An IOT Enabled Smart Doorway Security System

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ABSTRACT

The study being undertaken here in was about checking and validating the feasibility of an IoT system integrated with a cloud server. As securityis one of the major concerns for public today they want to ensure security at everyplace possible when they are into their homes or away from their homes. Keeping in view of this problem the idea of a highly reactive, versatile, low cost and real-time responsive security system was formulated here in this study to prevent or deter the unauthorized intrusion or trespassing activity in or around one's premises. The architecture of the system was well planned keeping every minute detail in mind so as tobe able to finally realize it into a working prototype.

Keywords: *ESP32-CAM, Security System, IoT, Blynk, Door Bell.*

INTRODUCTION

The IoT may be defined as an extended internet and network connections to diverse sensors and devices — or 'things' — offering a better degree of calculation and analytical capability even for basic products like light bulbs, locks and sales. The accessibility of the IoT is among the most significant features of its increasing popularity. Connected or 'smart' devices – as 'things' in the IoT are commonly termed – may collect data and exchange it with other wired and wireless networks from their surroundings. By analyzing and interpreting the data, machines may carry out their tasks with little or no human intervention. Components of their goods are introduced by suppliers to enable them to communicate data back on how things work. This can enable individuals to monitor if a failure happens and exchange before damage might occur. Companies may also make their systems and logistics providers more efficient using the information provided by these sensors, given that they have much more precise information on what actually happens. Production systems may become substantially more responsive also with inclusion of extensive, real-time data collecting and processing.

MOTIVATION

Several security systems are already available in the market to provide the security related solutions but most of them are either expensive or require high storage space for recording surveillance video. Some security systems are static and least versatile but comparably high in cost while others are dynamic but support only half-duplex communication, means the user can only monitor the system output remotely but cannot control it. Now in this era of IoT, cloud computing and machine learning a paradigm shift in the design and development of advanced, smart and intelligent systems has been noticed. Rapid prototyping of IoT devices using certain low-cost Wi-Fi enabled development boards like ESP12, ESP32, NodeMCU, Arduino, etc. has now become much easier than ever before. Also, it has widened the scope of creativity as the whole process of turning one's idea into a working prototype has now become faster and easier due to lot of support available over the internet.

OBJECTIVE

The objective was an adaptable, practical, low-power door security technology with a reliable reaction in real time. IoT network and cloud computing should integrate the system that has been built. The aim was to build a dynamic wireless safety door system that enables the user to obtain the photo identity of

the visitors and to make educated decisions to provide them with entry. If necessary for investigative purposes, including the data gathered by the cloud server can be accessed. The system created should be easy to use and viable.

PROBLEM STATEMENT

The research work was mainly concerned with the design and development of an IoT based doorway security system while integrating a cloud server with it for remote access. Specifically, the investigator was specifically asked to reply to the following questions:

1.What were the relative strengths and shortcomings of other comparable models in the literature?

2.Which computational devices and cloud server platforms were most likely to be used to implement such systems?

3.To what extent does the results obtained by the experimentations performed match the desired results?

4.Whether the system developed was static or dynamic?

5.Whether the system developed responds in real-time or not?

6.Whether the system developed could be accessed remotely or not?

7.Whether the system developed was a cost-effective solution or not?

PROPOSED WORK

The proposed work was to design, develop and implement a highly effective doorway security system. In this system there were two units: Indoor Unit and Outdoor Unit. Outdoor Unit deployed an infrared proximity sensor and ESP32-CAM board with an LED flashlight over it. Usually, a visitor making a visit to someone's place reaches at the doorstep and notifies the owner inside by ringing the doorbell available at the doorway. Here the same procedure was to be followed except a minor change that the doorbell switch has been replaced here with a contactless sensor-based switch. So, here the visitor needs to raise his/ her hand closer to the deployed sensor to trigger the doorbell. As soon as the sensor detects someone, the owner inside will be notified by a message on the Blynk project dashboard over the smart-phone followed by a visitor's picture clicked by the ESP32-CAM. The Indoor Unit has a solenoid door lock in control of the user. The system empowered the user with two options to control this door lock electronically via physical access or via remote access. For physical access a tactile push button was provided for the user. To unlock the door, user needs to press that button for few seconds. Similarly, the other option to unlock the door was via the smart-phone by using a virtual button provided in the Blynk application dashboard created for this project. Also, user can click multiple pictures of the visitor if required by using another virtual button named 'Take Photo' on the same dashboard screen. The image clicked and the notification appeared on the same dashboard screen via Blynk server. For smooth working of this prototype both the devices i.e., ESP32-CAM and the user's smart-phone must share the same Wi-Fi credentials, otherwise there would be no connectivity between the two.

