MINI PROJECT

(2021-22)

“SMART BELL”

Project Report

Institute of Engineering & Technology

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Declaration

We hereby declare that the work which is being presented in the Bachelor of technology. Project **Smart Bell**, in partial fulfillment of the requirements for the award of the ***Bachelor of Technology*** in Computer Science and Engineering and submitted to the Department of Computer Engineering and Applications of GLA University, Mathura, is an authentic record of my/our own work carried under the supervision of **Mr. Amir Khan, Technical Trainer, Dept. of CEA, GLA University.** The contents of this project report, in full or in parts, have not been submitted to any other institute or University for any award or degree.

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Acknowledgement

First and foremost, we would like to take this opportunity to thank GLA University for assigning us **Mr. Amir Khan** Sir as our mentor who is technical trainer and supervisor.

He has been a great mentor from the very beginning of the project. He encouraged our idea and guided the team throughout the journey. He has been constantly checking the progress of our report by conducting the regular meeting and helped us to explore about the resources which enhanced our understanding of the project. His guidance played a crucial role in completing and implementing our whole idea.

And at last, but not the least we would like to pay our sincere gratitude and thanks to our dear parents for providing us the platform to get this opportunity and my team members who helped me finding all the resources during this whole journey.

Thanking you

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Abstract

In today’s world Automatic systems are being preferred over manual systems. Automation reduces human efforts and leads to more accuracy. Wireless Home Automation system (WHAS) using IoT is a system that uses computers or mobile devices to control basic home functions and features automatically through the internet from anywhere around the world.

Smart doorbells allow home owners to receive alerts when a visitor is at the door, see who the guest is, and communicate with the visitor from a smart device. They greatly improve people's quality of life and contribute to the evolution of smart homes. However, the commercial smart doorbells are quite expensive, usually between 3000 rupees to 10000 Rupees, which is a substantial impediment on the pervasiveness of smart doorbells. To solve this problem, we introduce the budget smart doorbell system for home use. It connects a Wi-Fi enabled device, ESP32 module, to a network and enables the home owner to answer the bell triggered by the dash button using a smartphone. The Doorbell system also enables face recognition and with the help of our app, home owner can answer the person outside with ease with the possibility of no contact and sense of security.

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Chapter 1

Introduction

1.1 Overview

Nowadays, we have remote controls for our television sets and other electronic systems, which made our lives really easy. Have you ever wondered about a home doorbell which would give the facility of controlling the doorbell at home using a remote control? Of course, Yes! But, are the available options cost-effective? If the answer is No, we have found a solution to it. We have come up with a new system called Smart home doorbell using the Internet. This system is super-cost effective and can give the user the ability to control any electronic device without even spending for a remote control. This project helps the user to control the electronic devices using his/her smartphone. Time is a very valuable thing. Everybody wants to save time as much as they can. New technologies are being introduced to save our time. To save people's time we are introducing a Home doorbell system using the Internet. With the help of this system, you can control your communication with people on the other side of your door or gate.

1.2 IoT in Home Automation

In this fast-moving world, time has been the most precious thing to be spent wisely. Automation is the best practice to save the time and human efforts. It doesn't just save our time but increases the precision of tasks. In home automation, we deploy the gadgets in our homes and control the devices using simple applications. Most smart IoT home automation devices allow you to control them via an app or even via voice commands. Now imagine if you don't even need to undertake such actions. In other words, the smart home will know when to take certain actions and automatically take them. This is where the future of home automation lies.

1.3 Smart bell System

A video doorbell is a more secure way to monitor your visitors and speak to them using the built-in pinhole camera, microphone, and speaker. It allows you to view everything on the installed indoor unit or even on your smartphone or tablet. Many such doorbells are equipped with infrared LEDs to activate night vision, which allows you to see everything outside your door even when it is dark. The built-in motion sensors can detect any movement outside your door and alert you on your smartphones in case of any intrusion. This nifty yet helpful features let you monitor your visitors and stay secured at all times. We have curated a list of the best video doorbells to help you keep an eye on the other side of your door.

1.4 Motivation

We got the motivation for this project from various reasons. This project is very useful for security reasons. It saves the data of the people coming at the door. Many theft and murder cases take place in our society where people are not aware to the person at the door. By using smart bell system, we can see if who is at the door already and can see the person in our phone from anywhere.

1.5 Objectives

Security has always been an important issue in the home as per the increasing crime rate scenarios. A remote home security offers more benefits apart from keeping home owners and their properties safe from intruders.

This system designed enables the users to monitor visitors in real-time, remotely via the IoT-based doorbell installed near the entrance door to a house. When a visitor is on the door and press the doorbell, this device notifies with a real time video to the owner’s smartphone.

