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Smart Doorbell Using ESP32 CAM

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ABSTRACT: Today, security is one of the most important part of our lives, whether it's data security or the security of our own house. In IOT technology, the digital lock does not need a physical key, but it uses RFID, fingerprint, Face ID, pin, passwords, etc. In the past, we have developed numerous applications for digital door locks using these diverse technologies. In this project, we construct a Face ID digital lock system with ESP32-CAM.

The AI-Thinker ESP32-CAM module is a low-cost development board with a very small size OV2640 camera and a micro SD card slot. It has an ESP32 S chip which has built-in Wi-Fi and Bluetooth connectivity, with 2 high-performance 32-bit, 7-stage pipeline architecture. We have previously explained ESP32-CAM in detail and used it to build a Wi-Fi door Video doorbell. This time we will use the ESP32-CAM to build a Face Recognition based Door Lock System using a Relay module and Solenoid Lock.

KEYWORDS: ESP 32 CAM, solenoid,relay,FTDI,IOT.

I. INTRODUCTION

The main entrance to a house is a door, so earlier there was usually a door with a single lock. Traditional lock have physical key so, with the help of that key we can open the door. Nowadays due to advancement in technology there are various types of lock. IOT means internet of things so, with the help of IOT we can control who can access our house. The main purpose of this project is to make a smart doorbell system. This project needs few components which are easily available in the market ESP32 CAM, solenoid, relay, FTDI and push button. Now first with the help of the FTDI we can upload code in ESP32, after uploading code we can connect ground and Vcc pin to relay and one i/o pin of ESP32 is connected to relay and other i/o pin to push button.

The working of project is that when a visitor push the doorbell button, the owner of the house is notified with the help of bylnk app. This app provides visual information obtained from camera module present at the smart doorbell. A solenoid lock is further connected to grant/deny access to the visitor.



II. BLOCK DIAGRAM

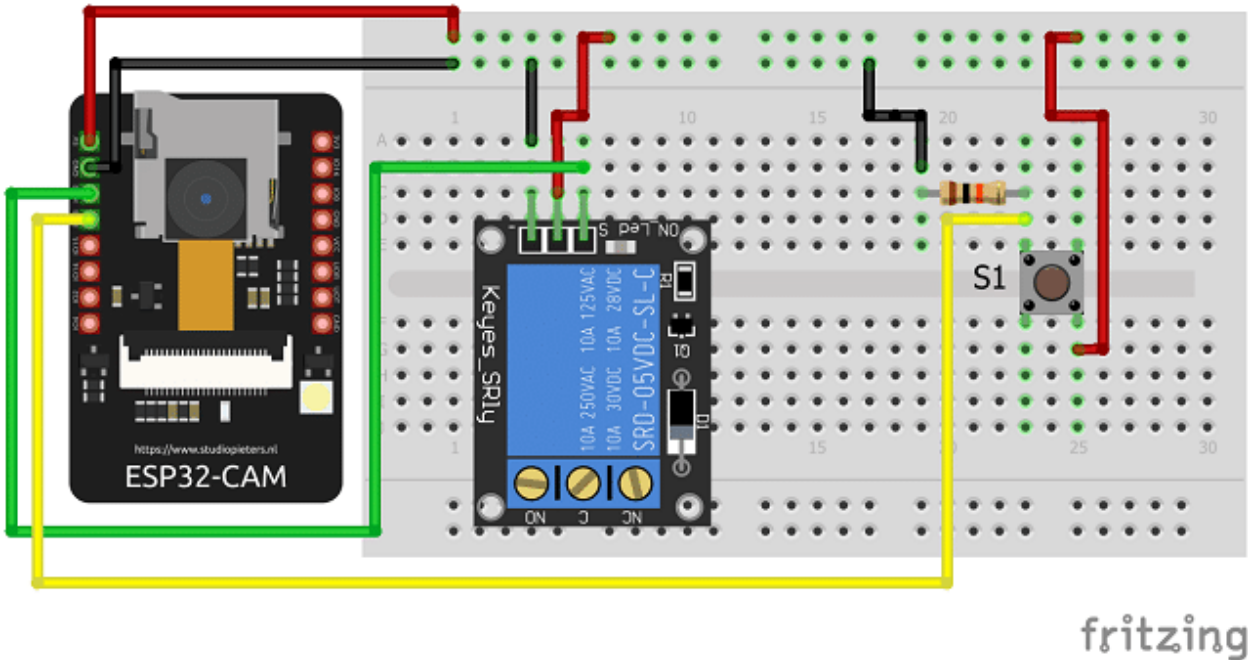


Figure 1: ESP32 CAM with Relay and Switch

Now as you can see in the above block diagram that relay module is connected to the ESP 32 CAM module. In order to upload code in the ESP 32 CAM module we have to use Arduino & USB to TTL module

Initially when we press the push button, ESP 32 CAM becomes active. It sends a notification in the owner’s phone with the visual from the camera. Now if the owner accepts the entry, relay module will go high & thus the lock will be disabled. In case when owner denies entry, relay module will remain low, keeping the lock enabled. A prominent thing one needs to take care about is, the ESP32 CAM & owner’s phone must be connected to same Wi-Fi Network.