COMPONENTS REQUIRED

The development of the hardware prototype was a high-performance computer platform for implementing IoT-based security solutions. The following provides a quick explanation of the components for the system development.

S.No.	Component / Module	Specification	Quantity
1	ESP32-CAM Board	Genuine make	1
2	IR Proximity Sensor	4-PIN	1
3	Solenoid Door Lock	+12V	1
4	Buzzer for Door Bell	+12V	1
5	SPDT Relay	+5V	2
6	IN4007 Diode	1A	6
7	Resistor 10K	Quarter Watt	6
8	Resistor 220E	Quarter Watt	6
9	Resistor 1K	Quarter Watt	4
10	Capacitor Electrolytic	2200uF/35V	1
11	Tactile Push Button	Large	1
12	Voltage Regulator IC	LM7805	1
13	General Purpose PCB	130 x 85 mm^2	1
14	Transformer	12-0-12 / 200mA	1
15	Connecting Cable	220V AC	1
16	Berg Strip	Male Connector	2
17	Berg Strip	Female	2
18	Connector	2-PIN	2
19	LEDs	Red	2
20	NPN Transistor	BC-547	2
21	Jumper wires	multicolor	20

Table 3: List of Components

HARWARE CONNECTIONS

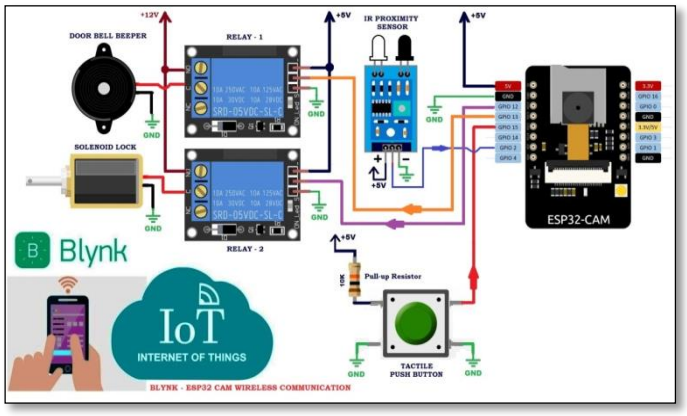

Figure 1: Circuit Diagram of Implemented System

S. No.	ESP32-CAM Pin	Interfaced with	Signal Nature	Action
1	GPIO 12	RELAY -2	Output	Turn ON/ OFF Door Lock
2	GPIO 13	RELAY-1	Output	Turn ON/ OFF Door Bell
3	GPIO 15	TACTILE PUSH BUTTON	Input	To Open the Door Lock from Inside
4	GPIO 2	IR PROXIMITY SENSOR	Input	To Ring the Door Bell & Click Photo
5	+5V	+5V DC Power Supply	Power	To drive the complete circuit
6	GND	DC Power Supply	Power	To drive the complete circuit

Table 4: ESP32 CAM Pin Connections

The ESP32CAM features a highly competitive camera system, with a footprint of just 27*40.5*4.5 mm and a deep sleep current of up to 6 mA. The camera module may be operated separately. In many IoT applications, ESP-32CAM may be widely employed. It is ideal for smart domestic gadgets, industrial wireless controls, wireless monitoring, wireless QR IDs, wireless system location and other IoT applications. The solution is excellent for IoT applications. ESP-32CAM utilizes a DIP packaging and can be placed directly in a product backpack to produce goods rapidly, offering clients with an easy-to-use high-reliability connectivity method in different IoT devices.

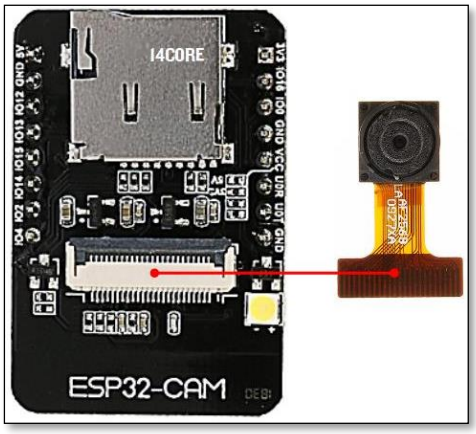

Figure 2: ESP32-CAM Board

A. Relay Board

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal, or where several circuits must be controlled by one signal. Relays are the components which allow a low-power circuit to switch a relatively high current on and off, or to control signals that must be electrically isolated from the controlling circuit itself. To make a relay operate, we have to pass a suitable pull-in and holding current (DC) through its energizing coils. Generally, relay coils are designed to operate on a supply voltage often 12V or 5V.