1.6 Existing System

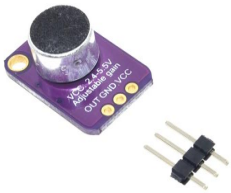
The Security has always been an important issue in the home as per the increasing crime rate scenarios. A remote home security overcome many drawbacks that exists in a normal doorbell such as –

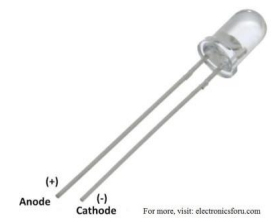
- More strength and strain of manual owner needed
- Low security
- No record could be kept of visitors
- Absence of night vision
- Lack of distant monitoring
- Weather non-resistance
- Communication can’t be established

Chapter 2

Proposed Work

2.1 Components Required

Sr. No.	Sensor Name	Energy Required	Image	Price	Links to Buy
1.	ESP32 CAM WiFi Module Bluetooth with OV2640 2MP Camera Module			₹540	https://www.electronicscomp.com
2.	MAX4466 Electret Microphone Amplifier with Adjustable Gain Module			₹181	https://www.electronicscomp.com
3.	LM386 Audio Amplifier Module			₹49	https://www.electronicscomp.com

4.	Speaker 8 Ω			₹45	https://www.electronicscomp.com
5.	Push Button Switch - 12mm - 4 pin - Tactile - 10mm Height			₹9.50	https://www.electronicscomp.com
6.	HLK-2M05 Hi-link 5V 2W AC to DC Power Supply Module			₹230	https://www.electronicscomp.com
7.	5mm IR LED Infrared Transmitter			₹25/5 pieces	https://www.roboelements.com

2.2 Description of sensors

a. ESP32 - CAM

- The ESP32-CAM is a full-featured microcontroller that also has an integrated video camera module and microSD card socket.
- It's inexpensive and easy to use, and is perfect for IoT devices requiring a camera with advanced functions like image tracking a recognition.
- There is a square white LED on the top of the module, this can act as a "flash" for illuminating the subject you are trying to view with the camera.
- As mentioned above, a USB connection is missing. The board must, therefore, be powered via the 5V pin and GND pin.

Fig.(i)

a.1 ESP32-CAM Specifications

The ESP32-CAM is based upon the ESP32-S module, so it shares the same specifications. It has the following features:

- 802.11b/g/n Wi-Fi.
- Bluetooth 4.2 with BLE.
- UART, SPI, I2C and PWM interfaces.
- Clock speed up to 160 MHz.
- Computing power up to 600 DMIPS.
- 520 KB SRAM plus 4 MB PSRAM.

- ❖ Supports Wi-Fi Image Upload.
- ❖ Multiple Sleep modes.
- ❖ Firmware Over the Air (FOTA) upgrades possible.
- ❖ 9 GPIO ports.

a.2 Camera Specifications

The ESP32-CAM includes an OV2640 camera module. The device also supports OV7670 cameras. The OV2640 has the following specifications:

- ❖ 2 Megapixel sensor.
- ❖ Array size UXGA 1622×1200.
- ❖ Output formats include YUV422, YUV420, RGB565, RGB555 and 8-bit compressed data.
- ❖ Image transfer rate of 15 .

b) MAX4466 Electret Microphone Amplifier with Adjustable Gain Module

MAX4466 Electret Microphone Amplifier with Adjustable Gain Module is fully assembled; tested board comes with a 20-20KHz electret microphone soldered on. For the amplification ,we use the Maxim MAX4466, an op-amp specifically designed for this delicate task; The amplifier has excellent power supply noise rejection, so this amplifier sounds really good and isn't nearly as noisy or scratchy as other mic amp breakouts we've tried!

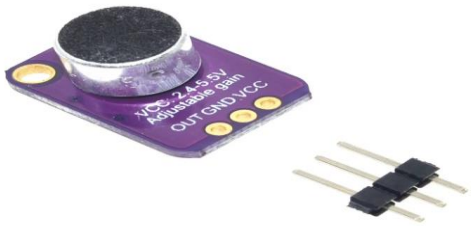


Fig.(ii)

b.1) Features of MAX4466 Electret Microphone

- Supply Voltage Operation: +2.4V to +5.5V.
- Versions with 5nA Complete Shutdown Available only (MAX4467/MAX4468).
- Excellent Power-Supply Rejection Ratio: 112dB.
- Excellent Common-Mode Rejection Ratio: 126dB.
- High AVOL: 125dB (RL = 100kΩ).

c)LM386 Audio amplifier

- Supply Voltage: 4-15V.
- Quiescent Power: 24mW @ 6V.
- Analog input voltage 0.4V (maximum).
- Voltage Gain: 20 to 200 (26dB to 46dB).
- PSRR: 50dB
- Speaker impedance 4Ω.
- Available in 8-Pin PDIP,SOIC and VSSOP packages.

