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Automatic Door Access Control System Based on Facial Recognition Using ESP32-CAM

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Abstract: ***Contactless Doorway Security System for Remote Monitoring and Control the usage of ESP32-CAM and a Cloud Server". People need protection in every place viable while they're into their houses or far from their houses. An anti-robbery device is a tool or approach used to save you or deter unauthorized intrusion or trespassing hobby in its insurance area. The carried-out device changed into evolved in a mixture of hardware and software. It's a completely unique protection device made with low-value wi-fi digital digicam and sensors which ensured far-flung tracking and manipulate of doorways. The device empowered the consumer to screen the entrance by taking pictures of the usage of a high-performance wi-fi digital digicam i.e. ESP32-CAM connecting different gadgets and sensors in an IoT network. For different duties like manipulating digital door lock remotely, to click on greater pix, in addition, to get notifications a cloud server application „Blynk" changed into used over the clever-phone. A fundamental project changed into to expand this dynamic The Project suggested right here in and titled "Design & Implementation of an IoT Networked.***

Keywords: ESP32-CAM, Camera, IoT, Cloud, Blynk, Security, etc.

I. INTRODUCTION

In this work we supplied perception into the improvement of IoT structures. The studies location of the Internet of Things in the latest years has skilled increased and improved in an interdisciplinary manner. IoT is the inter-networking of bodily devices, vehicles, homes, and different gadgets embedded with electronics, software, sensors, actuators, and community connectivity that permit those gadgets to accumulate and trade data. The conventional fields of embedded systems, wi-fi sensor networks, management systems, automation structures are collectively interconnected to shape the IoT. That approach the net of factors builds over the progressive fulfillment of cellular and network community.

II. OBJECTIVE

The purpose of this paper changed to gain a versatile, viable, low electricity doorway safety answer with real-time response. The device evolved to have to be included with the IoT community and cloud computing. The goal changed into to broaden a dynamic Wi-Fi doorway safety device which empowers the person to accumulate visitor's image identification and take a knowledgeable selection for giving that character get admission to into his/ her premises. Also, the records gathered with the aid of using the cloud server might be retrieved if required for a few research purposes. The evolved device has to be person-pleasant and feasible.

III.RESEARCH METHODOLOGY

This workt had applied the experimental installation primarily based totally approach of studies because it changed into aimed to illustrate the hardware interplay with a cloud server the use of a Wi-Fi neighbour-hood hotspot to remotely switch the information mainly for tracking and control-primarily based totally applications. The hardware used right here is constructed from a high-overall performance low-price Wi-Fi enabled computational platform with incorporated digital digicam i.e. ESP32CAM board. It has more than one GPIOs for interfacing with outside input/ output devices. The different additives used right here to put in force the proposed gadget has been a solenoid lock, +5V, and +12V DC, a buzzer, a two-channel relay module, an infrared proximity sensor module, a tactile push button a USB TTL UART Convertor to software ESP32-CAM board and ultimately a smart-phone with a "Blynk" account. The experimental outcomes acquired from this hardware experimental set-up ought to validate the paintings. The studies will contain the collection of information from the datasheets approximately numerous additives utilized in growing the hardware. Data collected from those studies efforts have been used to formulate the general manner to design, increase and put in force the gadget. Appropriate tables, flowcharts, and figures have been covered with inside the very last record alongside the snapshots of the operating prototype.

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A. Components Required

1) Breadboard

A Breadboard is a plastic board that is in a rectangular shape with several tiny holes in it. These holes make it easy to place electronic components into an electronic circuit shown in figure 1

2) ESP32 CAM

The ESP32 CAM is a small size camera, it consumes low power. ESP32 CAM was invented and developed by Espressif Systems. It is a low-power system on chip microcontroller with built-in Wi-Fi and dual-mode Bluetooth. It costs around $10.Due to the lack of a USB port in ESP32 CAM, you'll need an FTDI programmer to upload code via the U0R and U0T pins.ESP32 CAM is used in most intelligent IoT applications like wireless monitoring, facial recognition, QR wireless identification. Some of the features of ESP32 CAM are low power 32-bit dual-core CPU for application processors -up to 240MHz,600 DMIPS, built-in flash support for OV2640 and OV7670 cameras support for serial local firmware upgrades as well as remote firmware upgrades(FOTA) and Secondary developer support as in figure 2.

3) FTDI BOARD

FTDI is Future Technology Devices International figure 3, it is a tiny computer with one notable exception. Instead of being installed into a circuit, its pins link to another electronic device. As a result, the FTDI chip may be used to communicate with any other electronic device via an RS232 serial interface. It has many applications such as it can be used as a serial adapter, USB-to-RS232 converter, and as USB keyboard. The communication around the device and the FTDI chip is much faster than communication around two computers using an RS232 cable.

