INTERNSHIP PROJECT REPORT

on

SMART WIFI DOOR LOCK USING ESP32-CAM AND TELEGRAM

Submitted by

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BONAFIED CERTIFICATE

This is to certify that this project report entitled **"SMART WIFI DOOR LOCK USING ESP32-CAM AND TELEGRAM"** submitted to National Institute of Technology, Warangal is a Bonafide record of work done by **"M.Pravallika, R.Sai Spandana, N.Siddhartha"** under my supervision from **"20 may 2024"** to **"20 June 2024"**

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Place: Warangal

Date: 20 June 2024

DECLARATION

This is to declare that this report has been written by us. No part of the report is plagiarized from other sources. All information included from other sources have been duly acknowledged. We aver that if any part of the report is found to be plagiarized, we are shall take full responsibility for it.

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ACKNOWLEDGEMENT

We extend our sincere gratitude to the following individuals and organizations whose support and contributions were instrumental in the successful completion of this project and thesis.

First and foremost, we express our deepest appreciation to Dr. T. Kishore Kumar, Professor and Head of CTL (Center for Training and Learning), NIT Warangal. His constant motivation, guidance, and unwavering support were pivotal in helping us achieve this significant milestone.

The NIT Warangal AIOT (Artificial Intelligence of Things) and Its Applications Internship, conducted under the auspices of CTL, was enriched by the contributions of the teaching and non-teaching staff, and particularly the PhD scholars. Their expertise and dedication significantly enhanced our learning experience. The PhD scholars' contributions were particularly noteworthy, as they imparted knowledge in Arduino IDE, IoT fundamentals tailored for ECE and CSE students, and conducted daily Python programming sessions. Their guidance played a pivotal role in our understanding and proficiency in the AIOT field.

We are deeply grateful to Dr. Kishore Kumar for providing us with the opportunity to acquire such valuable knowledge through this internship.

Special thanks are due to Boeing for their generous sponsorship, which was crucial to the success of this internship program at NIT Warangal.

We also extend our sincere thanks to the faculty and staff of AITAM college and SR University for their continued support and encouragement throughout our academic journey.

In conclusion, we sincerely thank everyone involved for their invaluable support and contributions. This journey would not have been possible without you, and we are truly privileged to have been part of this enriching experience.

ABSTRACT

This project explores the development of a WIFI door lock system utilizing the ESP32 microcontroller and Telegram messaging platform. The aim is to create a secure, efficient, and user-friendly solution for remote access control. The ESP32, known for its low cost, low power consumption, and integrated WiFi and Bluetooth capabilities, serves as the core of the system, controlling the door lock mechanism and handling communication. Telegram is employed for its robust bot API, providing a convenient interface for users to receive real-time notifications and send commands to lock or unlock the door via a secure chat interface. This integration ensures that the system remains both reliable and secure, with encrypted communication safeguarding against unauthorized access. The project addresses key challenges such as network reliability and power efficiency, incorporating deep sleep modes and efficient power management to enhance performance. Through this project, we demonstrate a practical application of IoT in home security, offering insights into the potential of combining microcontrollers and cloud-based messaging platforms to create innovative smart home solutions.

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1.Aim

The aim of this project is to develop a smart WIFI door lock system using the ESP32-CAM module and Telegram. The system will allow remote control of the door lock through Telegram, provide real-time video streaming for visitor verification, and send notifications of door status changes. This project seeks to enhance home security and convenience by integrating secure remote access and monitoring capabilities.

2.Objectives

2.1 Design and Implementation:

Develop a functional WIFI door lock system utilizing the ESP32-CAM module to control door access remotely through the Telegram app.

2.2 Real-Time Surveillance:

Integrate live video streaming capabilities to enable users to visually verify visitors at their door via Telegram.

2.3 Secure Access Control:

Implement a robust user authentication mechanism within Telegram to ensure only authorized users can operate the door lock.

2.4 Notification System:

Establish a notification system to alert users of door lock status changes and security events through Telegram messages.

2.5 Enhanced Functionality:

Explore the integration of additional sensors and automation features, such as motion detection and proximity-based locking/unlocking, to improve overall system functionality and security.

3.Introduction

In today's world, home security is a top priority for many individuals and families. The advent of smart home technology has revolutionized the way we think about and manage security. One such innovation is the smart WIFI door lock, which combines convenience with enhanced security features. This project aims to develop a smart WIFI door lock system using the ESP32-CAM module and the Telegram messaging platform.

The ESP32-CAM module is a powerful and versatile microcontroller with integrated camera capabilities, making it an ideal choice for creating a remote-controlled door lock system with video streaming functionality. By leveraging the widely used Telegram app, this project seeks to provide a user-friendly interface for remote door access control, real-time video surveillance, and instant notifications.

The primary objective of this project is to design a secure and efficient smart door lock system that allows users to control their door locks remotely, verify visitors through live video feeds, and receive notifications of any changes in the door lock status. Additionally, the project aims to explore the integration of advanced features such as user authentication, motion detection, and automation to enhance the overall functionality and security of the system.

Through this project, we aim to offer an affordable, scalable, and user-friendly solution that addresses the growing need for enhanced home security and convenience. The development of this smart WIFI door lock system will demonstrate the potential of combining microcontroller technology with modern communication platforms to create innovative and practical security solutions.

4.Literature Review

IoT has been applied in previous researches in smart home technology to remotely control and monitor various appliances, namely fire, gas, water, air conditioner and fan. Some research also focuses on efficiency to lower energy | consumption Some of research like the following, have been done about home security system. From the literature review that have been discussed, there are few researchers that discusses the IoT, home security system, and remote door. Therefore, we make research that can monitor and control the door remotely, receive alerts when a movement is detected near the door, grant a door access to people who are trusted to control the door, view the door access history log and user | access, get a notification that the door is still open after a certain limit time. The big differences between the related works and the system we proposed are that our program can give access to other users and the owner of the house can see the log history of door's activity such as who has opened or closed the door and, when the activity happen. In this project we've built a Home Security System using ESP32-CAM Which notify us on Telegram App about any Intruder trying to break in our house by capturing and sending his photo to us. For that we've used motion and Door Sensors. We've also implemented Fire, Smoke and Gas Leak Alert system in this project.

