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ESP32 CAM BASED CONTACTLESS DOORBELL SECURIT YSYSTEM USING IOT

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Abstract
The study, "Design & Implementation of an ESP32-CAM Based contactless doorbell security system using IoT," is being covered here. Utilizing a cloud server and the ESP32-CAM for monitoring and control. Everywhere they can, whether inside or outside of their homes, individuals look for security. A tool or technique used to stop or deter unlawful access to a location covered by the system is known as an anti-theft system. Both hardware and software were used to develop the system that was put into operation. It is a unique security system created with low-cost wireless cameras and sensors that enabled for doorway monitoring and management from a distance. By snapping photographs using a high-performance wireless camera like the ESP32-CAM that is linked to other objects and sensors in an IoT network, the system allowed the user to keep a watch on the doorway. For additional tasks like taking more pictures, receiving notifications, and remotely activating an electronic door lock, a smart phone app named "Telegram" was employed. Creating a dynamic system with zero mistake, real-time responsiveness, smooth performance, viability, intelligence, and feasibility was quite challenging.

Keywords: Telegram, Cloud, Camera, IoT, ESP32-CAM

I. Introduction

The research has done here provide insight into how IoT systems are being developed. In recent years, the Internet of Things research field has seen.IoT refers to the interconnection of physical objects such as machinery, vehicles, buildings, and other things with electronics, software, sensors, actuators, and network connectivity that allow them to gather and share data. The traditional disciplines of embedded systems, wireless sensor networks, control systems, and automation systems make up the Internet of Things (IoT). The revolutionary success of mobile and the internet network is therefore built upon by the internet of things. The door is important for home security. The owner will always keep the door shut to the house in order to keep it safe. However, if someone is rushing out of the house, they can misjudge whether the door is closed or not, or they might fail to lock the door. The suggested Door Security System application makes use of the Wi-Fi Door Lock with ESP32 CAM and Internet of Things (IoT) technology to control the door, monitor its condition, and increase home security. There are a variety of IOT device applications for which this software is used. The ESP-32 is a highly sophisticated board. The camera that notices a person's image in front of the door. It uses very little powerless than 5v. It has a built-in TF card slot and an OV2640 camera. Widely applicable clever IOT applications for the ESP32-CAM include wireless video monitoring and Wi-Fi image upload. This is appropriate for IOT applications like wireless monitoring, intelligent agriculture, facial recognition, and image upload from smart home devices. A wireless networking technology called Wi-Fi uses radio waves to deliver high-speed Internet access wirelessly. There is a popular misunderstanding that Wi-Fi stands for "wireless fidelity," however the term actually relates to IEEE 802.11x standards. The OV2640 is a SOC sensor with an integrated

image signal processor (ISP) that can do auto-exposure and auto-white balance in a tiny sensor package to depict a pleasant image.

II. Literature

According to **Arpita Mishraet al:** suggested a system to prevent unauthorised individuals from opening the door. The framework of a home security system includes a matrix keypad, a door latch opener, and a GSM modem for the security dial up interfaced to the microcontroller. The keypad on the controller is used as the password entry system to open and close doors. When the user enters the correct password, the door lock automatically unlocks. If the password is input incorrectly, a security alert sounds and, concurrently, the security dial-up function is enabled via the GSM modem connected to the microcontroller. The UART interface to the controller is used by the GSM modem. The controller uses the modem to notify the owner when an unauthorised user provides an invalid password. [1]

According to **Karan Maheshwari et al:** Proposed is a system to open doors based on recognition. When the doorbell is pressed, an HD camera takes a picture, which is then processed by the application to remove the face and send it to the Microsoft Face API, which is interfaced to the application through the Microsoft Azure cloud infrastructure. From a database of previously saved facial image files on the cloud, the face is recognised and named. If the faces match, the processor controlling the relay module opens the door and the user hears the phrase "welcome USER NAME" as well as the solenoid moving. [2]

According to **HteikHtarLwinet al:** This system uses MATLAB, which is installed on a PC, to implement face detection and identification. The interface between the PC and 16F887 microcontroller is a USB to RS232 converter. If the door reaches one of its two end locations, edge sensors are employed to turn off the motor. This switching mostly operates on the basis of serial port data given by the PC after evaluating the face and an algorithm installed in the microcontroller. [3]

According to **M.R.Sanghavi et al**: To improve security, I suggested a Facial Recognition-based Smart Door Unlock System. In this method, the face is captured using a camera sensor, and an image matching algorithm is utilised to identify faces that have been verified. Only the individual whose face matches can unlock the door. Hence, the restriction on handling keys will be eliminated [4].

