CONTACTLESS DOORBELL SYSTEM

DESIGN PROJECT WITH IOT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report **Contactless Doorbell System using IoT** is the bonafide work of **R E DHARSHAN (21113049), S S HARISH JAYARAM (21113050) & P A ABIRAJAH (21113069)** who carried out the project work under my supervision during the academic year 2**023-2024**.

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Designation:_____________________

Project Viva - voce conducted on ________________

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ABSTRACT

This abstract provides an overview of the project's objectives. The project includes efficient and cost-effective security through the use of an infrared (IR) sensor that detects human presence and alerts users, even when they are not physically present. The Blynk app enables users to monitor the person at the door by capturing images and provides the convenience of remotely unlocking the door using the app. Privacy and data control are prioritized by storing images securely on the local cloud server, giving users complete control over their data. An overview of the project's goals, important conclusions, and suggestions is given in this abstract. Enhanced security via the use of an infrared (IR) sensor that senses human presence and notifies users even when they are not physically there is one of the project's main findings. With the Blynk app, users can conveniently unlock the door from a distance while keeping an eye on the person at the entrance through image capture. By safely keeping photos on the local cloud server and granting consumers total control over their data, privacy, and data control are given priority.

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LIST OF ABBREVIATIONS

ESP	Espressif Systems
IR	INFRARED Sensor
UART	Universal asynchronous receiver-transmitter
TTL	Transistor to Transistor

CHAPTER 1
INTRODUCTION

1.1 Overview

The Contactless Doorbell System with Local Cloud Server is a solution designed to enhance security and convenience in homes and businesses. It detects human presence, captures images, and enables remote monitoring through a smartphone app. The system includes an infrared sensor to detect people at the door and alert the user. Images of visitors are securely stored on a local cloud server, ensuring privacy and control. The app allows users to monitor the doorstep in real time to capture images and unlock the door remotely. This project showcases the simulation of cloud server integration with high security for the users.

1.2 The Motivation of the Project

The motivation for this project is to make a contactless doorbell system with efficient cost and more security for a doorbell system that prioritizes both security and user privacy. Focusing on simplicity and practicality, we aimed to create a contactless doorbell solution that detects human presence, captures images, and allows remote monitoring through a smartphone app. By emphasizing local storage on a secure Windows platform, we aimed to give users complete control over their data.

1.3 Problem Definition and Scenarios

The problem we tackled was the lack of a secure and privacy-focused contactless doorbell system. Existing solutions often compromise user data security by relying on cloud servers. We aimed to create a system that detects human presence, captures visitor images, and allows remote monitoring, all with local data storage. Our focus was on providing a seamless, user-controlled way to enhance doorstep security and convenience while safeguarding privacy.

1.4 Organization of the Report

The report consists of 10 chapters. This report begins with a preface to the motives and the project being undertaken. Following that in the second chapter, exemplifications and literature reviews are bandied. We discuss the objects of the proposed affiliated work system and its advantages over the subsisting systems in the third chapter of the report. The system design and flowchart are shown in the report's fourth chapter. The project requirements, which include the hardware and software needed to run this system, are discussed in the fifth chapter of the report. A thorough explanation of the modules utilized in the system can be found in Chapter 6. The perpetration and results deduced from executing the inferred system are covered in Chapters 7 and 8 We have discussed the result's conclusion in Chapter 9. The report consists of the contribution of the team in chapter 10 followed by the references section and appendix.

1.5 Summary

The summary of this chapter is to provide how the doorbell system is cost-effective and high security for the users and to prevent diseases from spreading. Additionally, the project aims to encourage the user to without physically touching the doorbell.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter is to review the research papers that were taken for this project. The algorithms used for the project will be examined in this chapter. Research papers extracted from reputed journals

2.2 Contactless IoT Doorbell

This paper presents a comparative analysis of contactless IoT doorbell systems utilizing ultrasonic sensors and infrared sensors. The research explores the use of Arduino UNO for transmitting data to mobile devices, highlighting the methodology adopted for data communication. The study discusses the cost implications of using different sensors, emphasizing the limitations related to higher costs when opting for the ultrasonic sensor. Additionally, the paper addresses latency issues in transmitting information, providing valuable insights for future developments in contactless doorbell technology.