Smart home security systems have evolved significantly over the past decade, driven by the need for enhanced security, convenience, and automation. These systems typically include components such as smart locks, surveillance cameras, motion sensors, and alarm systems. The integration of IoT has enabled these devices to communicate and be controlled remotely, providing users with real-time access and control over their home security.

Studies have shown that smart locks offer significant advantages over traditional locks, including remote access, automated locking/unlocking, and real-time notifications. However, challenges such as cybersecurity, power management, and user authentication remain critical areas of research and development.

In the context of smart door locks, the ESP32-CAM can provide a cost-effective solution for incorporating video surveillance, allowing users to visually verify visitors before granting access. Previous studies have demonstrated the feasibility of using the ESP32-CAM for home automation and security, emphasizing its ease of integration and programmability.

Telegram is a widely used messaging platform known for its security features and support for bots and automation. It has been increasingly utilized in IoT applications for remote monitoring and control due to its robust API, ease of use, and widespread adoption. Research has shown that Telegram can be effectively used to create user-friendly interfaces for various IoT devices, enabling real-time communication and control.

Case studies and existing projects illustrate the feasibility and benefits of combining ESP32 with Telegram for smart door locks. One project implemented an ESP32-based door lock with Telegram bot integration, highlighting ease of use and reliable performance. Another project focused on enhancing security through advanced encryption of communication between the ESP32 and Telegram servers, ensuring secure command transmission.

Despite the promising potential, several challenges remain. Security vulnerabilities need to be addressed through robust encryption and secure communication to prevent unauthorized access. The dependence on network connectivity poses reliability concerns, particularly in the event of WiFi outages. Additionally, scalability is a consideration, requiring solutions that can adapt to larger environments or integrate seamlessly with other smart home systems.

In conclusion, the combination of ESP32 and Telegram offers a promising approach to modern home security solutions. The versatility and robust features of the ESP32, paired with Telegram's secure and user-friendly messaging platform, provide a flexible and effective method for remote door access. Future research and development should focus on enhancing security measures, improving network reliability, and exploring broader applications within smart home automation to realize the full potential of this technology.

5.Gaps Identified

5.1 Integration Complexity: While existing research and projects have utilized the ESP32-CAM and Telegram for various applications, there is limited documentation and guidelines on integrating these components specifically for a comprehensive smart door lock system. Detailed implementation strategies and best practices are often missing.

5.2 User Authentication and Security: Many projects and studies focus on basic functionality and overlook the depth of security measures required for a robust system. There is a need for enhanced user authentication methods to ensure only authorized users can control the door lock, as well as secure data transmission protocols to protect against cyber threats.

5.3 Power Management Solutions: Effective power management is critical for the reliability of smart door locks, but existing literature does not thoroughly address power optimization and backup solutions for systems utilizing the ESP32-CAM. Research on battery life, power-saving modes, and backup power options is limited.

5.4 User Interface Design: There is a lack of focus on creating an intuitive and user-friendly interface within the Telegram app for controlling the door lock system. Most studies do not delve into the design principles and user experience aspects necessary for seamless interaction.

5.5 Scalability and Customization: While the potential for scalability and customization is often mentioned, there is insufficient exploration of how these systems can be adapted to different door types, environments, and additional home automation needs. More research is needed on modular and flexible design approaches.

5.6 Advanced Features Integration: Existing projects tend to focus on basic functionalities like remote access and video streaming, with limited exploration of advanced features such as motion detection, automatic locking/unlocking based on user proximity, and integration with other smart home devices.

5.7 Power Consumption: ESP32-CAM modules can have high power consumption, which might not be ideal for battery-operated door locks.

5.8 Camera Quality: The camera quality of the ESP32-CAM is relatively low, which may result in poor image resolution and make it hard to recognize faces or verify identities.

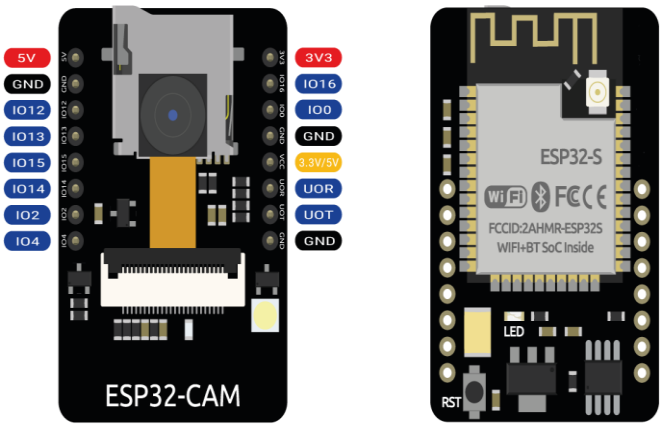
6.Design Methodology

6.1 System Overview:

The smart WIFI door lock system will integrate the ESP32-CAM module for remote control and video surveillance, utilizing the Telegram messaging platform for user interaction and notifications. The key components include the ESP32-CAM module, a servo or electronic lock mechanism, power supply, and the Telegram Bot API for communication.

6.2 Hardware Design:

6.2.1 ESP32-CAM Module: Selected for its WIFI capabilities and integrated camera.



6.2.2 Lock Mechanism: An electronic lock will be interfaced with the ESP32-CAM to physically control the door lock.

6.2.3 Power Supply: A stable power source, possibly supplemented with a battery backup for reliability.

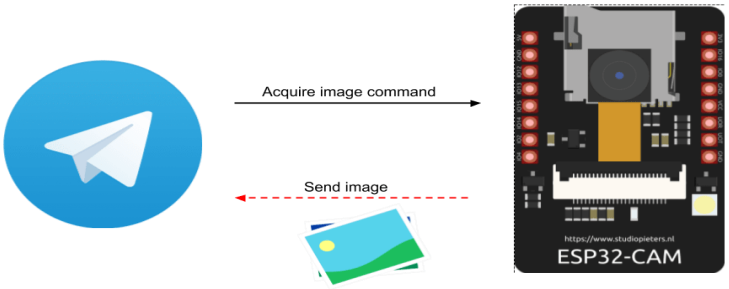
6.2.4 Additional Sensors: Optional integration of motion detectors for enhanced security.