Fig.(iii)

d) HLK-2M05 Hi-link 5V 2W AC to DC Power Supply Module

HLK-2M05 Hi-link 5V 2W AC to DC Power Supply Module is a plastic enclosed PCB mounted isolated switching step-down power supply module. It can supply 5V DC from 120V AC – 230V AC and has a power rating of 2 Watt. This makes it perfect for small projects that need a 5

volt supply from mains. This power supply module replaces lots of parts from the traditional power supply like diodes, voltage regulator and transformers.

e) Features of HLK-2M05 Hi-link 5V 2W AC to DC Power Supply Module

- Meet UL, CE requirements.
- Ultra-thin, ultra-small.
- All voltage input (AC: 90 ~ 264V).
- Low ripple and low noise.
- Output overload and short circuit protection.
- High efficiency, high power density.
- The product is designed to meet the requirements of EMC and Safety Test.
- Low power consumption, environmental protection, no-load loss <0.1W.

Fig.(iv)

e.1) Environmental conditions of HLK-2M05 Hi-link 5V 2W AC to DC Power Supply Module

- Technical indicators: Single bit.
- Working temperature: – 20-60 +degree.
- Storage temperature: + 80-40 -degree.
- Relative humidity: 5-95%.

f) 5mm IR LED Infrared Transmitter

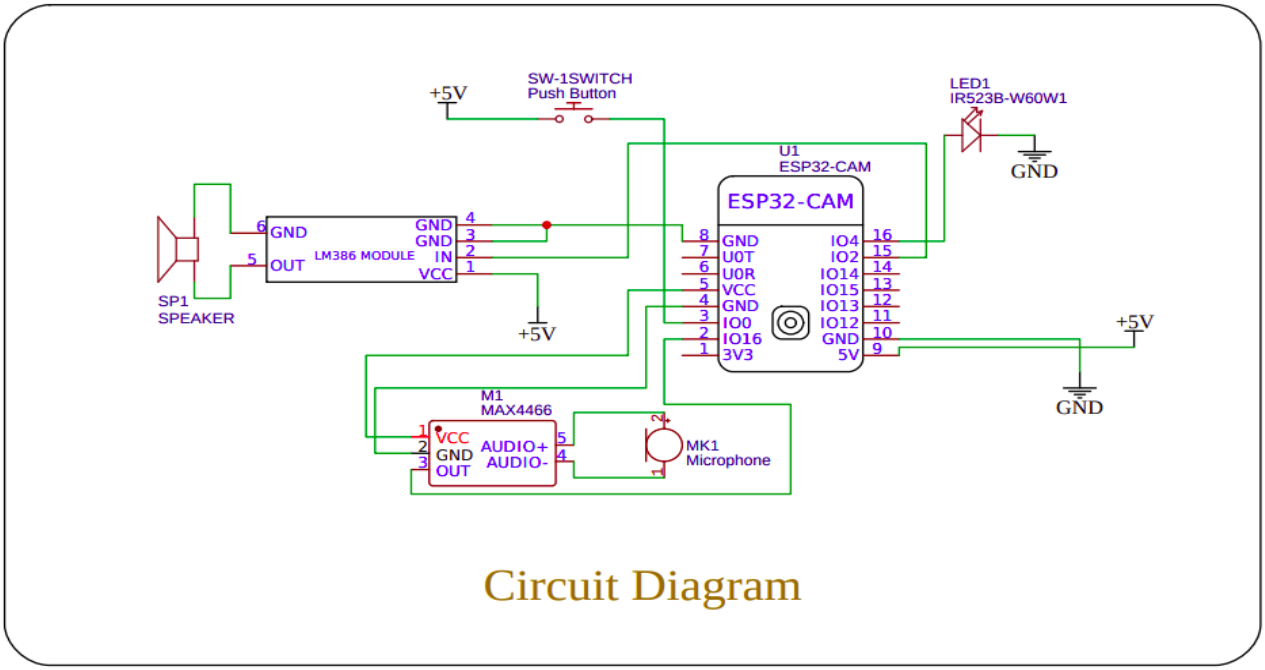
They have excellent linearity with respect to incident light, these also have low internal noise, are compact and lightweight, have wide spectral response and are mechanically rugged.

Fig.(v)

f.1 Features

- Reverse voltage: 5V.
- Forward voltage: 1.35 to 1.6V.
- Forward current: 100mA.
- Peak forward current: 200mA.
- Surge forward current: 1.5A.
- Power dissipation: 160mW.
- Peak wavelength: 940nm

2.3) Circuit Diagram



Fig(vi)

According to the circuit diagram a push button connected to the ESP32 which helps to start the camera module ,microphone and speaker will be on. Here, +5v power is supplied to the ESP32 and is provided by a power supply to +5volt. A LM386 speaker amplifier module connected with the speaker with a gnd and output pin, it has 4 other pins gnd, pins are connected to the gnd pin of esp-32 module input pin is connected to the I/O pin2 of esp-32 and vcc pin is supplied power of +5v.