2.1. Existing methodology

We have key locks from past several years which are easily breakable. This security problem is overcome by using IOT devices. In existing methodology code lock system was introduced. In code lock system we use a microcontroller that stores a password by the user. The door will open only when the person type the correct password. The lock does not open when we enter wrong password. Digital Door Lock has a definite response to the problem. Alternatively known as a mix entrance bolt, it allows you to enter and exit a building without the need for a key instead, a PIN code is used. A security system is installed and a keypad can be used by the user to input the PIN. This will address the key problem. Without any physical effort from the user, a motor unlocks the door when the PIN is entered.

Step1: Connecting each component to Arduino Uno is the first step.

Step2: Associating the Arduino Uno and related components with the Arduino compiler is the second step. Start dumping the code into Arduino Uno once it is connected to the Arduino compiler.

Step3: After completing the Arduino's setup. There are various activities available, and it is the easiest to use.

Step4: When Arduino begins to stack, a group of lines of code will appear. This will continue up until the boot process is complete. At that moment, the device automatically operates the engine using the provided code and functions similarly when using the provided secret key.

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Block Diagram of Code lock system:

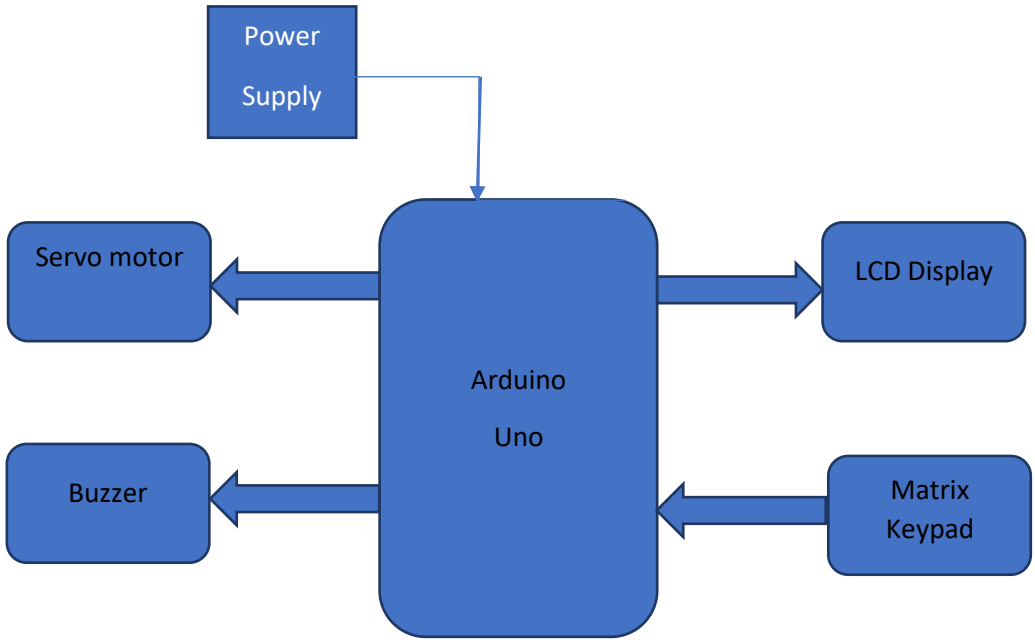

Fig1: System Architecture of Door Locks

III. Methodology

To demonstrate the hardware integration with a cloud server while transferring data remotely for applications based on monitoring and control, this work has used an experimental setup-based technique of research. For connection to external input and output devices, it contains a number of GPIOs.A smartphone with a "Telegram" account, The design of the system also featured a buzzer, a two-channel relay module, an infrared proximity sensor module, a tactile push button, +5V and +12V DC power supplies, and a USB TTL UART Convertor to program the ESP32-CAM board. In this functional prototype, a person must raise his hand to the IR module as he approaches a door before the ESP32 CAM may take a picture of him. The owner then receives a notification on his or her phone along with the picture of the person. After reviewing the image on their phone, the owner can also unlock the door. The suggested Door Security System application tracks the condition of the door using the Door Lock with ESP32 CAM and Internet of Things (IoT) technology.