6.2.5 Relay Module: A relay module controls high-power circuits using low-power signals. When the control signal activates, it energizes a coil, creating a magnetic field that moves the switch, connecting or disconnecting the high-power circuit. It isolates and safely switches loads in applications like home automation, industrial control, and automotive systems.

6.3 Software Design:

6.3.1 Firmware Development: Program the ESP32-CAM using the Arduino IDE or similar platform. Develop code to control the lock mechanism, handle camera streaming, and manage WIFI connectivity. Implement encryption for secure data transmission.

6.3.2 Telegram Bot Integration: Create a Telegram bot using the Bot Father on Telegram. Use the Telegram Bot API to handle commands for locking/unlocking, streaming video, and sending notifications. Implement user authentication to ensure only authorized users can access the system.



6.4 Network and Security Design:

6.4.1 WIFI Configuration: Ensure stable and secure WIFI connection for the ESP32-CAM.

6.4.2 Encryption: Use TLS/SSL for data transmission between the ESP32-CAM and Telegram servers.

6.4.3 Authentication: Implement secure user authentication mechanisms within the Telegram bot to prevent unauthorized access.

6.5 User Interface Design:

6.5.1 Telegram Bot Commands:

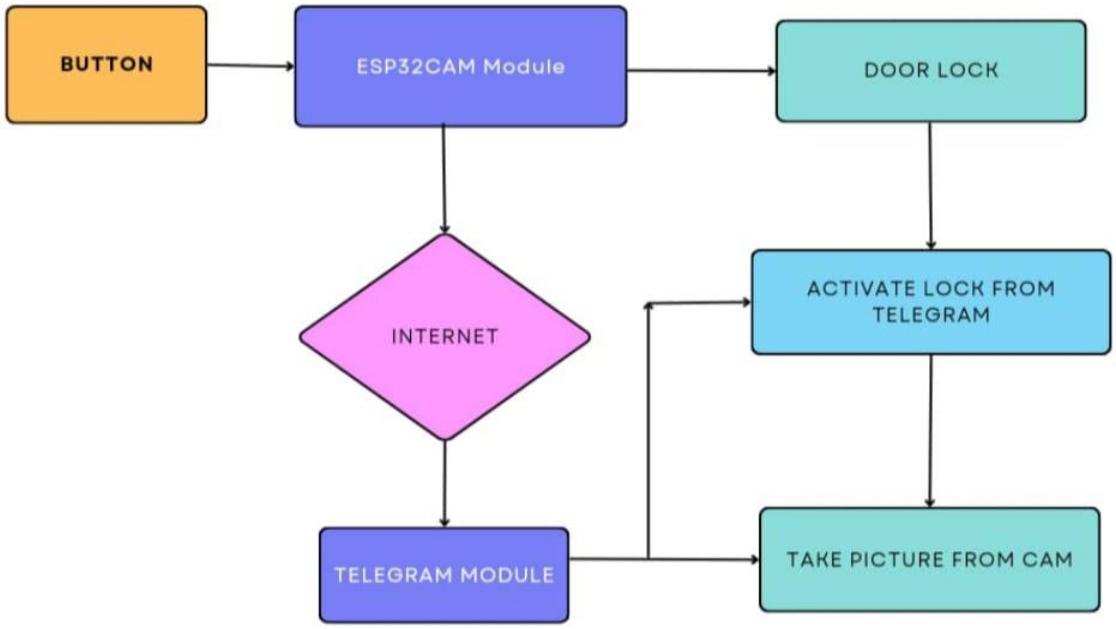
/start to start the esp32cam

/photo to capture the photo

/lock to lock the door

/unlock to unlock the door

7.ALGORITHM FLOWCHART



Start:

Initialize the ESP32-CAM and connect to Wi-Fi.

Capture Image:

The ESP32-CAM captures an image of the person or object causing the motion.

Send Image to Telegram:

The captured image is sent to a predefined Telegram chat using the Telegram Bot API.

Wait for User Response:

The system waits for a response from the user in the Telegram chat.

User Response Received?

If no response is received within a set time limit (e.g., 30 seconds), the system goes back to waiting for motion detection.

If a response is received, proceed to the next step.

Analyse User Response:

The system analyzes the user’s response (e.g., "unlock" or "deny").

Unlock Command?

If the user response is to unlock, proceed to unlock the door.

If the user response is to deny, the system logs the event and goes back to waiting for motion detection.

Unlock Door:

The ESP32-CAM sends a signal to an attached relay or actuator to unlock the door.