2.3 Doorbell System in Home using IoT

This paper presents a comparative analysis of contactless IoT doorbell systems utilizing ultrasonic sensors and infrared sensors. The research explores the use of Arduino UNO for transmitting data to mobile devices, highlighting the methodology adopted for data communication. The study discusses the cost implications of using different sensors, emphasizing the limitations related to higher costs when opting for the ultrasonic sensor. Additionally, the paper addresses latency issues in transmitting information, providing valuable insights for future developments in contactless doorbell technology.

2.4 IoT and AI Based Smart Doorbell System

This paper introduces an advanced Smart Doorbell System integrating IoT and AI technologies. The research leverages deep learning models, such as CNN, for in-depth analysis of captured images, enhancing system intelligence. The methodology involves setting up cloud services, including AWS and Azure, for efficient data storage and processing. The study sheds light on challenges such as lack of compatibility, proposing innovative solutions, and addresses security risks associated with IoT and AI integration. The findings contribute to the development of secure and intelligent doorbell systems, paving the way for future innovations in smart home technologies.

2.5 A Study on IoT Smart Doorbell

This paper presents an in-depth study on IoT-based smart doorbells, focusing on visitor classification. The research explores the system's ability to distinguish between humans, animals, and objects, enhancing home security. The methodology involves rigorous validation of AI model accuracy, system responsiveness, and image analysis effectiveness. The study sheds light on limitations related to biases in AI models, emphasizing the potential impact on visitor classification accuracy. By addressing these challenges, the research contributes valuable insights to the development of more reliable and unbiased IoT smart doorbell systems.

2.6 Summary

Researching several research papers that are related to this work led to the conclusion stated here. Detailed summaries of each research paper have been provided, along with a description of the advantages and disadvantages of each proposed system.

CHAPTER 3

PROJECT DESCRIPTION

3.1 Overview

In this chapter, the objectives and benefits of the project will be discussed. In addition, the existing system will be evaluated and its drawbacks discussed.

3.2 Objective of the Project Work

The project's objective is to develop a Contactless Doorbell System, enhancing security and convenience for residential and commercial spaces. Using ESP32-CAM and an infrared sensor, it detects human presence, captures images, and securely stores them on a local cloud server. Through a smartphone app, users can monitor their doorstep, make informed decisions, and remotely unlock the door. It stands as a prototype inspiring similar solutions, continuous improvement, user education, and legal compliance.

3.3 Existing System

The existing system for contactless doorbell solutions often lacks robustness and privacy features. Traditional systems may not efficiently detect visitors, leading to security gaps. Many rely on cloud storage, raising concerns about data privacy. Additionally, existing models might not offer user-friendly interfaces for remote access and control. The absence of stringent data control measures poses potential risks. The need for an improved system integrating accurate detection, local secure storage, user-friendly interfaces, and privacy safeguards is evident in the current landscape.

3.4 Shortcomings of Existing System

The shortcomings of existing contactless doorbell systems are notable. They often suffer from unreliable visitor detection, leading to potential security vulnerabilities. Cloud-based storage compromises user privacy, raising concerns about data security. Additionally, many systems lack intuitive user interfaces, hindering seamless remote access and control. The absence of stringent data control measures poses a significant risk, potentially leading to unauthorized access or data misuse. These limitations highlight the urgent need for more robust and privacy-conscious solutions in the domain of contactless doorbell systems.

3.5 Benefits of the Proposed System

The proposed Contactless Doorbell System offers several key benefits. Firstly, it ensures accurate visitor detection, enhancing security by effectively identifying human presence at the door. Secondly, the system prioritizes user privacy and data control by securely storing captured images on a local cloud server, mitigating concerns related to data security and privacy breaches. Thirdly, the user-friendly Blynk app, enables seamless remote monitoring and informed decision-making, providing users with real-time access to their doorstep activities. Additionally, the system allows users to remotely unlock the door, enhancing convenience. Overall, the proposed system combines enhanced security, privacy, convenience, and user control, making it a comprehensive and reliable solution for residential and commercial settings.