III. COMPONENT DESCRIPTION

1.ESP32 CAM



Figure 2: ESP32 CAM



The ESP32-CAM is an Ai-Thinker’s Original ESP32 CAM WiFi+Bluetooth with OV2640 Camera Module based on the ESP32 chip with the additional facility of using a camera. It is ideal for various IoT applications. The ESP32-CAM has a very competitive small-sized camera module that can operate independently as a minimum system.

Ai-Thinker ESP32 CAM can be widely used in various IoT applications. It is suitable for home smart devices, industrial wireless control, wireless monitoring, QR wireless identification, wireless positioning system signals and other IoT applications. It is an ideal solution for IoT applications.

Specification:-

- Ultra-small 802.11b/g/n Wi-Fi + BT/BLE SoC module
- Low-power dual-core 32-bit CPU for application processors
- Up to 240MHz, up to 600 DMIPS
- Built-in 520 KB SRAM, external 4M PSRAM
- Supports interfaces such as UART/SPI/I2C/PWM/ADC/DAC
- Support OV2640 and OV7670 cameras with built-in flash
- Support for images WiFi upload
- Support TF card
- Support multiple sleep modes
- Embedded Lwip and FreeRTOS
- Support STA/AP/STA+AP working mode
- Support Smart Config/AirKiss One-click distribution network

Support for serial local upgrade and remote firmware upgrade (FOTA)

2. RELAY MODULE



Figure 3: Relay Module

This is a single channel relay board with one 24 volts high current relay. It is an ideal board to control & switch high current loads like a fan, lights, low power heater coils. It not only provides switching but also provides isolation between the power device and your micro-controller. Devices up to 5 Ampere can be switched using this relay.

This relay module has an onboard driver and a led to indicate the Relay Status (ON/OFF). Since this Relay board has an onboard driver transistor to provide the relay with the necessary holding and latching current these relays can work with any microcontroller, Arduino, Intel Edison Boards, Beagle-bone & Raspberry pi as well.



Specification

- Output SPDT Relay.
- Header connector for connecting power and trigger voltage.
- LED indicates relay status.
- Screw terminal connector for easy relay output connection
- voltage = 24
- current=20

Relay Pin Configuration

| Pin Number | Pin Name | Description |
|------------|---------------------|--|
| 1 | Coil End 1 | Used to trigger(On/Off) the Relay, Normally one end is connected to 5V and the other end to ground |
| 2 | Coil End 2 | Used to trigger(On/Off) the Relay, Normally one end is connected to 5V and the other end to ground |
| 3 | Common (COM) | Common is connected to one End of the Load that is to be controlled |
| 4 | Normally Close (NC) | The other end of the load is either connected to NO or NC. If connected to NC the load remains connected before trigger |
| 5 | Normally Open (NO) | The other end of the load is either connected to NO or NC. If connected to NO the load remains disconnected before trigger |

3.DC 12V SOLENOID LOCK

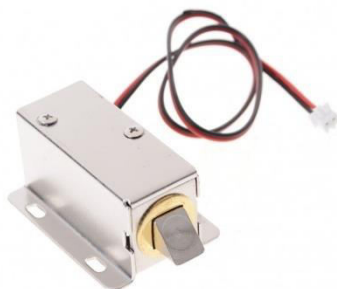


Figure 4: Solenoid Lock



This DC 12V Solenoid Electromagnetic Cabinet Door Lock can be used for locking sell-machine, storage shelf, file cabinet and etc. The hidden way of unlocking can be used for an emergency. The lock works as the circuits disconnects, and it will unlock as the instant power-on. It is steady, durable, and energy-saving and had a long lifespan. In the anti-theft and shockproof design, the lock is better than other kinds of locks. After connecting the wires and when the current is available, the electric lock can control the doors opening and closing.

SPECIFICATION

- Rated Operating Voltage (VDC)=12
- Rated Current (mA)=0.80mA
- Power Consumption (Watt)
- Iron Body Material
- High quality ultra-compact electric lock.
- Rustproof, durable, safe, convenient to use.