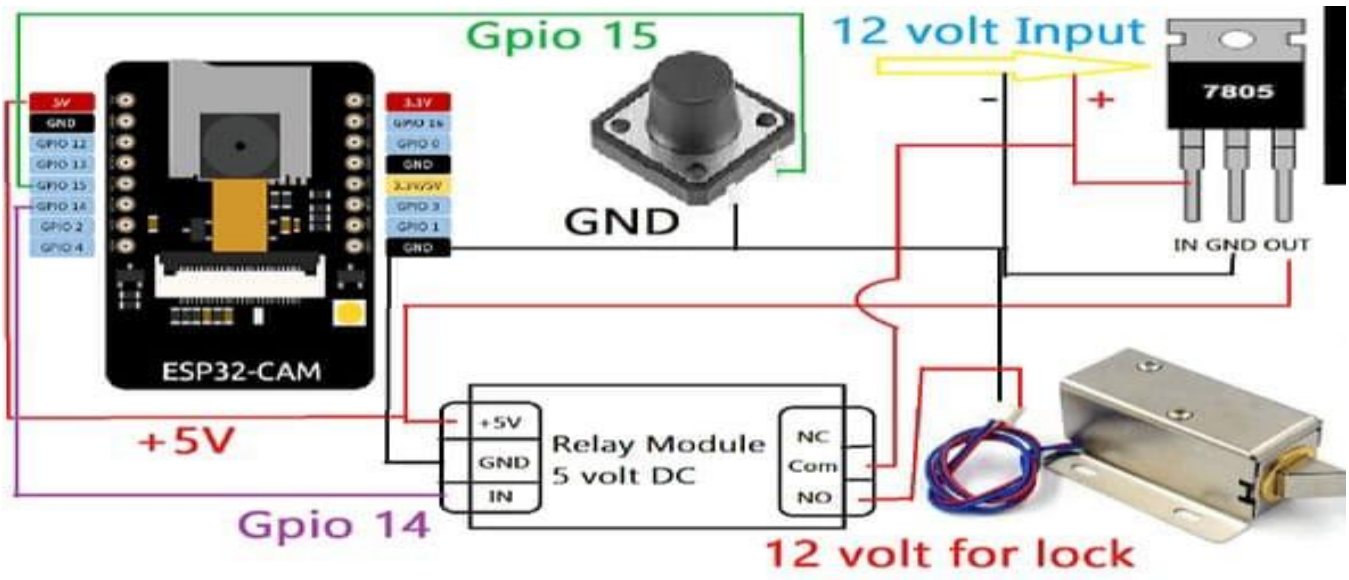
Door Unlocked:

The system confirms the door is unlocked and notifies the user via Telegram.

End:

The system goes back to waiting for motion detection

8.CIRCUIT DIAGRAM



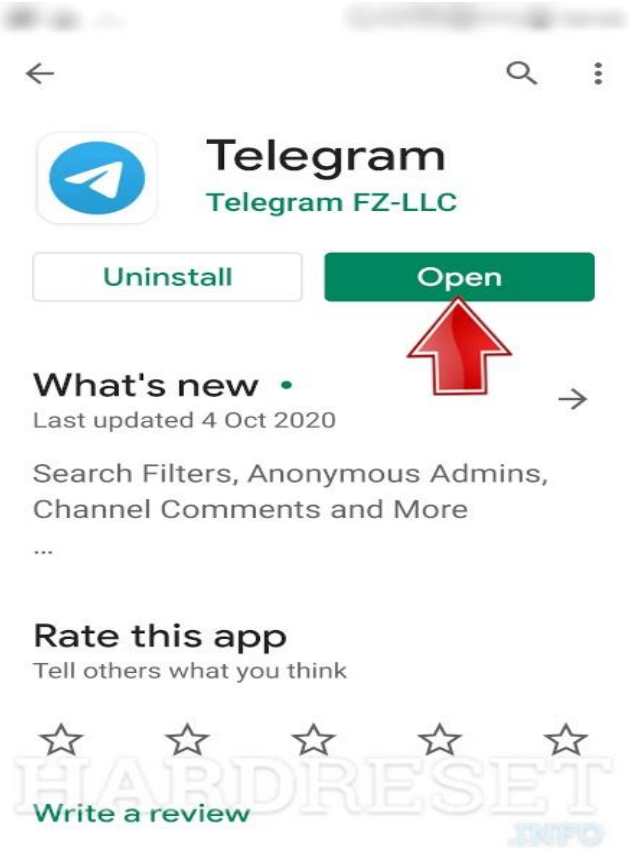
A smart door lock system utilizing an ESP32-CAM and Telegram can offer a secure and convenient solution for controlling access to a home or office. The ESP32-CAM module, equipped with a built-in camera, Wi-Fi, and Bluetooth capabilities, acts as the core of the system, providing both the locking mechanism control and the video surveillance functionality. The system operates by interfacing the ESP32-CAM with an electric door lock, typically a solenoid or servo-based mechanism, which can be activated or deactivated remotely through commands sent via the Telegram app.

For enhanced functionality, the system can incorporate additional features such as motion detection, where the ESP32-CAM can notify users of any detected movement near the door, or two-factor authentication, where users must provide a secondary form of identification. These features further improve the security and usability of the smart door lock system. The integration of Telegram provides a user-friendly interface, allowing remote control from anywhere with an internet connection, thus making the smart door lock system both efficient and secure.

9.STEPS FOR IMPLEMENTATION

9.1 Configure the Telegram app for wife lock

First, download and install the Telegram app from Google Play Store or App Store. Then create an account.



9.2 Create a New Bot in Telegram app

1.Search for BOT FATHER in Telegram app.

2.Tap on start.

3.Type /newbot and press enter.

4.Give a name for the Bot.

5.Note the bot token marked in the red box.

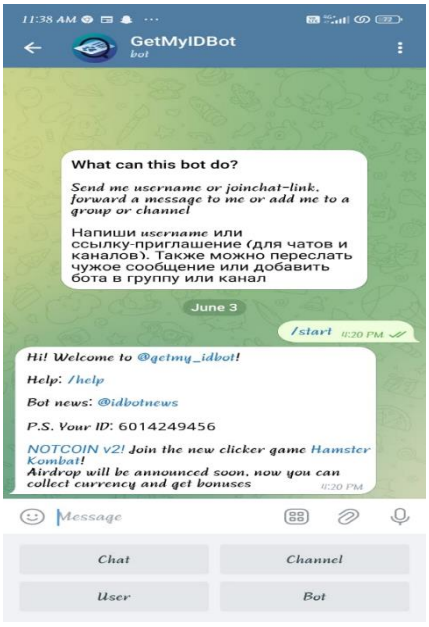
9.3 Get the user Id in Telegram App

1. Search for IDBot in Telegram.

2.Tap on START.