3.6 Summary

We have summarized this chapter about the Existing system, proposed system, and objective. By evaluating the current system, the chapter justifies the need for this project and sets the stage for the proposed system.

CHAPTER 4

SYSTEM DESIGN

4.1 Overview

In this chapter, we will provide a clear explanation of the architecture diagram for the proposed system.

4.2 Architecture Diagram: Data Flow

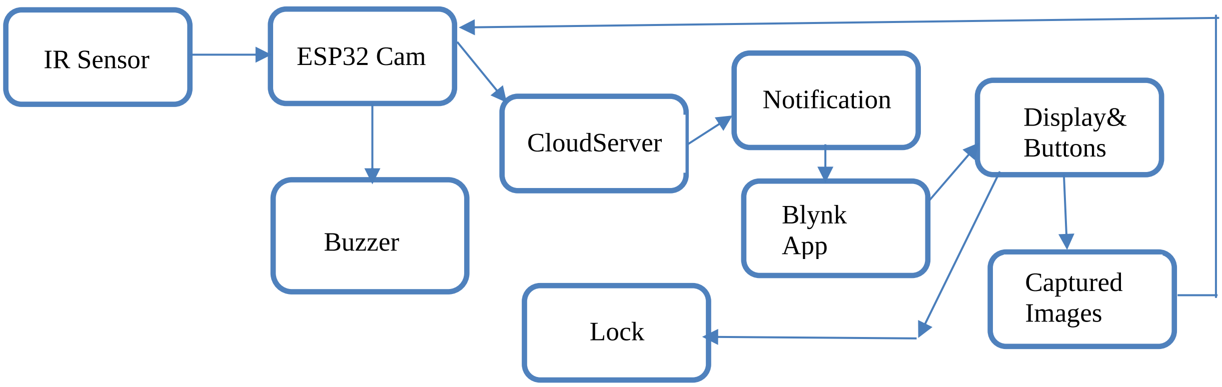

Figure 4.1 Architecture Diagram Data Flow

The project architecture of the Contactless Doorbell System involves a streamlined data flow for efficient operation. When a visitor approaches, the infrared sensor detects their presence and triggers the ESP32-CAM device to capture an image. This image data is then processed and securely transmitted to the local cloud server. Users can access real-time images and control the system remotely through the Blynk app, enabling informed decision-making. The system ensures secure data storage, user privacy, and seamless communication, creating a robust and user-friendly contactless doorbell experience..

4.3 Summary

The architecture diagram for the proposed system was discussed and the idea of this project was known by this architecture

CHAPTER 5
PROJECT REQUIREMENTS

5.1 Overview

The hardware and software used in this project will be discussed in this chapter along with its specifications. A brief description of the technology is as follows

5.2 Components Lists

- LED and Resistor (1 ohm)
- 12V Battery
- BreadBoard-2
- Buzzer
- Solenoid Lock
- Relay Module
- UART TTL Module
- 7805 IC Voltage Regulator
- 16v 100uF Capacitor
- IR Proximity Sensor-2
- ESP32 Cam

5.3 Technology Used

- **ESP32 - Camera**

  Known for versatility and IoT capabilities.

- **Infrared (IR) Sensor**

  Enables accurate human presence detection at the door.

- **Blynk App**

  It provides a user-friendly interface for remote monitoring and control

- **Local Cloud Server(Windows Platform)**

  Ensures secure storage of captured images.

