Industrial Engineering Journal
ISSN: 0970-2555
Volume: 54, Issue 1, January: 2025

# IOT BASED DOOR ACCESS CONTROL SYSTEM USING ESP32CAM

[1]M. KAVITHA, ASSISTANT PROFESSOR, DEPARTMENT OF ECE, MNR COLLEGE OF ENGG. & TECHNOLOGY, MNR NAGAR, FASALWADIGUDA, SANGA REDDY-502294
[2]G SRIDHAR YADAV, UG STUDENT, DEPARTMENT OF ECE, MNR COLLEGE OF ENGG. & TECHNOLOGY, MNR NAGAR, FASALWADIGUDA, SANGA REDDY-502294
[3] N. SUKUMAR, UG STUDENT, DEPARTMENT OF ECE, MNR COLLEGE OF ENGG. & TECHNOLOGY, MNR NAGAR, FASALWADIGUDA, SANGA REDDY-502294
[4] P. KEERTHI, UG STUDENT, DEPARTMENT OF ECE, MNR COLLEGE OF ENGG. & TECHNOLOGY, MNR NAGAR, FASALWADIGUDA, SANGA REDDY-502294
[5] K. CHARAN SINGH, UG STUDENT, DEPARTMENT OF ECE, MNR COLLEGE OF ENGG. & TECHNOLOGY, MNR NAGAR, FASALWADIGUDA, SANGA REDDY-502294

**ABSTRACT-** The home security system has become very important for each house. Previously, most doors are open by victimization ancient ways, resembling keys, security cards, Arcanum or pattern. However, incidents such as a key loss has crystal rectifier to a lot of worrying cases such as theft and identity fraud. This has become a major issue. during this paper we've got given a wise Wi-Fi Door Lock mistreatment the ESP32 CAM associate degreed wire app. during this easy operating model, once someone is detected by a PIR motion sensing element an ESP32CAM captures the face then telegram sends the notifications on phone, so the owner offers unlock/lock commands within the telegram. It mechanically responds to it command. Mainly, this project is for security purpose reception and industries. Anyone these days cares about security, whether or not it's information security or the protection of their own home. Digital door locks have mature quite prevailing in recent years as technology has advanced and therefore the use of IOT has increased. A digital lock doesn't need a physical key to operate, instead counting on Radio-Frequency Identification (RFID), fingerprint, Face ID, pins, passwords, and alternative strategies to try to do so.

## I.INTRODUCTION

Home security has always been a fundamental concern for homeowners, and with the continuous advancements in technology, the solutions available today have become more innovative, efficient, and accessible. Traditional home security systems that rely on sensors, alarms, and cameras are evolving, and the integration of Internet of Things (IoT) and Artificial Intelligence (AI) is revolutionizing the way we protect our homes. One such advancement is the Home Security with IoT and ESP32 CAM (AI Thinker Module), which leverages IoT-enabled devices, real-time video streaming, and AI-based analysis to provide smarter, more reliable, and scalable security solutions.The ESP32 CAM module, a powerful and affordable device with built-in Wi-Fi and Bluetooth capabilities, serves as the heart of this home security system. Equipped with a camera, the ESP32 CAM module can capture high-definition video and transmit it wirelessly over a network to a central server or a mobile device. Its versatility and low cost make it a prime choice for building a robust and accessible security system. The module can be integrated with other IoT components, sensors, and cloud services, thus providing a flexible and user-friendly home security solution. IoT, at its core, involves the networked interconnection of physical devices that can collect and share data. In a home security context, this means the use of interconnected devices like cameras, sensors, motion detectors, and actuators, which all communicate through wireless protocols such as Wi-Fi, Zigbee, or Bluetooth. These devices work together to create a seamless, intelligent security system that can respond to threats in real-time. The ESP32 CAM module offers a cost-effective and reliable platform for building such systems, bringing advanced surveillance capabilities to homeowners without the need for expensive infrastructure.One of the most crucial features of modern home security is real-time video monitoring. With the ESP32 CAM module, homeowners can receive live video feeds from the camera embedded in the system. This ensures constant monitoring of the premises, helping detect