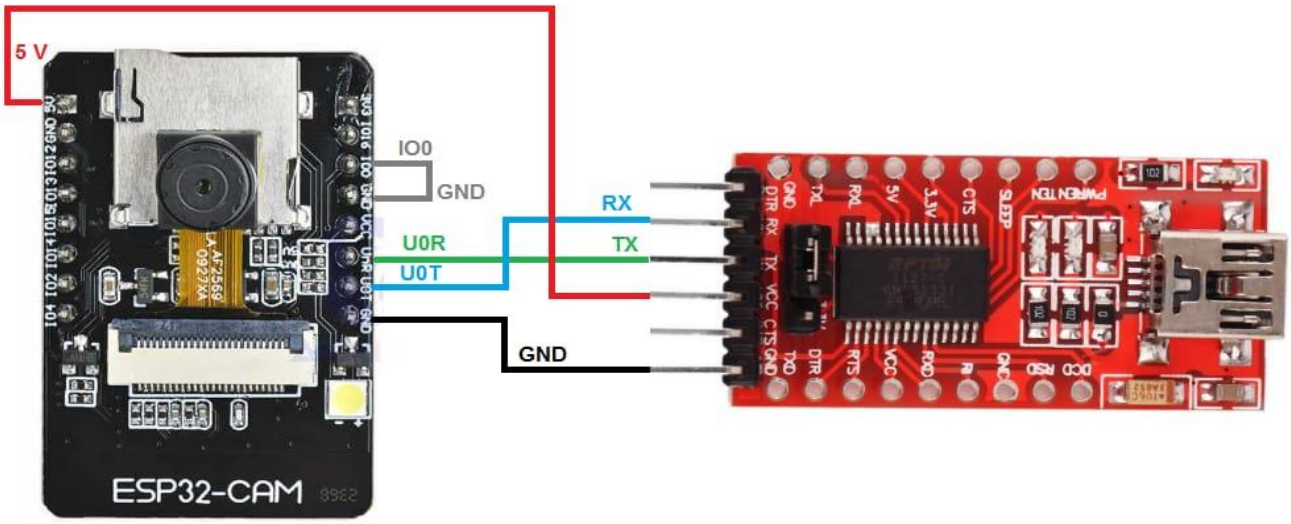
3.Tap on the /getid in IDBot.

4.User Id will be occur.



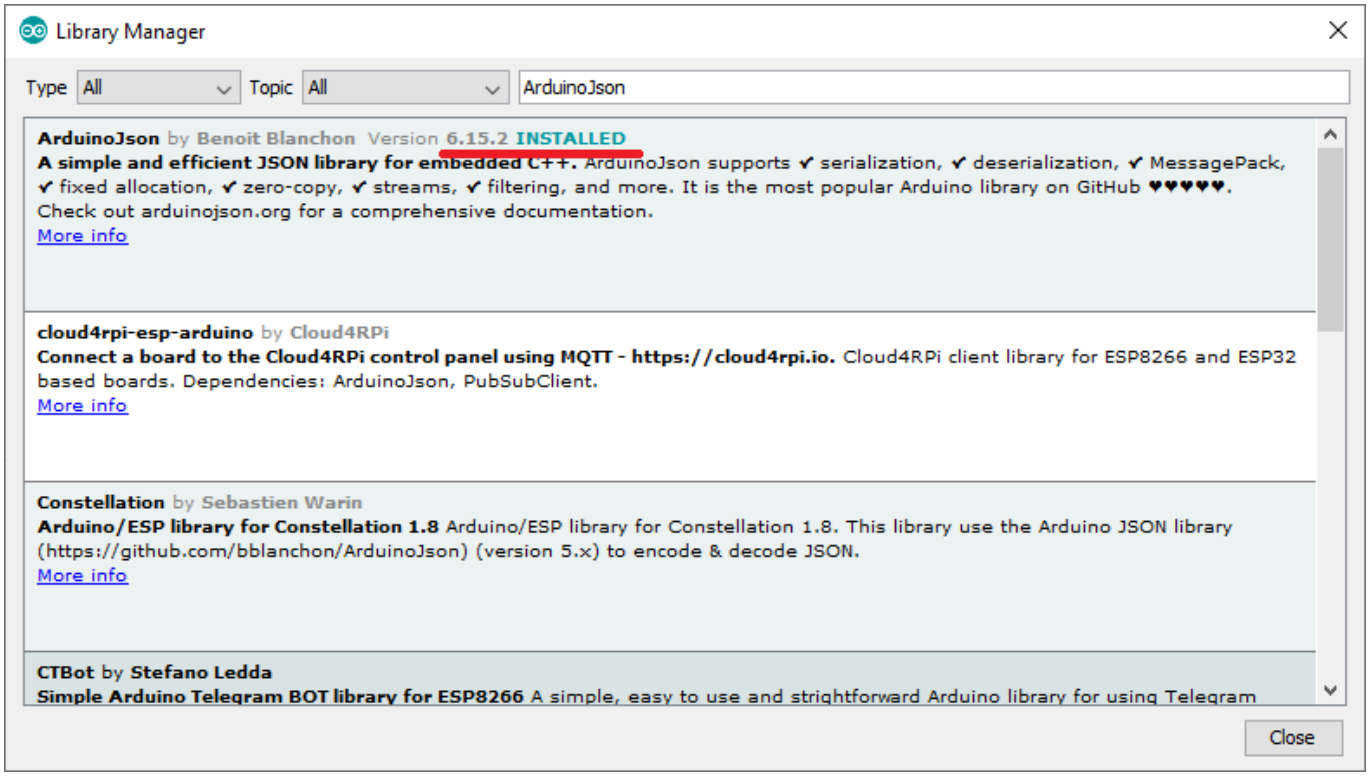
9.4 Program ESP32CAM with ArduinoIDE

1.Use FTDI232 to program the ESP32 camera module



2.During uploading the code the GPIO-0 and GND pin of ESP32-CAM should be connected.

3.We should use UniversalTelegramBot and ArduinoJson library.