A MAX4466 microphone amplifier module connected to the microphone via Audio -pins VCC pin of esp-32 GND pin is connected to the microphone via Audio + and Audio - pins VCC pin of this module is connected to the gnd pin of esp-32 output pin of this module is connected to the I/0pin 16. For a perfect night vision we are using an Infra red Led which is connected to the I/O pin4 of the esp32 module and the other terminal is grounded and amplifier modules for speaker and microphone as the direct connection with esp32 won't provide an audible efficient sound quality.

Chapter 3

Software Architecture

3.1 Arduino IDE

The Arduino Integrated Development Environment (IDE) is a cross-platform application that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution.

Fig.(vii)

3.2 Firebase

Firebase is **a development platform** known originally for its real-time database that's still at its core a multi-node, key-value database optimized for synchronizing data, often between user machines or smartphones and centralized storage in the cloud.

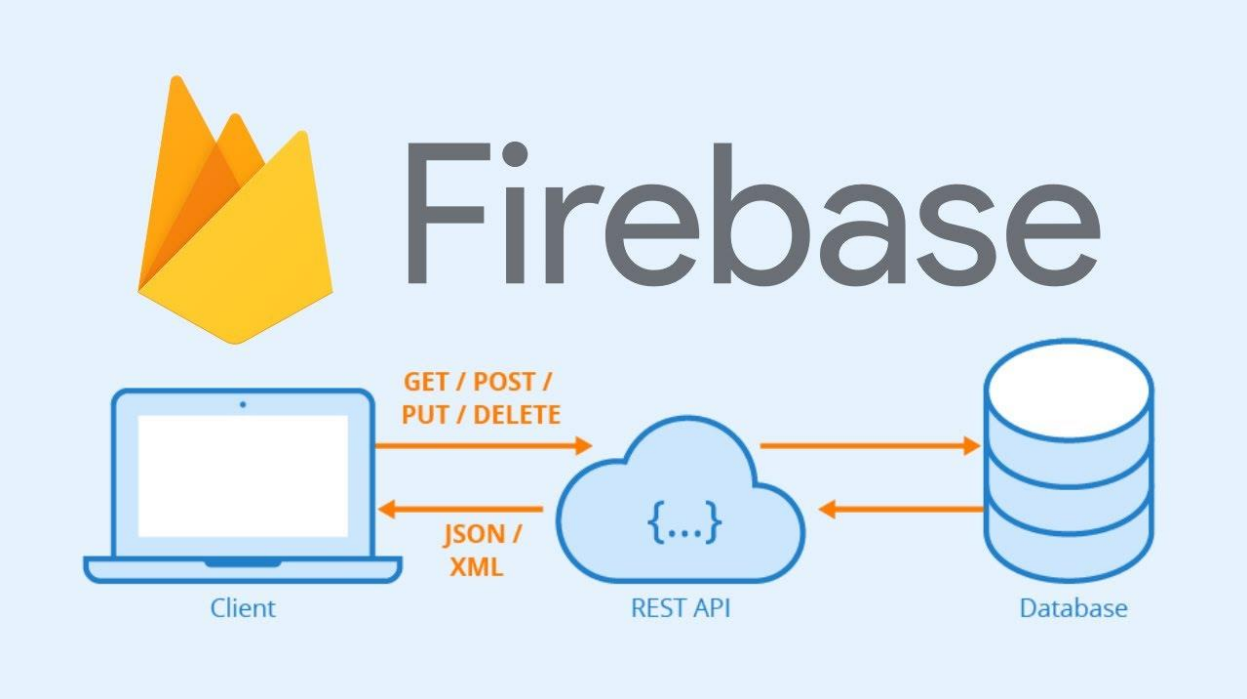


Fig.(viii)

3.3 MIT App Inventor

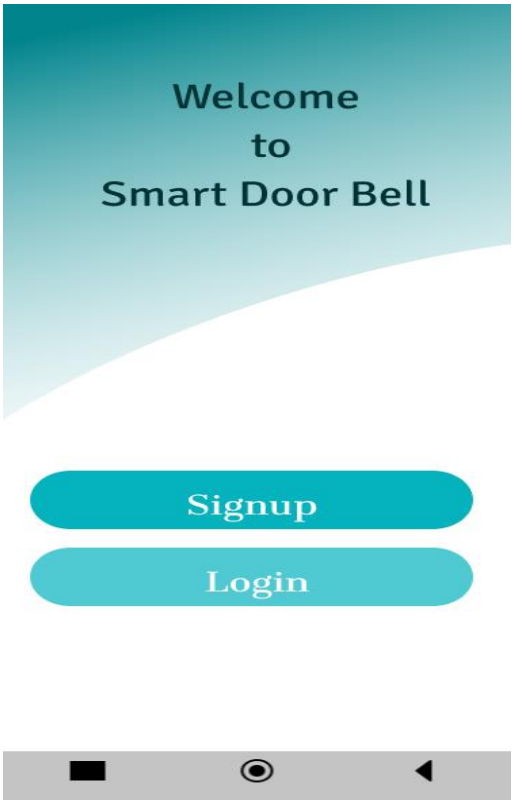
App Inventor is a **free, cloud-based service** that allows you to make your own mobile apps using a blocks-based programming language. You access App Inventor using a web browser (Chrome, Firefox, Safari). With these **beginner-friendly** tutorials, you will learn the basics of programming apps for Android devices.