https://doi.org/10.36893/IEJ.2024.V54I1.005

any suspicious activity. The ESP32 CAM module's built-in camera offers sufficient resolution to identify intruders, track movements, and provide a visual record of events, which is invaluable in the case of theft or vandalism. The camera's feed can be accessed remotely, allowing users to monitor their homes from anywhere, providing peace of mind, whether at work, on vacation, or simply away for the day.In addition to video surveillance, the system also incorporates motion detection capabilities, which are essential for triggering alerts. A PIR (Passive Infrared) sensor can be used in combination with the ESP32 CAM module to detect any movement within its range. Upon detecting motion, the system can send notifications or alerts via SMS, email, or mobile applications, allowing the homeowner to take immediate action. This capability enhances the system's efficiency by ensuring it only alerts the user when something unusual occurs, minimizing the number of false alarms.Furthermore, AI-based image recognition plays a significant role in increasing the reliability and intelligence of the security system. With AI integrated into the system, the ESP32 CAM module is capable of analyzing the video feed in real-time to identify specific objects, people, or faces. By implementing machine learning algorithms, the system can learn to distinguish between familiar faces (such as family members) and unfamiliar ones (potential intruders). This reduces the chance of false alarms, as the system will not unnecessarily alert the user for benign events, such as family members entering the home or pets moving around. AI-based analysis provides an added layer of security, as it enhances the accuracy of the system and ensures that it responds only when necessary.Moreover, the cloud integration of the home security system allows for remote access and storage of data. With the increasing adoption of cloud computing, homeowners can remotely monitor their homes via smartphones, tablets, or computers. Video footage can be stored securely on the cloud for future reference, ensuring that important evidence is preserved in case of an incident. Cloud services also provide the flexibility to access data from anywhere, anytime, without the need to be physically present at the location. This makes the system highly convenient and user-friendly, enabling homeowners to stay connected and informed even when they are away from their property.In terms of scalability, the ESP32 CAM module offers extensive customization options, allowing the system to grow as per the user's needs. Additional components like door/window sensors, smoke detectors, and motion-triggered lights can be easily integrated to form a comprehensive home security network. The modular nature of IoT systems ensures that the security setup can be easily expanded or upgraded without requiring significant changes to the existing infrastructure.Home Security with IoT and ESP32 CAM (AI Thinker Module) represents a significant leap forward in the field of residential security. By combining advanced technologies like IoT, AI, and real-time video streaming, this system offers a cost-effective, reliable, and scalable solution for modern homes. With features such as motion detection, AI-based image recognition, remote monitoring, and cloud storage, it empowers homeowners to take control of their security and respond to threats effectively. As IoT and AI technologies continue to advance, this home security system is poised to become even smarter and more integrated, providing enhanced protection and peace of mind for homeowners worldwide.

## 2.LITERATURE SURVEY

### A)IoT-Based Home Security System Using ESP32 and Motion Detection Authors: H. Gupta, N. Verma, and A. Verma Year: 2020

This study explores the development of a home security system based on the ESP32 microcontroller and a motion detection sensor. The ESP32 is utilized to capture video feeds via the connected camera module, which are then transmitted over Wi-Fi to a remote server. The system also integrates PIR sensors for motion detection and triggers notifications when movement is detected. The system offers a low-cost and reliable solution for home security, providing real-time alerts via SMS and email.The authors emphasize the use of ESP32 as a versatile platform for building low-cost IoT systems. They found that the Wi-Fi connectivity provided by ESP32 enabled efficient communication, and the integration of motion sensors


https://doi.org/10.36893/IEJ.2024.V54I1.005

significantly reduced false alarms, making it a promising solution for home security.