4.Before uploading the code enter userId and BotToken which is generated by the IDBot and BotFather in Telegram app.

5.Add the network credentials in the code.

CODE:

```
#include <WiFi.h>
#include <WiFiClientSecure.h>
#include "soc/soc.h"
#include "soc/rtc_cntl_reg.h"
#include "esp_camera.h"
#include <UniversalTelegramBot.h>
#include <ArduinoJson.h>
// Replace with your network credentials
const char* ssid = "P0C0 M4 Pro";  //WiFi Name
const char* password = "pravallika123";  //WiFi Password
// Use @myidbot to find out the chat ID of an individual or a group
// You need to click "start" on a bot before it can message you
// Initialize Telegram BOT
String chatId = "6014249456";
String BOTtoken = "7299357743:AAFEsXkp1lB51G6oz-UwWHlHBesWDF3OJg8";
bool sendPhoto = false;
WiFiClientSecure clientTCP;
UniversalTelegramBot bot(BOTtoken, clientTCP);
// Define GPIOs
#define BUTTON 13
#define LOCK 12
#define FLASH_LED 4
//CAMERA_MODEL_AI_THINKER
#define PWDN_GPIO_NUM     32
#define RESET_GPIO_NUM    -1
```

```
#define XCLK_GPIO_NUM      0
#define SIOD_GPIO_NUM     26
#define SIOC_GPIO_NUM     27
#define Y9_GPIO_NUM       35
#define Y8_GPIO_NUM       34
#define Y7_GPIO_NUM       39
#define Y6_GPIO_NUM       36
#define Y5_GPIO_NUM       21
#define Y4_GPIO_NUM       19
#define Y3_GPIO_NUM       18
#define Y2_GPIO_NUM        5
#define VSYNC_GPIO_NUM    25
#define HREF_GPIO_NUM     23
#define PCLK_GPIO_NUM     22
int lockState = 0;
String r_msg = "";
 const unsigned long BOT_MTBS = 1000; // mean time between scan messages
unsigned long bot_lasttime; // last time messages' scan has been done
void handleNewMessages(int numNewMessages);
String sendPhotoTelegram();
String unlockDoor(){
 if (lockState == 0) {
  digitalWrite(LOCK, HIGH);
  lockState = 1;
  delay(100);
  return "Door Unlocked. /lock";
 }
 else{
  return "Door Already Unlocked. /lock";
 }
```

```
}

String lockDoor(){

 if (lockState == 1) {

  digitalWrite(LOCK, LOW);

  lockState = 0;

  delay(100);

  return "Door Locked. /unlock";

 }

 else{

  return "Door Already Locked. /unlock";

 }

}

String sendPhotoTelegram(){

 const char* myDomain = "api.telegram.org";

 String getAll = "";

 String getBody = "";

camera_fb_t * fb = NULL;

 fb = esp_camera_fb_get();

 if(!fb) {

 Serial.println("Camera capture failed");

 delay(1000);

 ESP.restart();

 return "Camera capture failed";

  }

  Serial.println("Connect to " + String(myDomain));

 if (clientTCP.connect(myDomain, 443)) {

 Serial.println("Connection successful");

  Serial.println("Connected to " + String(myDomain));

 String head = "--IotCircuitHub\r\nContent-Disposition: form-data; name=\"chat_id\"; \r\n\r\n" + chatId + "\r\n--IotCircuitHub\r\nContent-Disposition: form-data; name=\"photo\"; filename=\"esp32-cam.jpg\"\r\nContent-Type: image/jpeg\r\n\r\n";
```

```
String tail = "\r\n--IotCircuitHub--\r\n";
uint16_t imageLen = fb->len;
uint16_t extraLen = head.length() + tail.length();
uint16_t totalLen = imageLen + extraLen;
clientTCP.println("POST /bot"+BOTtoken+"/sendPhoto HTTP/1.1");
clientTCP.println("Host: " + String(myDomain));
clientTCP.println("Content-Length: " + String(totalLen));
clientTCP.println("Content-Type: multipart/form-data; boundary=IotCircuitHub");
clientTCP.println();
clientTCP.print(head);
uint8_t *fbBuf = fb->buf;
size_t fbLen = fb->len;
for (size_t n=0;n<fbLen;n=n+1024) {
if (n+1024<fbLen) {
clientTCP.write(fbBuf, 1024);
fbBuf += 1024;
}
else if (fbLen%1024>0) {
size_t remainder = fbLen%1024;
clientTCP.write(fbBuf, remainder);
}
}
clientTCP.print(tail);
esp_camera_fb_return(fb);
int waitTime = 10000;   // timeout 10 seconds
long startTimer = millis();
boolean state = false;
while ((startTimer + waitTime) > millis()){
Serial.print(".");
delay(100);
```

```
while (clientTCP.available()){
char c = clientTCP.read();
 if (c == '\n'){
 if (getAll.length()==0) state=true;
 getAll = "";
 }
 else if (c != '\r'){
getAll += String(c);
}
if (state==true){
getBody += String(c);
}
startTimer = millis();
}
 if (getBody.length()>0) break;
 }
 clientTCP.stop();
 Serial.println(getBody);
 }
 else {
 getBody="Connected to api.telegram.org failed.";
 Serial.println("Connected to api.telegram.org failed.");
 }
 return getBody;
}
void handleNewMessages(int numNewMessages){
 Serial.print("Handle New Messages: ");
 Serial.println(numNewMessages);
 for (int i = 0; i < numNewMessages; i++){
  // Chat id of the requester
```

```
String chat_id = String(bot.messages[i].chat_id);
if (chat_id != chatId){
bot.sendMessage(chat_id, "Unauthorized user", "");
continue;
}
// Print the received message
String text = bot.messages[i].text;
Serial.println(text);
String fromName = bot.messages[i].from_name;
if (text == "/photo") {
 sendPhoto = true;
 Serial.println("New photo request");
 }
 if (text == "/lock"){
 String r_msg = lockDoor();
 bot.sendMessage(chatId, r_msg, "");
 }
 if (text == "/unlock"){
 String r_msg = unlockDoor();
 bot.sendMessage(chatId, r_msg, "");
 }
  if (text == "/start"){
 String welcome = "Welcome to the ESP32-CAM Telegram Smart Lock.\n";
 welcome += "/photo : Takes a new photo\n";
 welcome += "/unlock : Unlock the Door\n\n";
 welcome += "/lock : Lock the Door\n";
 welcome += "To get the photo please tap on /photo.\n";
 bot.sendMessage(chatId, welcome, "Markdown");
 }
}
```

```
}
void setup(){
 WRITE_PERI_REG(RTC_CNTL_BROWN_OUT_REG, 0);
 Serial.begin(115200);
 delay(1000);
pinMode(LOCK,OUTPUT);
pinMode(FLASH_LED,OUTPUT);
 pinMode(BUTTON,INPUT_PULLUP);
 digitalWrite(LOCK, LOW);
 WiFi.mode(WIFI_STA);
 Serial.println();
 Serial.print("Connecting to ");
 Serial.println(ssid);
 WiFi.begin(ssid, password);
 clientTCP.setCACert(TELEGRAM_CERTIFICATE_ROOT);
 while (WiFi.status() != WL_CONNECTED) {
Serial.print(".");
delay(500);
 }
 Serial.println();
 Serial.print("ESP32-CAM IP Address: ");
 Serial.println(WiFi.localIP());
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;
 //init with high specs to pre-allocate larger buffers
  if(psramFound()){
  config.frame_size = FRAMESIZE_UXGA;
  config.jpeg_quality = 10;  //0-63 lower number means higher quality
  config.fb_count = 2;
  } else {
    config.frame_size = FRAMESIZE_SVGA;
    config.jpeg_quality = 12;  //0-63 lower number means higher quality
    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);
    delay(1000);
    ESP.restart();
  }
```

```
// Drop down frame size for higher initial frame rate
  sensor_t * s = esp_camera_sensor_get();
  s->set_framesize(s, FRAMESIZE_CIF);  // UXGA|SXGA|XGA|SVGA|VGA|CIF|QVGA|HQVGA|QQVGA
}
void loop(){
  if (sendPhoto){
  Serial.println("Preparing photo");
  digitalWrite(FLASH_LED, HIGH);
  delay(200);
  sendPhotoTelegram();
  digitalWrite(FLASH_LED, LOW);
  sendPhoto = false;
  }
  if(digitalRead(BUTTON) == LOW){
   Serial.println("Preparing photo");
  digitalWrite(FLASH_LED, HIGH);
  delay(200);
  sendPhotoTelegram();
  digitalWrite(FLASH_LED, LOW);
  sendPhoto = false;
  }
  if (millis() - bot_lasttime > BOT_MTBS)
  {
   int numNewMessages = bot.getUpdates(bot.last_message_received + 1);
   while (numNewMessages)
   {
   Serial.println("got response");
   handleNewMessages(numNewMessages);
   numNewMessages = bot.getUpdates(bot.last_message_received + 1);
   }
```

```
 bot_lasttime = millis();

}

}
```

