistant's Band. The subject now gets a live feed from the camera outside the home on the doorbell; this helps him/her see who has arrived at the door without getting up from the place, all this can be done by keeping the cost and complexity limited.

3. **Fire Sensor** – Some buildings or complexes only have a ringing alarm when there is a fire emergency and there's a protocol to evacuate all the citizens of the building/complex to be followed. In such a situation it might become too late or the subject won't have any idea about the fire emergency, therefore we can also integrate the vibration motor on the Assistant band with the building's fire alarm system. Although we have to be dependent on the fire alarm system here to work properly without any error.

4. **Fingerprint Unlock** – We can also register few close families people on the doorbell through a fingerprint sensor, due to which the door will automatically unlock its lock and open for the respective human. Thus, making the system smarter but this can also increase the cost above limits so there has to be more advantages which can neglect the cost effect.