- **Simulation of Cloud Services**

  Utilize cloud-based solutions for efficient data management and accessibility

5.4 Hardware Description

LED (Light-Emitting Diode): An electronic component that emits light when current flows through it.
1 ohm Resistor: Limits the current passing through the LED to prevent damage and ensure proper operation.
Specifications: LED color, forward voltage, and current rating determine the resistor value.
2.12V Battery: A power source providing 12 volts for the system's operation.
Specifications: Battery capacity (Ah), and voltage stability.
3. Breadboard: A platform for prototyping circuits without soldering, facilitating component connections.
Specifications: Number of rows, columns, and power rails, compatibility with component sizes.
Buzzer: An audio output device that produces sound when voltage is applied.
Specifications: Operating voltage, sound frequency, current consumption, and sound level.
5. Solenoid Lock: An electromechanical device that uses an electrical current to generate a magnetic field, engaging the lock mechanism.
Specifications: Operating voltage, current draw, locking force, and compatibility with door types.
6. Relay Module: An electromagnetic switch that controls high-power devices using low-power signals.
Specifications: Number of relays, contact rating, coil voltage, and compatibility with input signals.
7. UART TTL Module: A communication module facilitating serial communication between devices.
Specifications: Baud rate, voltage levels (TTL), communication range, and data format.

Detailed explanation of the hardware components and their specifications.
8.7805 IC Voltage Regulator: An integrated circuit that regulates voltage output to a stable 5 volts.
Specifications: Input voltage range, output voltage, current rating, dropout voltage.
9.25V 100uF Capacitor: An electrical component that stores and releases electrical energy.
Specifications: Voltage rating, capacitance, ESR (Equivalent Series Resistance).
10. IR Proximity Sensor: A sensor that detects the presence of an object by emitting and receiving infrared light.
Specifications: Detection range, output type (analog or digital), response time.
11.ESP32-CAM: A versatile microcontroller combined with a camera module for image capture and processing.
Specifications: CPU speed, memory, camera resolution, Wi-Fi connectivity, GPIO pins

5.5 Summary

In this chapter, the hardware software, and technologies used were mentioned.

CHAPTER 6

MODULE DESCRIPTION

6.1 Overview

The objective of this section is to provide a comprehensive overview of all various modules implemented in this project

6.2 Modules

The following modules are used for the implementation of this project

- Human Presence detection
- Image Capturing and Processing
- Data Transmission
- Remote Monitoring
- Local Cloud Storage

6.2.1 Human Presence detection

Utilizes an infrared sensor and ESP32-CAM for accurate detection of human presence at the door.

6.2.2 Image Capturing and Processing

Captures images of visitors and processes them for further analysis and storage.

6.2.3 Data Transmission

Implements protocols like MQTT or HTTP for efficient communication between the system components.

6.2.4 Remote Monitoring

Integrates the Blynk app for real-time remote monitoring and control of the doorbell system.

6.2.5 Local Cloud Storage

Utilizes a Windows-based local cloud server for secure storage of captured images, ensuring data privacy and integrity.

6.3 Summary

This section described the description of every module which were used in our project.

CHAPTER 7
IMPLEMENTATION

7.1 Overview

This chapter provides an in-depth description of the implementation process. Additionally, the chapter describes the Pygame interface.

7.2 Implementation

In the implementation phase, the project focuses on configuring the hardware components, including the ESP32-CAM and infrared sensor, ensuring correct connections and power supply. Sensor calibration is crucial, involving fine-tuning parameters to optimize human presence detection and minimize false readings. Software programming involves developing code for the ESP32-CAM using Arduino IDE, integrating sensor data, image capture, and communication protocols such as MQTT or HTTP. The Blynk app is integrated to create a user-friendly interface for real-time monitoring and remote control. Concurrently, the local cloud server is set up and configured on a Windows platform for secure image storage. Rigorous testing is conducted, feedback is gathered and incorporated, and comprehensive documentation, including setup guides, is prepared. Continuous monitoring and improvement mechanisms are established to ensure the system's efficiency and user satisfaction.

7.3 Summary

The purpose of this chapter is to provide a detailed description of the proposed system and its implementation. In addition to using ESP32 cam module in our project.

CHAPTER 8
RESULT ANALYSIS

8.1 Overview

Implementation of the whole project is well explained in this chapter and the effectiveness of the proposed system is discussed.