6.After uploading the code disconnect the GPIO-0 and GND pin.

7.Then open the serial monitor and set the Baud Rate at 115220.

8. Now, press the reset button of ESP32CAM. If the WIFI is connected successfully then it will print the local IP address.

9.Now, connect the ESP32CAM with the circuit. and give the 12V DC supply.

10.Then search for the Bot you have created and tap on START**.**

11.If the BOT is connected with ESP32CAM, you will get following message.

10.PROJECT DESCRIPTION

The Smart Door Lock System, using the ESP32-CAM microcontroller and Telegram, revolutionizes access control by merging advanced IoT technology with heightened security measures. Designed for both residential and commercial use, this system significantly enhances security, convenience, and remote accessibility. Users can remotely unlock their doors via Telegram commands, which the ESP32-CAM processes to control an electric strike or solenoid lock. Upon receiving a command, the system captures a real-time image, verifying the user's identity and providing instant visual feedback. This image is then sent to the user via Telegram, ensuring that only authorized individuals gain access.

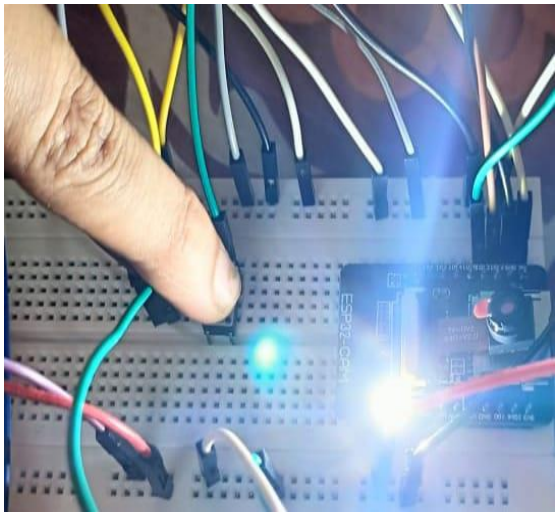
Security is further bolstered by automatic notifications and alerts sent to users in real time for various events such as door unlocks, unauthorized access attempts, and motion detection, allowing for immediate action if needed. The system's optional two-factor authentication adds an extra layer of security, requiring users to confirm their identity before unlocking the door. Additionally, an event log is maintained for comprehensive security auditing, ensuring that all access attempts are recorded and can be reviewed.