Fig.(ix)

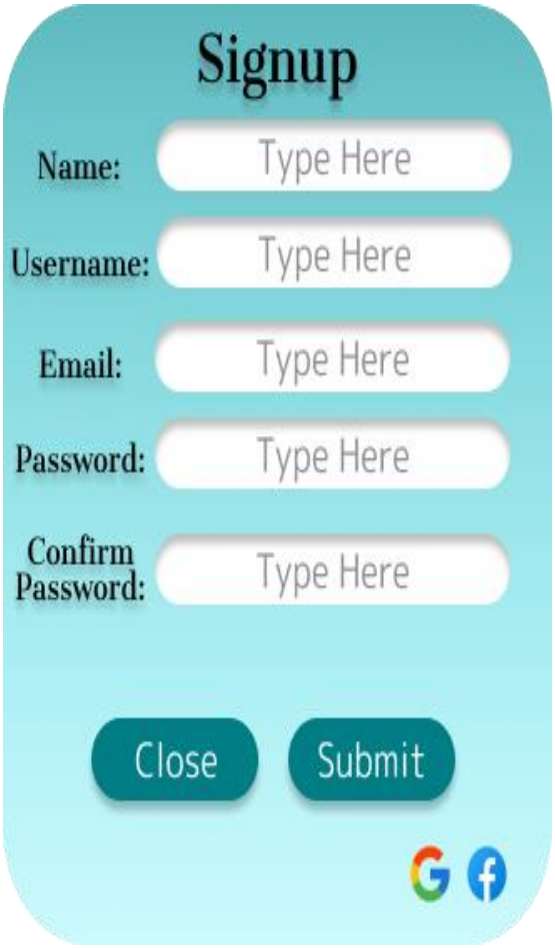
Chapter 4

UI & UX DESIGN

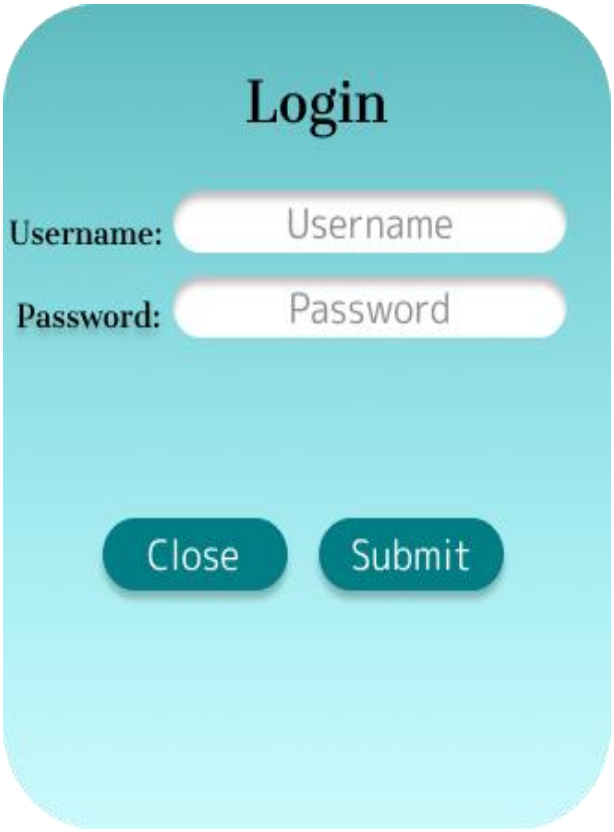
4.1) UI



This is our welcome screen and here we can see the two buttons login and signup. If we are new to this app then we have to fill our credentials by clicking on signup button and if our credentials are already provided in the app.



This is our signup page here we have to fill out all the details so that we can sign up in the application.