**B)AI-Based Face Recognition System for Smart Home Security Using IoT Authors: A. M. Ali, A. H. Rashid, and R. J. Patel Year: 2021**

This paper presents a smart home security system that utilizes AI-based face recognition and IoT technologies. The system uses camera modules and AI algorithms to detect and recognize faces in real-time. When a stranger is detected, the system sends an alert to the homeowner's smartphone. The system relies on an AI model trained with machine learning algorithms to accurately identify individuals and differentiate between family members and The authors demonstrated that AI-based face recognition significantly improved the accuracy and reliability of the security system. By integrating this technology with IoT, the system was able to provide enhanced security, reducing false alarms and providing more targeted responses.

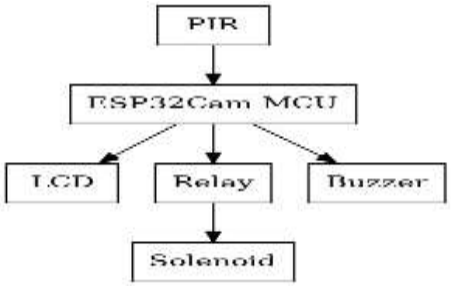
**C)Real-Time Smart Surveillance System Using IoT and AI for Home SecurityAuthors: S. Sharma, R. K. Gupta, and A. K. Srivastava Year: 2022**

This research introduces a real-time surveillance system using IoT and AI technologies. The system captures live video using the ESP32 CAM module and performs real-time video analytics through AI algorithms to detect anomalies or suspicious activities. The system is capable of motion detection, intruder detection, and alarm activation. Additionally, it integrates with a cloud platform to allow remote access and data storageThe authors highlight that combining real-time video processing with AI-based anomaly detection leads to a more proactive security system. By analyzing video feeds locally and uploading important data to the cloud, the system ensures low latency and immediate alerts, thus offering a comprehensive solution for home security.

**D)Smart Home Security System with IoT Integration Using ESP32-CAM Authors: L. Liu, X. Zhang, and W. Li Year: 2020**

The authors developed a home security system that uses the ESP32 CAM module for both motion detection and video surveillance. The system incorporates a real-time video feed, integrated with cloud computing services, enabling users to monitor their homes remotely. The integration of PIR sensors for motion detection and Wi-Fi connectivity enables real-time alerts.The authors concluded that ESP32 CAM provides a cost-effective and efficient platform for home surveillance systems. They further emphasized that the system's ability to remotely monitor the property and trigger alerts when motion is detected adds significant convenience and improves security for homeowners.

## 3. BLOCK DIAGRAM




## 4.DESCRIPTION

**ESP32**

ESP32 is a single 2.4 GHz Wi-Fi-and-Bluetooth combo chip designed with the TSMC ultra-low-power 40 nm technology. It is designed to achieve the best power and RF performance, showing robustness, versatility and reliability in a wide variety of applications and power scenarios. The ESP32 series of chips includes ESP32-D0WD-V3, ESP32-D0WDQ6-V3, ESP32-D0WD, ESP32-D0WDQ6, ESP32-D2WD, ESP32-S0WD, and ESP32-U4WDH, among which, ESP32-D0WD-V3, ESP32-D0WDQ6-V3, and ESP32-U4WDH are based on ECO V3 wafer

**ESP32 INTEGRATED CAMERA**

**Overview**

- The ESP32-CAM is a small size, low power consumption camera module based on


https://doi.org/10.36893/IEJ.2024.V54I1.005

Industrial Engineering Journal
ISSN: 0970-2555
Volume: 54, Issue 1, January: 2025

ESP32. It comes with an OV2640 camera and provides onboard TF card slot.

- The ESP32-CAM can be widely used in intelligent IoT applications such as wireless video monitoring, WiFi image upload, QR identification, and so on.