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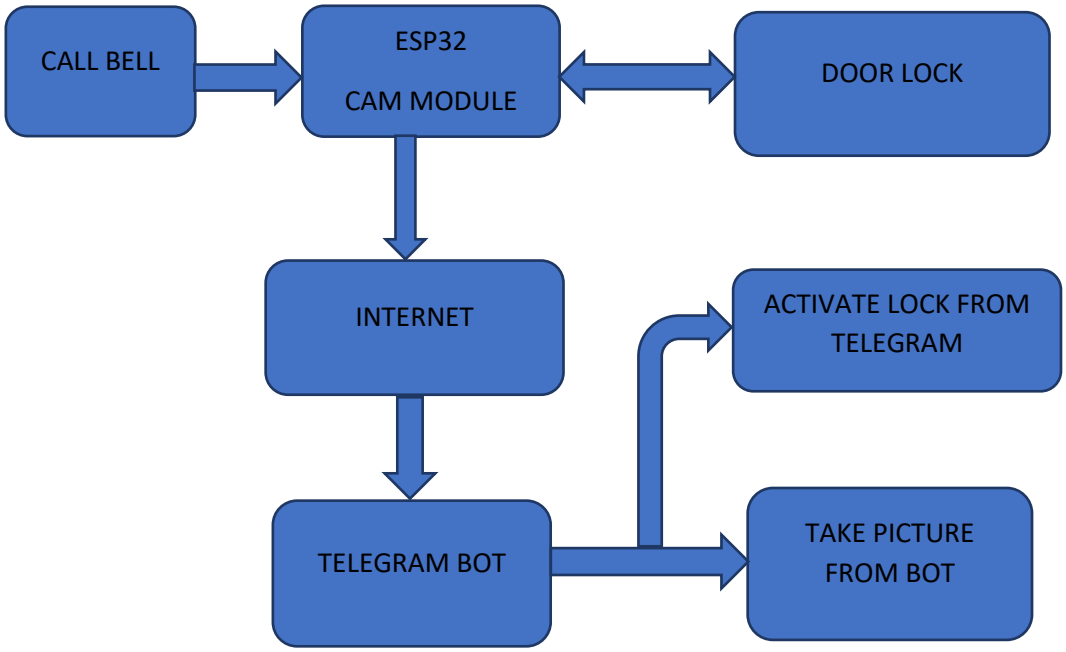

Fig2: Block diagram of ESP32-CAM based contactless doorbell security system

3.1. Component description

3.1.1Esp32-CAM AI-Thinker:

IoTs, or the Internet of Things, have long been the centre of attention in the world. Everyone is interested in smart technology, designing various prototypes and products, and putting them on the market, from hobbyists to innovators. One of the most well-liked clever modules for IoTs is the ESP32 Series processor. Espressif introduced the ESP32-CAM AI- Thinker, an upgraded version of the ESP8266-01 with various functions. The ultra-compact, low-power module has two 32-bit LX6 CPUs with exceptional performance and 7-stage pipeline architecture.

Fig 3:ESP32-Cam board

Wi-Fi and Bluetooth are built into the ESP32-CAM, which may be used with either the OV2640 or OV7670 camera. High-resolution ADCs, SPI, I2C, and UART protocols are available on the ESP32 IC for information communication. The module includes a temperature sensor, a touch sensor, a hall sensor, and watchdog timers. RTC can be used in a variety of modes. The module's maximum clock frequency is 160 MHz, which translates to a maximum computational capacity of 600 DMPIS. Additionally, it has good reliability and durability for internet access.

3.1.2.IR Proximity Sensor:

Infrared, or IR, is a light with a wavelength that is invisible to human sight but visible to cameras. Numerous products, including TV remote controls and night-vision cameras, employ it.An IR LED and a photodiode are used in proximity sensors to detect obstacles. When an obstacle is in front of the IR LED's forward-facing beam of light, the light reflects, activating the photodiode. This technique identifies the obstruction.

Fig 4: IR proximity sensor

3.1.2. Relay Module:

Relay modules are simple building blocks. They essentially serve as switches. Two internal metal contacts make up the typical relay module. Most of the time, these interactions don't overlap or come into contact. But in order to complete an electrical circuit that permits current flow, relays have an internal switch that connects these contacts. Relay modules are simple building blocks. They essentially serve as switches. Two internal metal contacts make up the typical relay module. Most of the time, these interactions don't overlap or come into contact. But in order to complete an electrical circuit that permits current flow, relays have an internal switch that connects these contacts.

Fig 5: Relay module

3.1.4.12V Solenoid Lock:

For locking sell-machines, storage shelves, file cabinets, and other items, 12V DC solenoid locks are employed. When the power is turned off and on again, the solenoid 12V lock functions and unlocks.