8.2 Result Analysis

In the result analysis phase, the Contactless Doorbell System's performance metrics are critically assessed. The accuracy and precision of human presence detection are evaluated to ensure reliable functionality. Response time is measured, aiming for real-time system responsiveness. Image quality and local cloud storage efficiency are scrutinized for clear visuals and seamless data management. User experience feedback is gathered, focusing on app usability and overall satisfaction. Security assessments are conducted to identify vulnerabilities, ensuring robust data privacy measures. The system's error-handling capabilities are tested for graceful degradation during faults. Comparative analysis against initial objectives validates project success and identifies areas for improvement. Scalability potential is considered, with proposals for future enhancements addressing challenges and technological advancements.

8.3 Summary

Thus the implementation of the whole project is well explained in chapter 8 and the proposed system has also shown how effective it is.

CHAPTER 9
CONCLUSION AND FUTURE WORK

9.1 Overview

The overview of this chapter is to discuss the result of this project, and this discussion is followed by the conclusion and future work of this project's possibilities

9.2 Conclusion

In conclusion, the Contactless Doorbell System represents a significant advancement in enhancing security and convenience for both residential and commercial spaces. By integrating IoT technology with accurate human presence detection and secure local cloud storage, the system ensures reliable performance and user privacy. The implementation of the Blynk app enables seamless remote monitoring and control, enhancing user experience. Throughout the project, emphasis was placed on user privacy, data control, and system efficiency

9.3 Future work

In future work, integrating facial recognition for enhanced security, exploring smart home device compatibility, and employing machine learning for improved visitor classification are key focuses. Additionally, energy-efficient sensors, user-friendly interfaces, and geofencing capabilities are areas of development, ensuring sustainability, accessibility, and automation in the Contactless Doorbell System.

9.4 Summary

The conclusion and Future work of this chapter are discussed well, detecting human presence and Blynk app integration.

CHAPTER 10
INDIVIDUAL TEAM MEMBER’s REPORT

10.1 Individual Objective

R E Dharshan

•Oversees the project, sets goals, and establishes timelines.

•Designs the physical components of the doorbell system.

S S Harish Jayarm

•Develops the firmware for the doorbell system.

•Designs the user interface for the mobile app or web portal..

P A Abirajah

•Designs the doorbell's housing, ensuring it is appealing and functional.

•Identifies and reports bugs or issues for the software and hardware..

10.2 Role of the Team Members

R E Dharshan

Reviewing some research papers and collected algorithms, preparing the PPT, and Some parts of “def codes”.

S S Harish Jayaram

Reviewing some research papers and modules to track presence of human, making efficient interface and some parts “def codes”.

P A Abirajah

Reviewing some research papers and selecting the right components for cost-effective and efficient componets.

10.3 Contribution of Team Members

Dharshan R E (21113049)

- Oversees the project, sets goals, and establishes timelines.
- Allocates resources effectively and manages the budget.
- Ensures the project stays on track and within scope.
- Facilitates communication among team members and stakeholders.
- Designs the physical components of the doorbell system.
- Selects appropriate sensors, microcontrollers, and other hardware.
- Develops the circuitry and PCB design.
- Ensures the hardware is robust and cost-effective.

Harish Jayaram S S (21113050)

- Develops the firmware for the doorbell system.
- Implements features like remote access, notifications, and user interfaces.
- Ensures the software is user-friendly and compatible with various platforms.
- Addresses security concerns to protect user data and the device.
- Designs the user interface for the mobile app or web portal.
- Focuses on creating an intuitive and visually appealing user experience.
- Conducts user testing to gather feedback and make improvements.
- Collaborates with the software engineer for seamless integration.

Abirajah P A (21113069)

- Works on the product's physical appearance and aesthetics.
- Designs the doorbell's housing, ensuring it is appealing and functional.
- Takes ergonomics and ease of installation into consideration.
- Collaborates with the hardware engineer to ensure a cohesive design.
- Develops and executes test plans to ensure the doorbell system's functionality and reliability.
- Identifies and reports bugs or issues for the software and hardware.
- Performs compatibility testing across different devices and environments.
- Ensures the product meets quality standards and safety regulations.