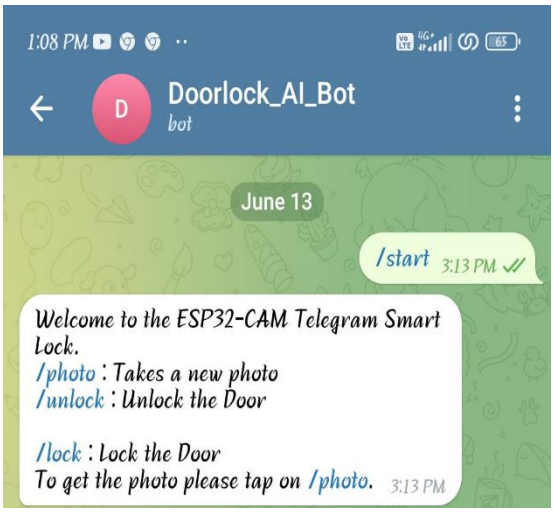
The system's hardware includes the affordable yet powerful ESP32-CAM, a relay module for controlling the lock, and an electric strike or solenoid lock for physical security. The integration with the Telegram bot facilitates seamless communication and control, while the configuration process ensures the system is user-friendly and easily manageable.

Looking ahead, the Smart Door Lock System is designed to accommodate future enhancements such as voice command integration with Google Assistant or Alexa, facial recognition for automatic user identification, support for multiple user accounts with varied access levels, and a battery backup to maintain functionality during power outages. By combining these features, the system not only provides robust security but also aligns with modern demands for smart home and office solutions, setting a new standard in access control technology.

11.RESULTS

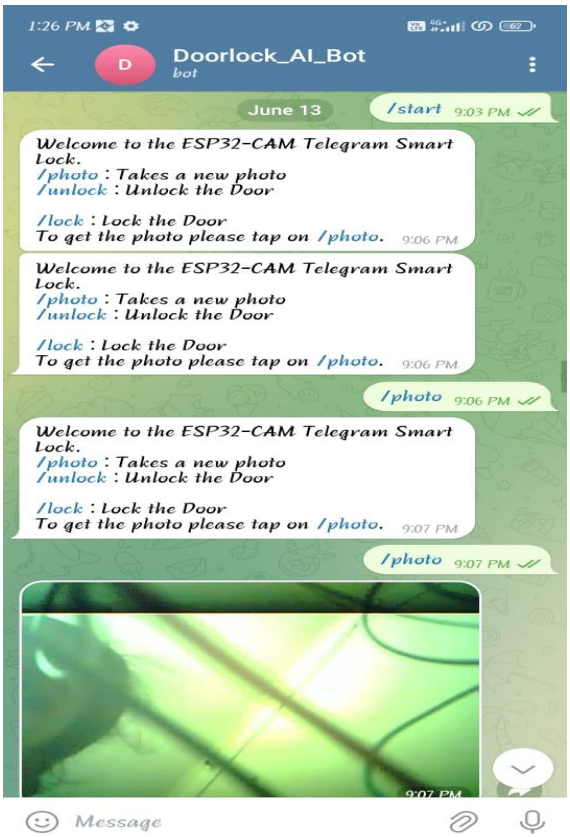
1.Press the pushbutton, the ESP32CAM will capture the photo and send it to telegram app.

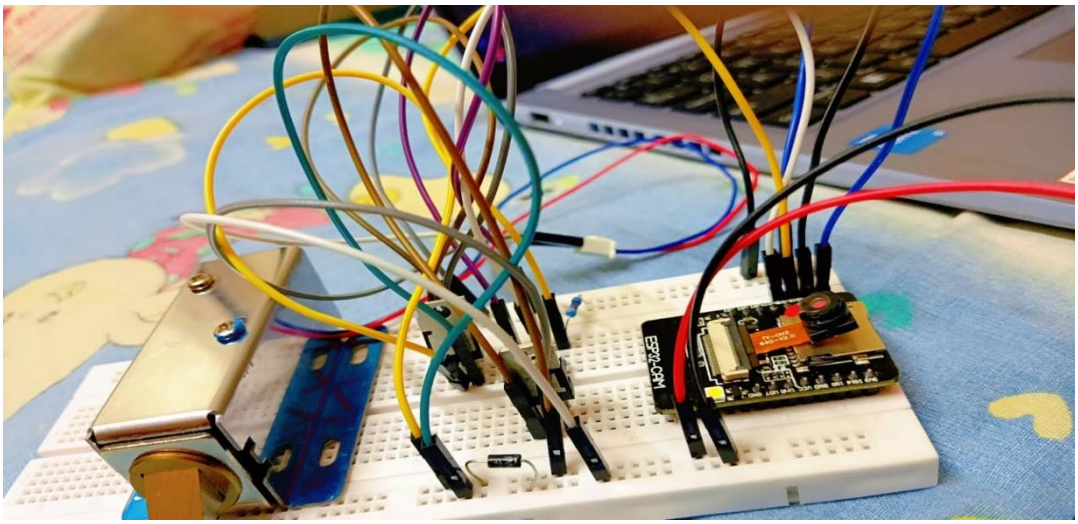




2. If you tap on the /photo, then ESP32CAM will again take the photo and send it to telegram app.

3. After that tap on the **/unlock** to unlock the door then tap on **/lock** to lock the door again.





When the button is clicked, the ESP32-CAM sends a photo of the person in Telegram app. If unlock button is pressed, the door unlocks. If the lock button is pressed, the door locks.

12.CONCLUSION

The development of a smart WIFI door lock system utilizing the ESP32-CAM module and Telegram has demonstrated the potential for enhancing home security through modern IoT technologies. This project successfully integrated remote control functionalities, real-time video surveillance, and secure communication features, providing users with a convenient and reliable method to manage access to their homes.

Despite these achievements, the project also identified several areas for further improvement and research, such as enhancing user interface design within the Telegram app, optimizing power consumption, and exploring additional advanced features like motion detection and automation. Addressing these gaps in future iterations will contribute to the creation of even more robust and user-friendly smart home security solutions.

In conclusion, this project has laid a solid foundation for a cost-effective and scalable smart WIFI door lock system. By leveraging the ESP32-CAM's capabilities and the widespread use of Telegram, this system offers a practical solution to modern home security challenges, combining ease of use with advanced technological features. The successful implementation and testing of this system highlight its potential for broader application and further development in the realm of smart home technologies.

13.References

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