Due to its anti-theft and shockproof design, the solenoid lock is better than other types of locks. The 12V solenoid lock has a long lifespan and is durable, sturdy, and energy-efficient. When it comes to shockproof design and anti-theft performance, the lock excels over other lock types.

Fig 6:12V Solenoid lock

3.1.5.7805 Regulator:

A voltage regulator with an output of +5 volts is the LM7805. It is a three-pin IC, similar to the majority of other regulators on the market; The regulator's ground is created by the ground pin, which also serves as the regulator's input pin, while the output pin delivers the regulator's positive 5 volts.

Fig 7:7805 Regulator

3.2. Hard ware configuration

To make it easier to identify which wire goes to which component, connections in this design were built utilising multicoloured wires with the proper signal flow directions. The input signal and the output signal are divided in this example of signal flow. All of the parts were connected to the ESP32-CAM's GPIOs.Another infrared proximity sensor could take the place of the tactile push button. Here, GPIO-15 on the ESP32-CAM board was connected to the tactile push button's pin, which was also wired to the GND signal (logic level 0). In order to pull-up (increase the logic level to high) this pin during the high-impedance state, a 10 kilo ohm resistor was further applied. The GPIO-15 only receives a logic low (0) signal when the push button is depressed; otherwise, it is in its default logic high (1) state. Similar to other proximity sensors, the GPIO 2 infrared proximity sensor produces logic high (1) for any detection and logic low (0) for no detection. Nonetheless, they were employed to regulate the switching of some devices that required a greater voltage (+12V DC), such as solenoid door locks and buzzers.

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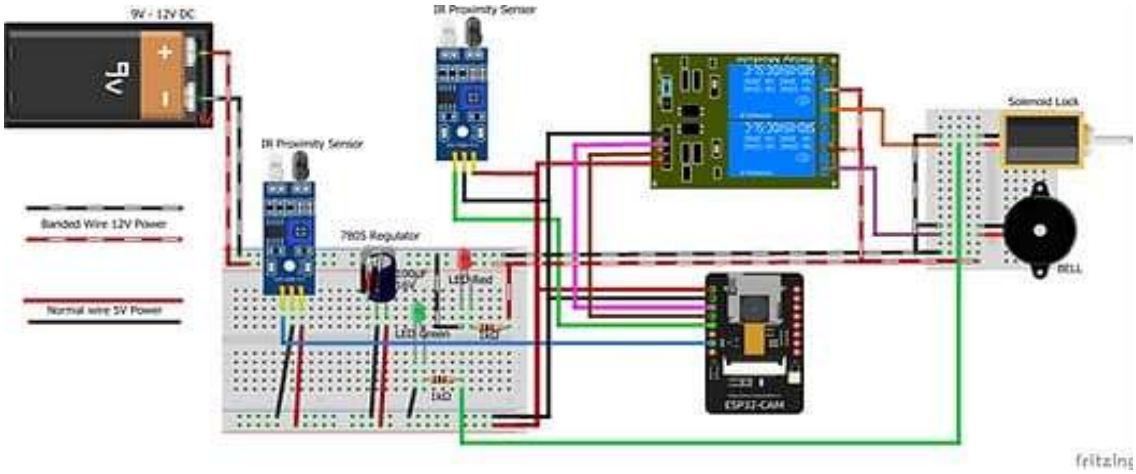

Fig 8:Experimental Setup

To demonstrate how the system might work as a genuine door, the hardware prototype was mounted over a piece of wood. On the guest side of the entrance, also known as the outdoor area, an ESP32-CAM, an IR proximity sensor, and two LED indicators were installed as part of this IoT system. On the owner's side of the door, also known as the indoor half, a solenoid door lock, door bell, and tactile push button were put in a manner similar to this.

IV. Result and discussion

Over the Telegram dashboard, the results from the final prototype board were easily visible. This required downloading and installing the Telegram application inside the using the necessary user credentials, an account was created on the user's smartphone.