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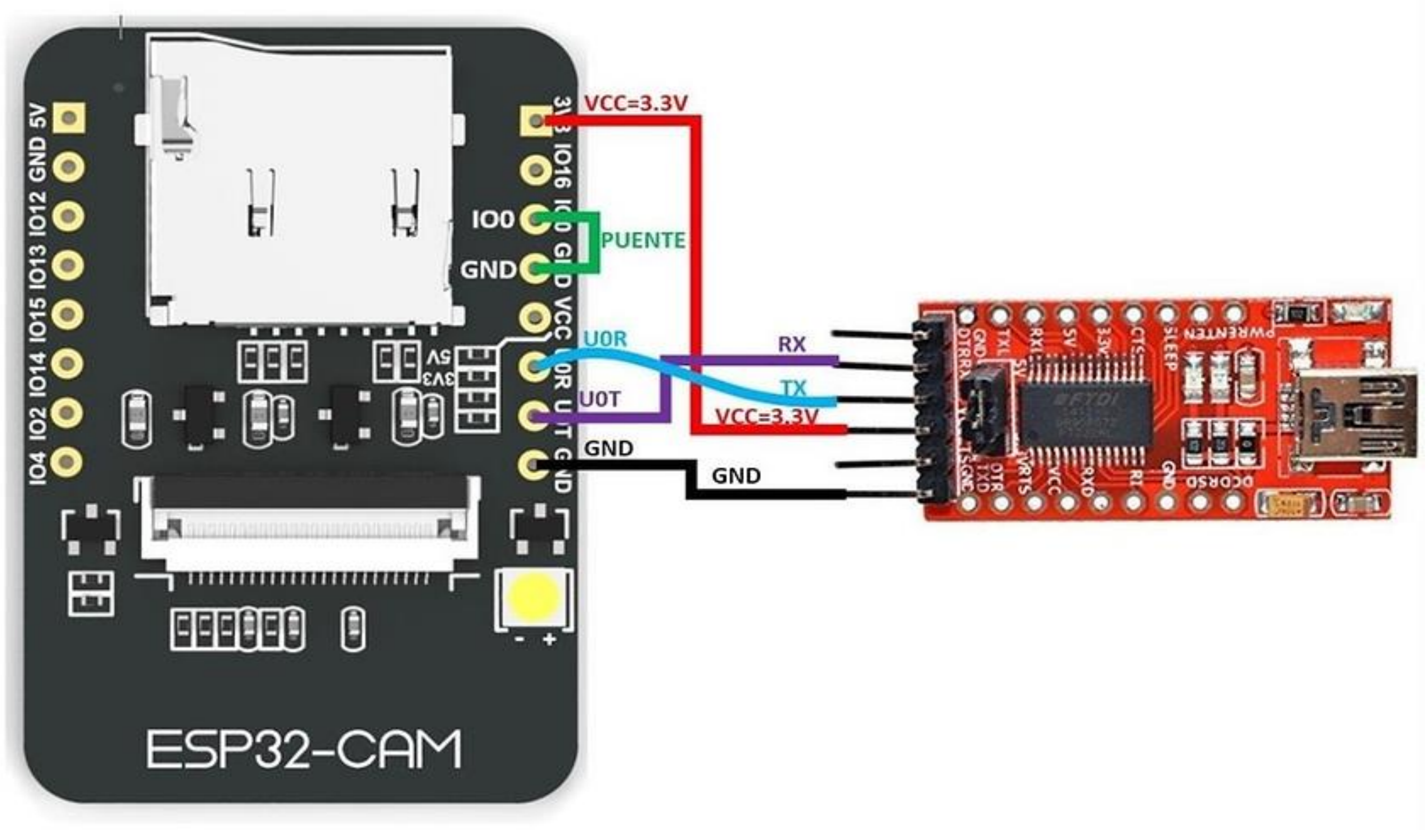