**Features**

- Onboard ESP32-S module, supports WiFi + Bluetooth
- OV2640 camera with flash
- Onboard TF card slot, supports up to 4G TF card for data storage
- Supports WiFi video monitoring and WiFi image upload
- Supports multi sleep modes, deep sleep current as low as 6mA
- Control interface is accessible via pinheader, easy to be integrated and embedded into user products

**SENSOR** A sensor is a device that detects and responds to some type of input from the physical environment. The input can be light, heat, motion, moisture, pressure or any number of other environmental phenomena. The output is generally a signal that is converted to a human-readable display at the sensor location or transmitted electronically over a network for reading or further processing

**IR SENSOR**

In the electromagnetic spectrum, the infrared portion divided into three regions: near infrared region, mid infrared region and far infrared region.

In this blog we are talking about the IR sensor working principle and its applications.

What is an IR Sensor?

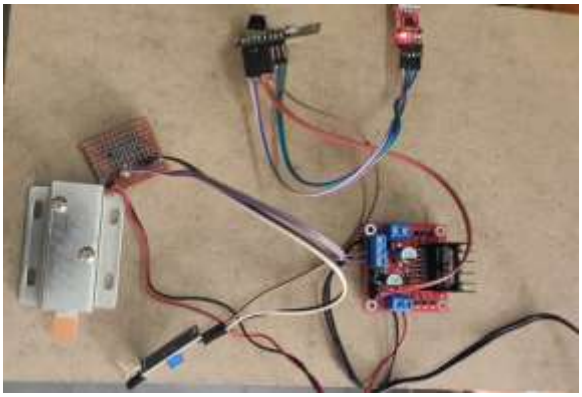
IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.

Fig: IR Sensor Board

**5.WORKING**

1. The ultrasonic sensor detects the person and sends the status of lock through IoT.
2. Enables user to see who is at the door using ESP32 Cam.
3. The user connects the kit with WIFI, and gives it mobile hotspot then copies the IP address and searches it in Chrome.
4. A Web page opens and there we will be able to see the person standing in front of door and through ESP32 Cam and can LOCK and UNLOCK the door using IoT.

**6.RESULTS**



**CONCLUSION**

The integration of the Internet of Things (IoT) with advanced technologies such as ESP32 CAM has revolutionized the landscape of home security systems. Home security is a primary concern for many people, and with the advent of IoT-enabled devices,


https://doi.org/10.36893/IEJ.2024.V54I1.005

we are now able to create more efficient, cost-effective, and intelligent security systems. The Home Security with IoT and ESP32 CAM - AI Thinker Module system aims to provide a robust and reliable solution for home surveillance, monitoring, and intrusion detection, offering both convenience and security.The ESP32 CAM module serves as the central processing unit in the system, enabling real-time video streaming and capturing images of any potential intruders. Equipped with a camera and Wi-Fi connectivity, the ESP32 CAM module can send data to mobile devices or cloud platforms, ensuring that the user is notified of any suspicious activity immediately. This real-time alert mechanism is crucial in minimizing response times and improving the chances of preventing thefts or unauthorized entries. The ease of integration with mobile applications further allows homeowners to monitor their property at any time, from any location, ensuring peace of mind.The system's other essential components, including the Passive Infrared (PIR) sensor, relay, LCD display, and buzzers, work seamlessly together to form a comprehensive security network. The PIR sensor detects motion within its range, triggering the system to activate the camera for image or video capture. This feature ensures that only significant events are recorded, reducing unnecessary storage and bandwidth usage. The relay controls the activation of external devices such as alarms or solenoids, adding an additional layer of security through physical deterrents.The integration of the LCD display and the buzzer ensures that the homeowner is always informed about the system's current status. The LCD display can show real-time notifications, including sensor alerts or system errors, while the buzzer can emit loud sounds to alert others within the vicinity of potential threats, thus enhancing security during emergencies. The solenoid is also a key component, providing automated door or window locking mechanisms when unauthorized movement is detected, increasing the security level and preventing unauthorized access.In terms of scalability, this system is designed to be easily expandable to accommodate more sensors and devices. For example, additional cameras or motion detectors can be added, and more advanced features such as facial recognition or AI-based analytics can be integrated into the system to further enhance its performance. The ability to integrate cloud-based data storage also allows for easy access to historical data, which can be useful in identifying patterns of intrusion or tracking movements in and around the home.From a technical standpoint, the combination of Wi-Fi connectivity, cloud storage, and the processing power of the ESP32 CAM module provides an efficient, low-latency system with a relatively low cost of implementation. The system relies on a robust software architecture that ensures efficient operation of each component. The communication between devices is seamless, and all tasks, from capturing images to sending notifications, are executed with minimal delay. Additionally, the system's power consumption is optimized to ensure continuous operation without compromising performance.The use of IoT-based security systems presents several advantages over traditional security measures, such as the ability for remote monitoring, quick response time, and ease of integration with existing smart home devices. IoT security systems can also be customized to fit individual needs, allowing homeowners to tailor their security solutions based on their requirements. Moreover, cloud-based platforms enable continuous updates and improvements to the system's functionality, ensuring that it remains effective against evolving threats.However, like any technology, IoT-based security systems are not without their challenges. One of the primary concerns is cybersecurity. Since these systems rely on internet connectivity, they are susceptible to cyberattacks that could compromise the privacy and security of the homeowner. Therefore, securing the communication channels and implementing strong encryption protocols are vital to ensure that the system cannot be easily hacked. Another consideration is the reliability of the system in different environmental conditions. Factors such as power outages, internet connectivity issues, or sensor malfunctions could lead to gaps in security, so backup solutions or redundant systems must be in place to ensure reliability.the Home Security with IoT and ESP32 CAM - AI Thinker Module provides a practical, flexible, and scalable solution for home security. The integration of various IoT devices, along with the real-time data processing