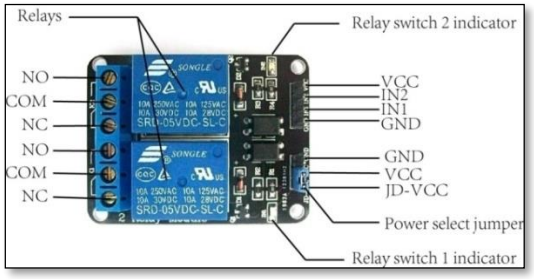

Figure 3: Relay Board

B. IR Proximity Sensor Module

Proximity Sensor is used to detect objects and obstacles in front of sensor. Sensor keeps transmitting infrared light and when any object comes near, it is detected by the sensor by monitoring the reflected light from the object. It can be used in robots for obstacle avoidance, for automatic doors, for parking aid devices or for security alarm systems, or contact less tachometer by measuring RPM of rotation objects like fan blades.

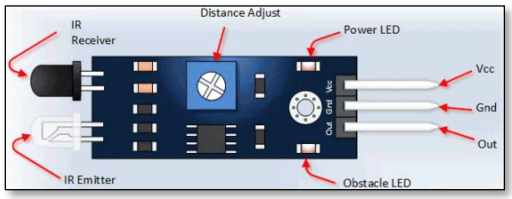

Figure 4: IR Proximity Sensor Module

C. Tactile Push Button Module

The tactile push button is the most commonly used mechanical switching device used in electrical and electronic circuits and panels. These small sized switches are placed on Printed Circuit Boards (PCBs) and are used to close an electrical circuit when the button is pressed by a person. When the button is pressed, the switch turns ON and when the button is released, the switch turns OFF. The switch is used to supply input signal to actuate a device or equipment, to generate an interrupt, to increment or decrement a value manually, to change the mode of operation of a device, as a key in matrix keypad. A pull-up resistor is interfaced to the switch line to prevent detection of false triggers when the line is in high-impedance state or tri-state.

D. LED Indicator Module

LED (Light Emitting Diode) is basically a pn-junction diode that emits light when connected to the power source in forward bias mode and doesn't operate in reverse bias mode. The Red colored

LED usually consumes 2.2V–2.4V and 10mA–20mA current. A current limiting resistor is required to connect in series with it as per the source voltage.

E. Solenoid Door Lock

The solenoid lock indicates a lock to be locked and unlocked electrically. This module is available for unlocking in power-on mode type and locking and holding in the power-on mode type. Only when the solenoid is moved can the power-on release be released. The door is secured and not opened in the event of electricity failure or cable disconnection, which ensures exceptional safety. This kind is typically utilized in locations where crime prevention is necessary. The electric lock type may lock the door while powering the solenoid. The door is unlocked if the electricity is unplugged. In the event of a fire or accident, such a kind opens the door and is used for emergency exits via which fire-fighting or evacuation activities should preferred be conductible, rather than for the prevention of crime. The holder conducts two actions; it locks and unlocks the solenoid using a positive or negative pulse voltage, retaining the no power condition in each position. This kind is energy-saving, because powering the solenoid is always unneeded.

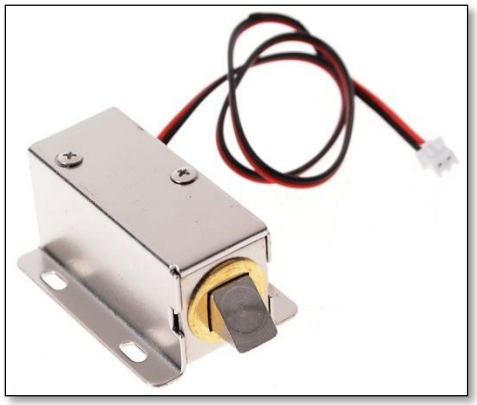

Figure 5: Solenoid Door Lock

CONCLUSION

When the study was successfully finished, we could link numerous input/output systems, multiple sensors and actuators to one another via IoT so that data gained from this may be used without human involvement, to maintain logs or monitor or to operate objects without human interaction. IoT is like worldwide networks that communicate between objects, between human and human and human. IoT is the development of current internet facilities to manage all that exists or exists worldwide. As per this work, monitoring is a method in which an individual is closely sensed or monitored, collected, and so forth, especially carefully or in question. I designed for these reasons a system which was furnished, in accordance with the application requirements, with sensor, camera, cellular, reel, buzzer, LED indications and drives. The technology functioned effectively in the local setting and met the requirements nicely. The Blynk cloud server was ideal for such applications as it is the most popular IoT platform for cloud-based devices, apps for remote monitoring and remote control and management of thousands of installed products. Blynk Software allows people and organizations, from a prototype of a connected product through its business launch, to develop effortlessly. The programme may be used quite easily. The device is Arduino, NodeMCU and other microcontrollers compatible. It requires very little code and you can start a system in no time.

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