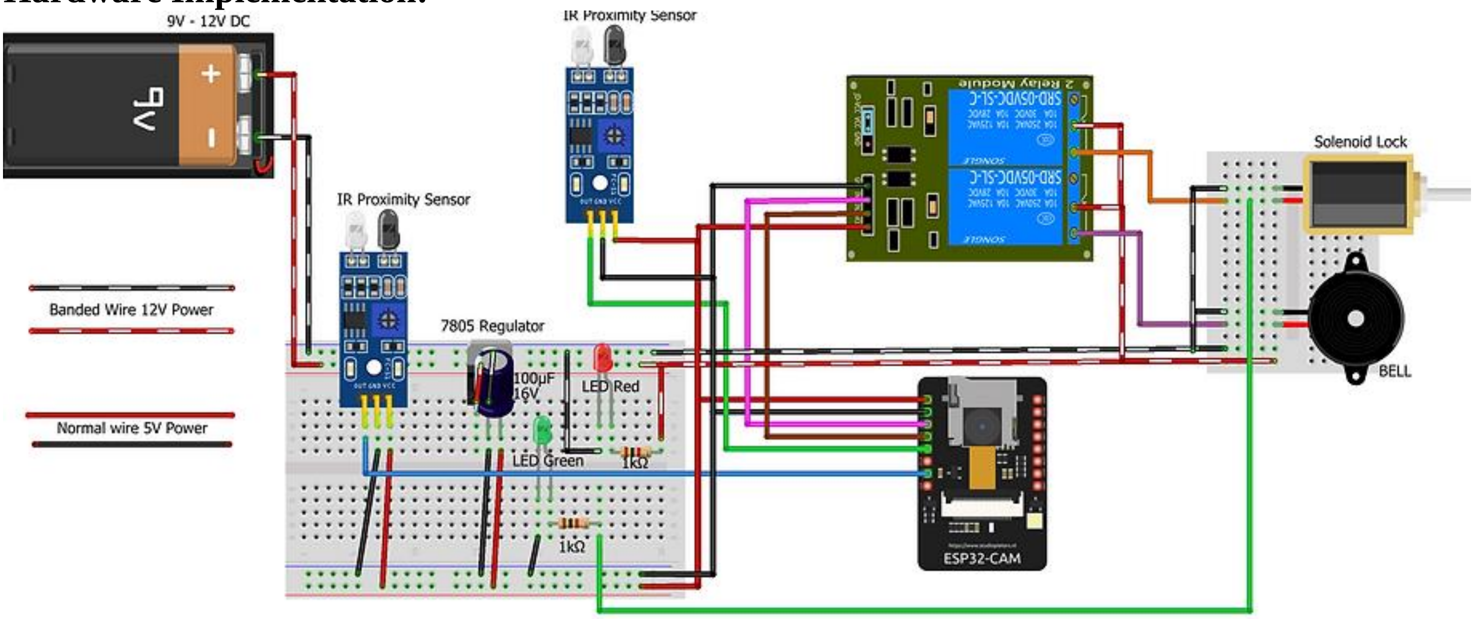
APPENDIX A
SAMPLE SCREEN