4. ARDUINO UNO



Figure 5: Arduino UNO

The Arduino Uno R3 is an open source microcontroller board based on the ATmega328P chip. This Board has 14 digital input/output pins, 6 analog input pins, Onboard 16 MHz ceramic resonator, Port for USB connection, Onboard DC power jack, An ICSP header and a microcontroller reset button. It contains everything needed to support the microcontroller. Using the board is also very easy, simply connect it to a computer with a USB cable or power it with DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. While the Arduino UNO can be powered via the USB connection or with an external power supply, the power source is selected automatically.

SPECIFICATION

- Microcontroller: ATmega328P.
- Operating Voltage: 5V.
- Input Voltage: 7-12V.



- Digital I/O Pins: 14 (of which 6 provide PWM output).
- Analog Input Pins: 6.
- DC Current: 40mA.
- Flash Memory: 32 KB.
- SRAM: 2 KB.
- EEPROM: 1 KB.
- Clock Speed: 16 MHz.

5.FT232RL USB - TTL CONVERTER

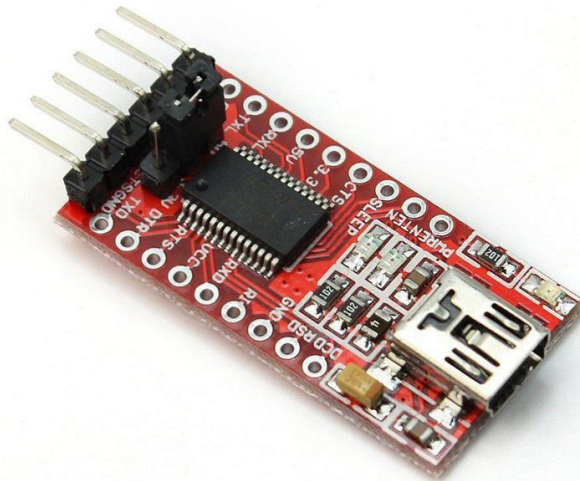


Figure 6: FT232RL

This is USB to TTL 3.3V 5.5V Serial Adapter Module based on FT232RL IC, It is mainly used for arduino applications.

SPECIFICATION

- Material: PCB + Electronic Component
- Support 3.3V, 5V
- Main Color: Red
- Chipset: FT232RL
- USB power has over current protection, using 500MA self-restore fuse
- RXD/TXD transceiver communication indicator
- Pin definition: DTR,RXD,TX,VCC,CTS,GND
- Pitch:2.54mm
- Module Size: About 36mm(length)*17.5mm(width)
- Interface : Mini USB



6.PUSH BUTTON SWITCH

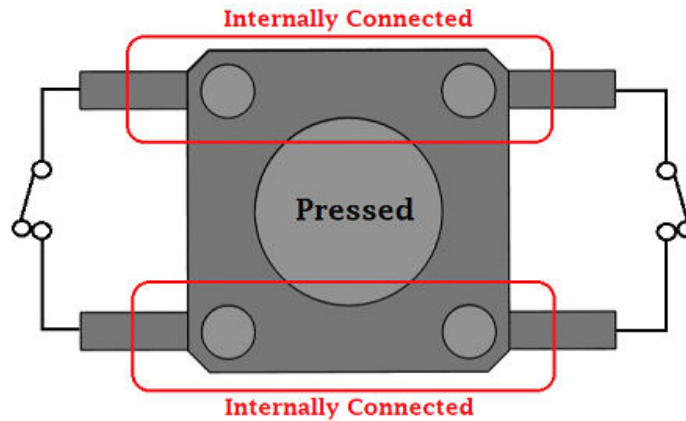


Figure 7: Push Button Switch

Push-Buttons are normally-open **tactile switches**. Push buttons allow us to power the circuit or make any particular connection only when we press the button. Simply, it makes the circuit connected when pressed and breaks when released. A push button is also used for triggering of the SCR by gate terminal. These are the most common buttons which we see in our daily life electronic equipment's. Some of the applications of the Push button are mentioned at the end of the article.

Specifications

- Mode of Operation: Tactile feedback
- Power Rating: MAX 50mA 24V DC
- Insulation Resistance: 100Mohm at 100v
- Operating Force: 2.55±0.69 N
- Contact Resistance: MAX 100mOhm
- Operating Temperature Range: -20 to +70 °C
- Storage Temperature Range: -20 to +70 °C

IV. A SCOPE OF THE PROJECT:

This project is usually used by elderly and disable people who cannot move quickly. Thus by using this project they can see the person present in front of the door and can control access of the door.