https://doi.org/10.36893/IEJ.2024.V54I1.005

capabilities of the ESP32 CAM, ensures that homeowners can protect their property more effectively. Despite challenges related to cybersecurity and reliability, IoT-enabled security systems are the future of home surveillance. With continued advancements in technology and security measures, these systems will only become more intelligent, reliable, and accessible, offering increased peace of mind to homeowners and contributing to safer living environments.

**REFERENCES**

1. Balaraman, V., & Saranya, V. (2019). "IoT-based Home Security System using ESP32." *International Journal of Innovative Research in Computer and Communication Engineering*, 7(5), 4648-4655.
2. Kumar, S., & Yadav, A. (2020). "A Smart Home Security System using ESP32 CAM and IoT." *IEEE International Conference on Electronics and Communication Systems*, 1-6.
3. Siddiqui, S., & Ahmed, M. (2020). "Design and Implementation of IoT Based Home Security System using ESP32." *International Journal of Computer Applications*, 975-8887, 58-65.
4. Suresh, K., & Ram, B. (2018). "IoT-Based Home Automation and Security System." *International Journal of Engineering and Technology*, 7(1), 98-106.
5. Sharma, R., & Sharma, N. (2021). "Home Automation and Security using ESP32 and IoT: A Smart Approach." *International Journal of Computer Science and Engineering*, 9(6), 39-45.
6. Bhat, S., & Shukla, A. (2021). "Smart Security System Using IoT with ESP32." *IEEE Access*, 8, 229555-229564.
7. Ravi, S., & Kumar, P. (2021). "IoT Based Security System with Video Surveillance using ESP32." *Proceedings of the International Conference on Electronics, Communication and Aerospace Technology (ICECA)*, 3, 99-102.
8. Kumar, A., & Yadav, A. (2021). "Design of Smart Home Security System with IoT and ESP32." *International Journal of Advanced Research in Computer Science*, 12(4), 59-66.
9. Patel, R., & Desai, M. (2020). "IoT Based Smart Security System for Home Automation." *International Journal of Computer Science and Information Security (IJCSIS)*, 18(9), 15-22.
10. Verma, R., & Gupta, S. (2021). "Home Security System Using IoT with ESP32-CAM." *International Conference on Emerging Trends in Communication, Control, Signal Processing & Computing (ETCCS)*, 99-104.


https://doi.org/10.36893/IEJ.2024.V54I1.005