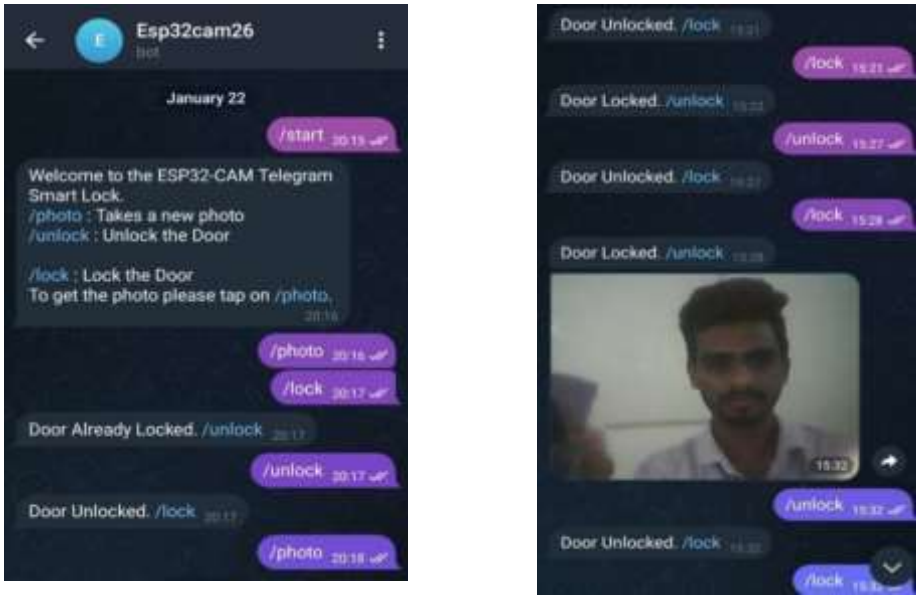

Fig 9: CAM Images Received over Telegram

Using a Wi-Fi hotspot network, the Smartphone's Telegram app was linked to the ESP32-CAM-based hardware. When the proximity sensor sensed an interruption, the entire process was started. Visitors could view each other in the Telegram project dashboard panel and get real-time alert notifications. This platform allows for remote activation of the relay that engages the solenoid door lock. The system's functioning was limited to the region covered by the local Wi-Fi hotspot that the user had used to create system access, and the user should be aware that the wireless network formed here for the system was a local network only.

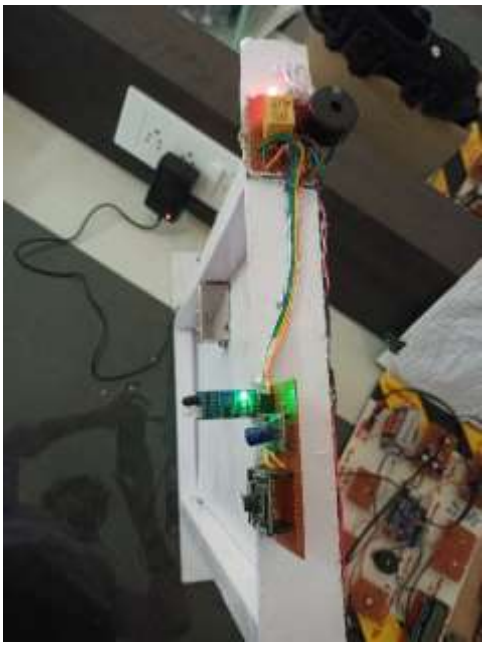

Fig 10:Final Prototype Implemented

V. Conclusion

The successful conclusion of this work led to the conclusion that In order for them to interact with one another and keep a log, monitor, or control the other items without the need for human intervention, we can network a large number of input/output devices, sensors, and actuators.IoT is hence similar to global networks that allow for communication between humans, other humans, and other humans as well as between things. IoT is the extension of the internet's current capacity to control anything that exists or will exist in the globe. According to this work, surveillance is the practise of keeping a close eye on someone, a group of people, etc., especially if they are in danger or under suspicion. For the aforementioned goals, According to the requirements of the application, we designed a system that included a sensor, camera, processor, relays, buzzer, LED indicators, and actuators. The Telegram cloud server was perfect for these kinds of applications because it is the most popular IoT platform for connecting devices to the cloud, developing apps to remotely manage and monitor them, and managing thousands of deployed items. The Telegram software enables people and organizations to move smoothly from a connected product prototype to a commercial launch. The software is quite simple to use. One can quickly get a system up and operating with very little coding.By incorporating temperature sensors, our suggested model can be expanded to automatically open and close doors in response to changes in the ambient temperature. The idea of this extended model is based on the setup and configuration of the Arduino UNO and other pertinent

modules as proposed (by KosalendraEethamakula et al., 2022) for the automatic detection, control, and monitoring of temperature. Additionally, the android application should eventually be able to control more doors, windows, and fundamental home electronic equipment. A battery backup system ought to be taken into consideration to ensure the system's completion.

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