LIMITATIONS: The limitation of this project is that phone and ESP module must be connected to the same Wi-Fi. Furthermore the picture quality of the camera can be further improved.

V. CONCLUSION

Safety has become an integral part of our life, this project is based on safety& security of our household. In this project of Smart Doorbell we have used ESP 32 cam, relay, push button& solenoid lock. When guest presses the doorbell ESP32 cam starts streaming live video in the owner's phone. Thus the owner gets notified and grant the entry to the house for the guest.

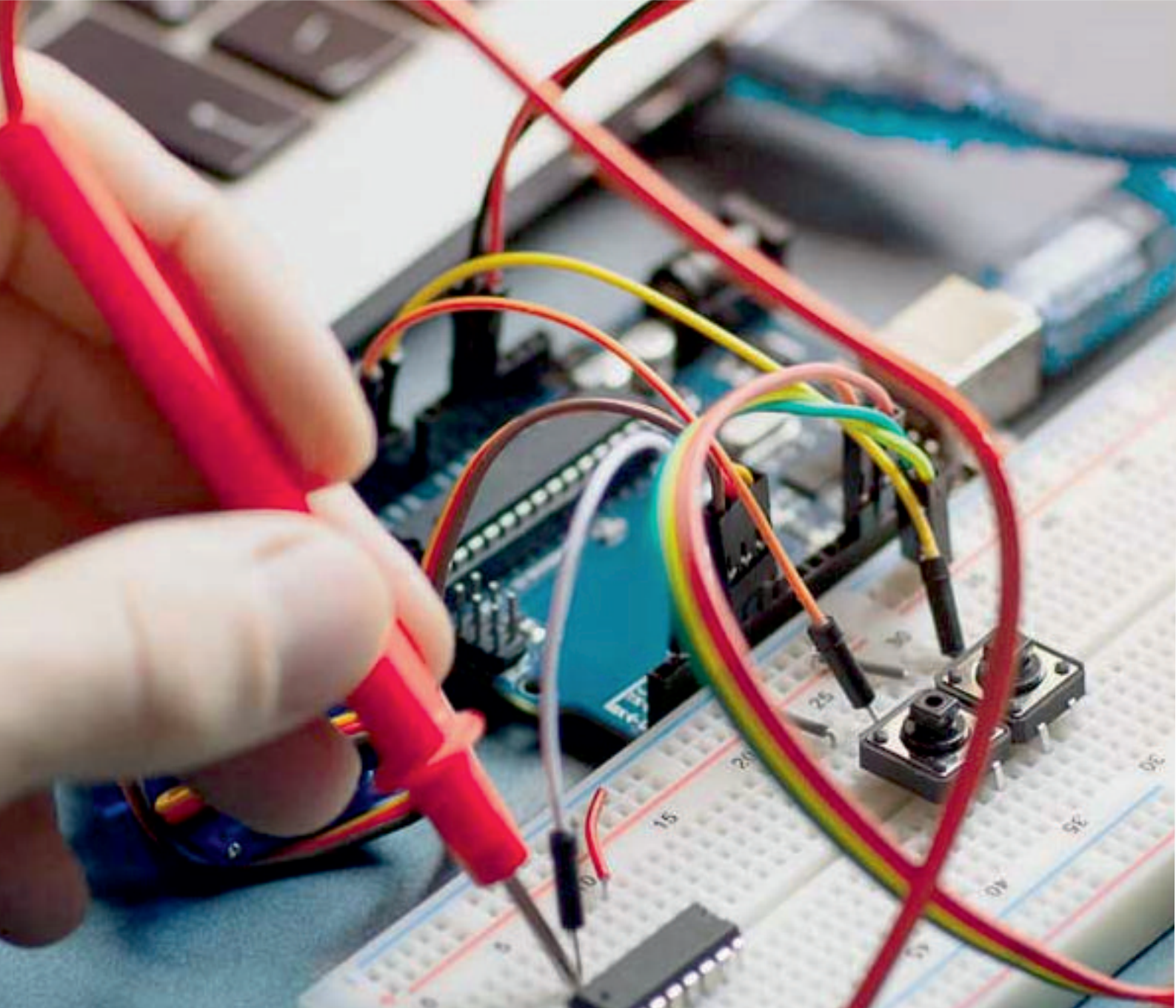
VI. FUTURE ENHANCEMENT

To enhance the connectivity of the ESP32 CAM and making it accessible from any internet network.



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