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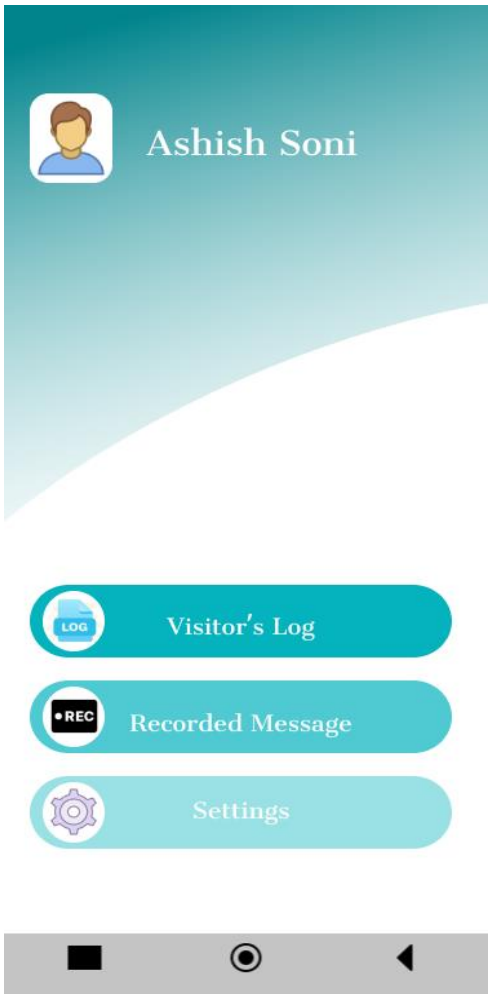


After done with the signup and login process, we came up to our dashboard where we can see our profile, although we had 3 options:

1: Visitor's log – Here we can see all the activities when we are not at home. It's like our third eye. It will show us the database.

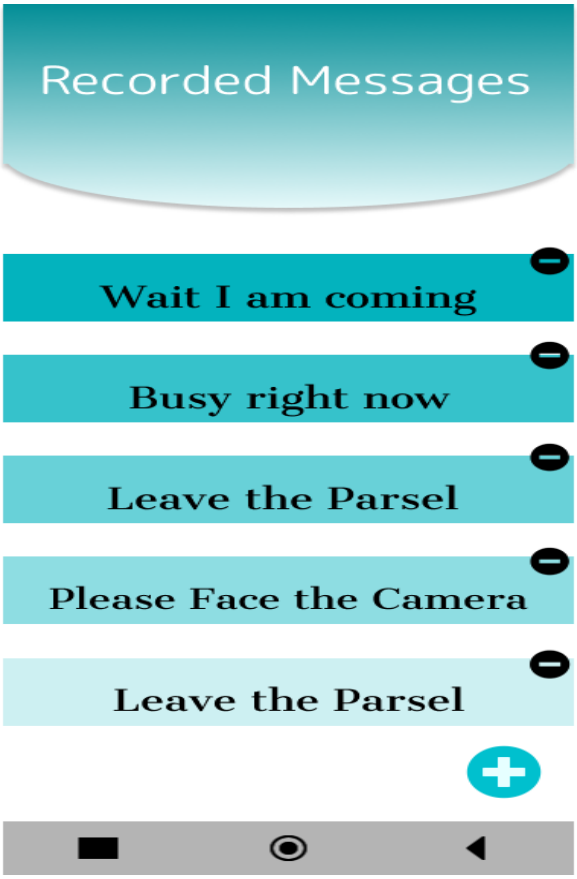
2: Recorded message – Here we can transmit any message to the person who stands outside the door.

3: Settings – Here we can change our settings according to our convenience.

This is our visitor log. It has two confirmation facilities.

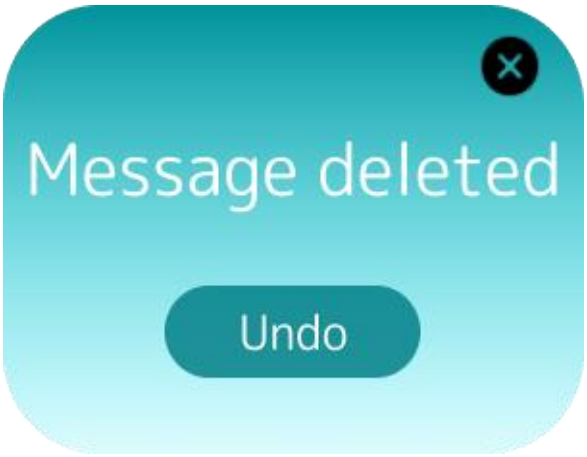
1. It I showing the database of the people coming at the door with the time of their arrival and a snapshot of them.

2. It can tell us the present activities that has been happening outside the door.

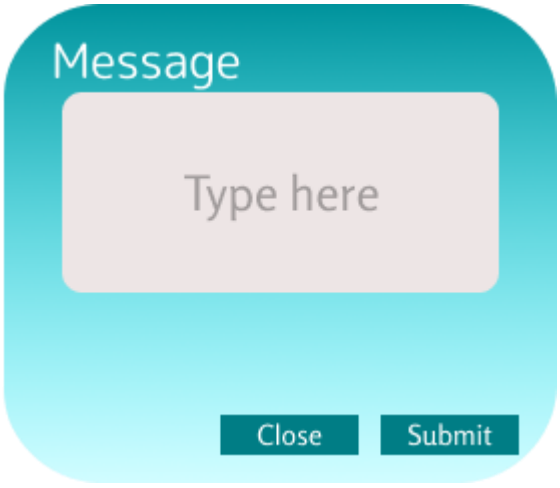


This is our Recorded messages dashboard. It has some basic messages that we need to ask usually to the person who is at the door. We want to add any other message then we just need to click on the plus button.