Circuit For Uploading Code:



Hardware Implementation:



APPENDIX B
SAMPLE CODE

```
#include "esp_camera.h"
#include <WiFi.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>

// Select camera model
#define CAMERA_MODEL_AI_THINKER // Has PSRAM

#include "camera_pins.h"

#define PHOTO 14
#define LED 4
#define LOCK 12
#define IN_BUTTON 15
#define IRSensor 2
#define BELL 13


const char* ssid = "rithvik";       //wifi name
const char* password = "123456789";       //password
char auth[] = "zgGRavuCsa5ZIOxI7lPp6QjtKFUSj0ML";          //sent by Blynk

String local_IP;
int count = 0;
void startCameraServer();

void takePhoto()
{
  digitalWrite(LED, HIGH);
  delay(200);
  uint32_t randomNum = random(50000);
  Serial.println("http://"+local_IP+"/capture?_cb="+ (String)randomNum);
```

```
  Blynk.setProperty(V1, "urls", "http://"+local_IP+"/capture?_cb="+(String)randomNum);
  digitalWrite(LED, LOW);
  delay(1000);
}

void setup() {
  Serial.begin(115200);
  pinMode(LED,OUTPUT);
  pinMode(BELL,OUTPUT);
  pinMode(LOCK,OUTPUT);
  pinMode(IRSensor,INPUT);
  pinMode(IN_BUTTON,INPUT);
  digitalWrite(BELL,LOW);
  digitalWrite(LOCK,LOW);
  Serial.setDebugOutput(true);
  Serial.println();

  camera_config_t config;
  config.ledc_channel = LEDC_CHANNEL_0;
  config.ledc_timer = LEDC_TIMER_0;
  config.pin_d0 = Y2_GPIO_NUM;
  config.pin_d1 = Y3_GPIO_NUM;
  config.pin_d2 = Y4_GPIO_NUM;
  config.pin_d3 = Y5_GPIO_NUM;
  config.pin_d4 = Y6_GPIO_NUM;
  config.pin_d5 = Y7_GPIO_NUM;
  config.pin_d6 = Y8_GPIO_NUM;
  config.pin_d7 = Y9_GPIO_NUM;
  config.pin_xclk = XCLK_GPIO_NUM;
  config.pin_pclk = PCLK_GPIO_NUM;
  config.pin_vsync = VSYNC_GPIO_NUM;
  config.pin_href = HREF_GPIO_NUM;
  config.pin_sscb_sda = SIOD_GPIO_NUM;
  config.pin_sscb_scl = SIOC_GPIO_NUM;
  config.pin_pwdn = PWDN_GPIO_NUM;
  config.pin_reset = RESET_GPIO_NUM;
```

```
config.xclk_freq_hz = 20000000;
config.pixel_format = PIXFORMAT_JPEG;

// if PSRAM IC present, init with UXGA resolution and higher JPEG quality
//                      for larger pre-allocated frame buffer.
if(psramFound()){
  config.frame_size = FRAMESIZE_UXGA;
  config.jpeg_quality = 10;
  config.fb_count = 2;
} else {
  config.frame_size = FRAMESIZE_SVGA;
  config.jpeg_quality = 12;
  config.fb_count = 1;
}

// camera init
esp_err_t err = esp_camera_init(&config);
if (err != ESP_OK) {
  Serial.printf("Camera init failed with error 0x%x", err);
  return;
}

sensor_t * s = esp_camera_sensor_get();
// initial sensors are flipped vertically and colors are a bit saturated
if (s->id.PID == OV3660_PID) {
  s->set_vflip(s, 1); // flip it back
  s->set_brightness(s, 1); // up the brightness just a bit
  s->set_saturation(s, -2); // lower the saturation
}
// drop down frame size for higher initial frame rate
s->set_framesize(s, FRAMESIZE_QVGA);

WiFi.begin(ssid, password);

while (WiFi.status() != WL_CONNECTED) {
  delay(500);
```

```
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected");

  startCameraServer();

  Serial.print("Camera Ready! Use 'http://");
  Serial.print(WiFi.localIP());
  local_IP = WiFi.localIP().toString();
  Serial.println("' to connect");
  Blynk.begin(auth, ssid, password);
}

void loop() {
  // put your main code here, to run repeatedly:
  Blynk.run();
  if(digitalRead(PHOTO) == HIGH){
    takePhoto();
    }
  if(digitalRead(IN_BUTTON) == LOW){
    digitalWrite(LOCK,HIGH);
    delay(3000);
    digitalWrite(LOCK,LOW);
    }
  if(digitalRead(LOCK) == HIGH){
    digitalWrite(LOCK,HIGH);
    delay(3000);
    digitalWrite(LOCK,LOW);
    }
  if(digitalRead(IRSensor) == LOW && count == 0){
    count = 1;
    digitalWrite(BELL,HIGH);
    delay(1000);
    digitalWrite(BELL,LOW);
    Blynk.notify("Someone Arrived");
```

```
    takePhoto();
    delay(3000);
    count = 0;
  }
}
```

APPENDIX C
PLAGIARISM REPORT

APPENDIX D
TEAM DETAILS

S.NO	ROLL NUMBER	TEAM MEMBERS	EMAIL ID	CONTACT NUMBER
1	21113049	R E Dharshan	21113049@student.hindustanuniv.ac.in	9884204022
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