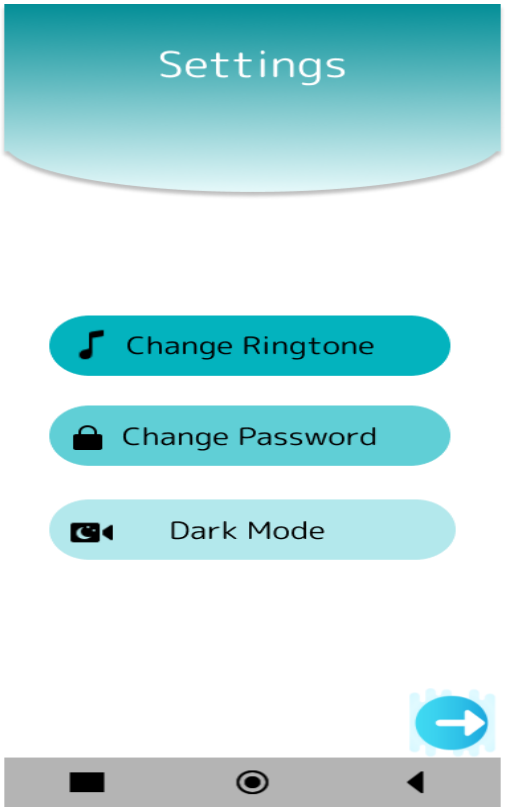
Now let's say if we are in the office or doing anything important then we can send a message directly from the calling screen.



If we want to delete any msg we just need to click on the minus button at the right corner of the message.



And if we click the plus button of the message dashboard then we need to type that message here and it will be saved after pressing submit button.

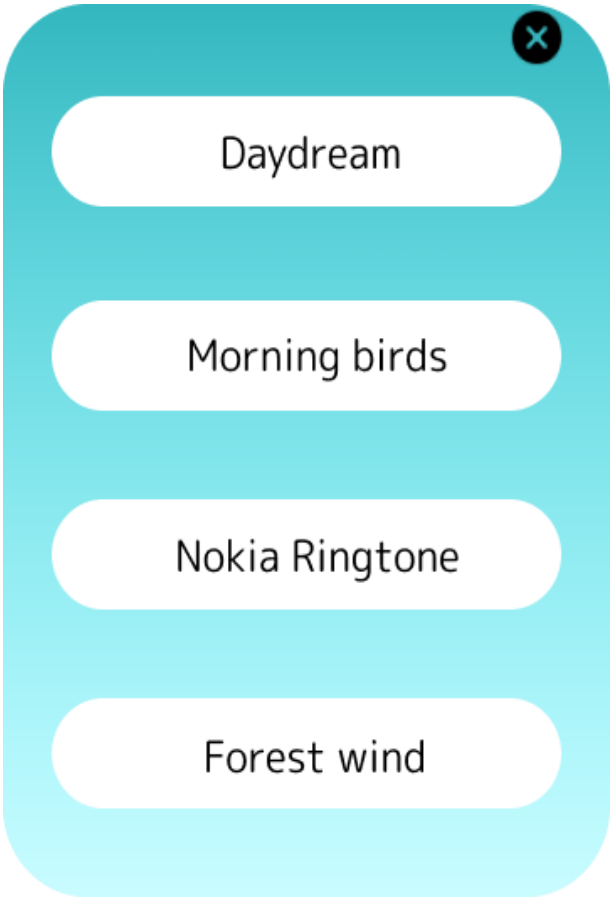


This is our settings dashboard here we can change our ringtone, old password and our theme i.e., dark theme or light theme.

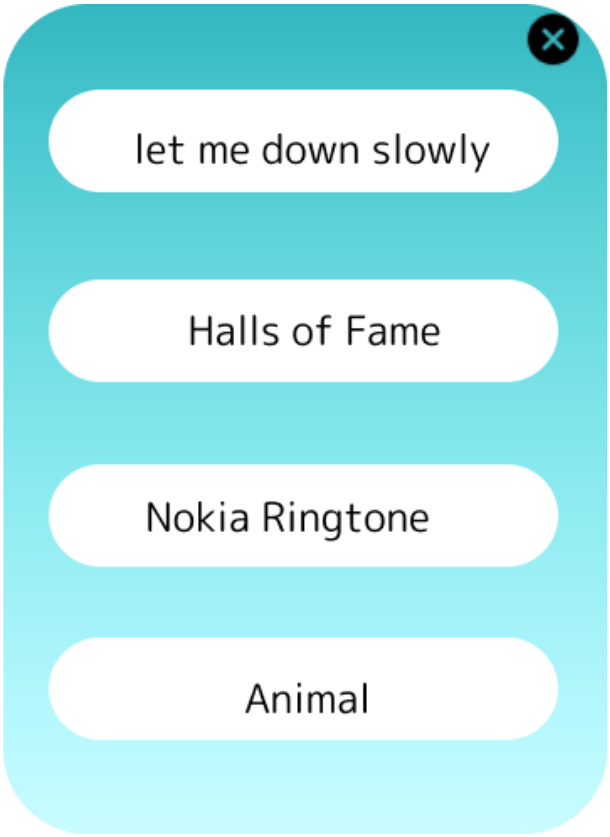
Here we have two ringtone panels:

1.default Ringtone

2.custom Ringtone



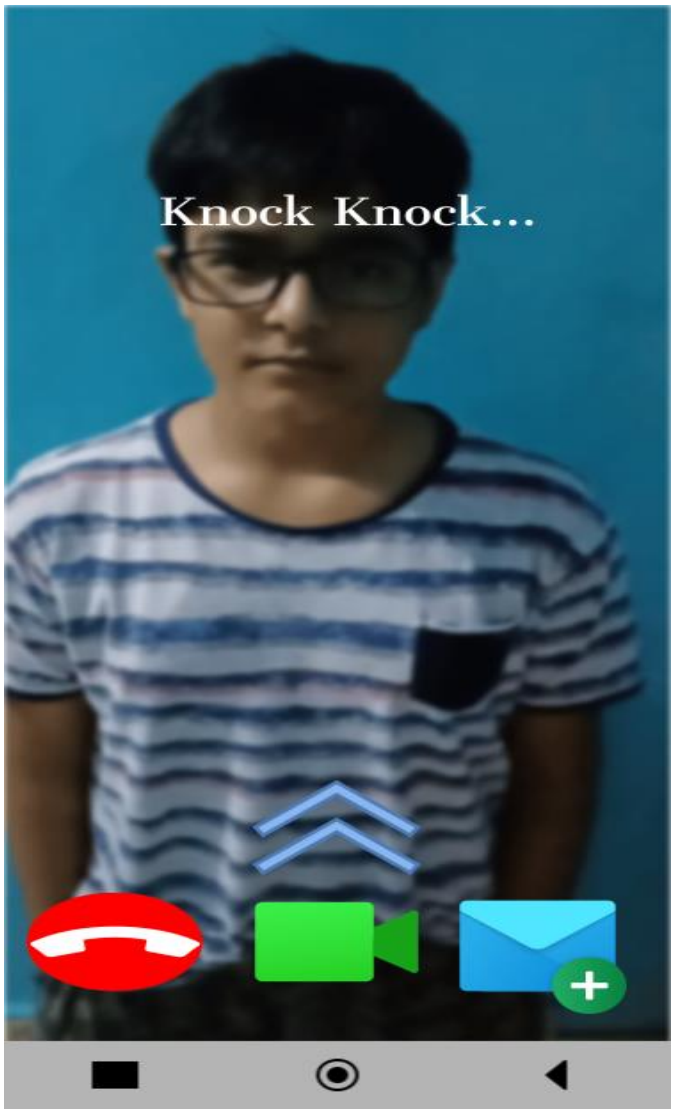
This is our Default ringtone page that has some basic ringtones for this application.



Here is the custom ringtone page.

We can customize the ringtone whatever we like and they are fixed until we change the ringtone.

After we changed the ringtone we get this pop up message that the ringtone has been changed successfully.



In this screen we can clearly see the person who is outside the door although if we want to talk to him, we just need to drag the green button up and our calling mode will be activated.

If we want to send pre recorded message then we need to click over message button then it will show us all the recorded messages stored.

This is our calling screen , We can talk on this video call to the person who is at the door. To end the call we can press the red button.

Chapter 5

Conclusion

Our project ‘Smart home Doorbell’ has been designed with the domain as Internet of Things Our project proposes a low cost, secure, accessible, auto-configurable, remotely controlled solution. With the help of our app, client can have easy access at the main Door. The doorbell recognizes and capture image of the person outside our door and keep the information in the app for the client to see. It has the facility of recorded message that can be sent to the visitor in audio format. Further, it also has video calling feature. So, when a person presses the doorbell our devices receive a notification and we can have live one- on –one communication with the visitor through the device. The proposed system is better from the scalability and flexibility point of view than the commercially available home doorbell

References

1. **Datasheet link of ESP-32 Cam Module:**
   https://media.digikey.com
2. **Datasheet link of MAX4466 Electret Microphone Amplifier:**
   https://www.farnell.com
3. **Datasheet link of LM386 Audio amplifier:**
   https://www.ti.com
4. **Datasheet link of HLK-2M05 Hi-link 5V 2W AC to DC Power Supply Module:**
   https://datasheet.lcsc.com
5. **Datasheet link of 5mm IR LED Infrared Transmitter:;**
   https://cdn-shop.adafruit.com