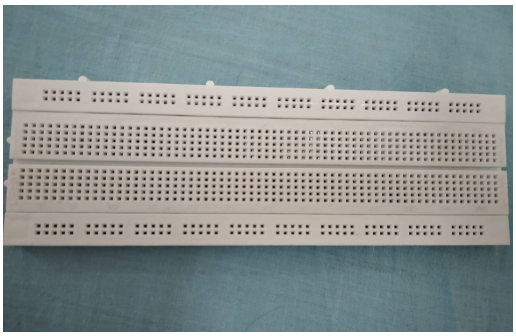


Figure 1

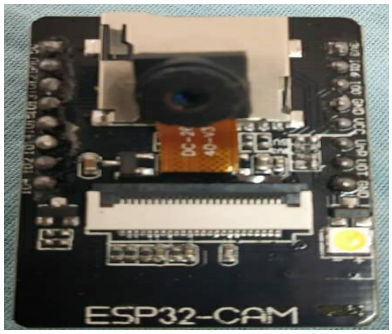


Figure 2

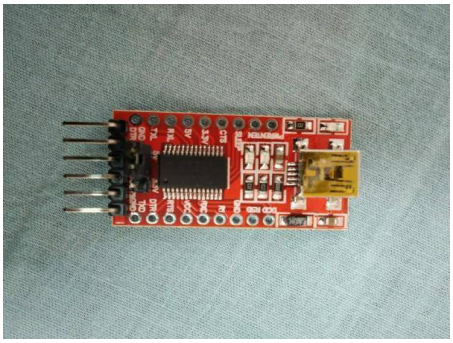


Figure 3

4) RELAY MODULE

Relay is one of the electromechanical components that act as a switch as shown in figure 4. It is an automatic switch that is used to regulate the high current signal utilizing a low current signal. It is also used in the automatic control circuit. An electromagnet operates the relay module. A separate low-power signal from a microcontroller triggers the electromagnet. The electromagnet drags to open or close an electrical circuit when triggered.

5) SOLENOID LOCK

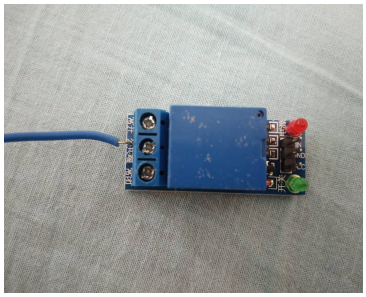
A solenoid door lock is a door locking system which uses an electromagnetic solenoid to unlock the door.The locking mechanism of a solenoid door lock is almost similar to that of a traditional key-operated replica figure 5. The only variation among the two is the existence of a low-voltage solenoid in the mechanism, which when triggered by a push button pushes the latch back into the door.

Jumper wires are wires which have connector pins on both ends, that can be used to connect two points. Jumper wires are commonly used with breadboards.

6) Capacitor

A capacitor is a electrical component with two terminals. They are one of the most basic **passive** components simultaneously with resistors and inductors.Capacitors have similar to a fully charged electric battery as in figure 6.

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Figure 4

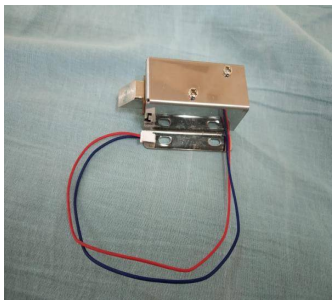

Figure 5


Figure 6



Figure 7

7) LEDs

LED is a Light-emitting diode figure 7, that emits light when an electric current is passed through it. When current travels through an LED, electrons recombine with holes, resulting in the emission of light.LEDs block the current in the reverse direction and allow the current to only flow in the forward direction.

8) UART TTL Programmer

Nowadays many microcontrollers have built-in UARTs(universally asynchronous receiver/transmitter) which can be used to receive and transmit data serially. UARTs transmit one bit at a time at a specified data rate (i.e. 9600bps, 115200bps, etc.). This method of serial communication is sometimes referred to as TTL serial (transistor-transistor logic). Serial communication at a TTL level will always remain between the limits of 0V and Vcc, which is often 5V or 3.3V.

9) Voltage Regulator

The voltage regulator is in charge of ensuring that the device's optimal voltage is maintained figure 7. Your laptop, wall charger, and coffee machine all include voltage regulators. Regardless of changes to the input voltage, a voltage regulator creates and maintains a fixed output voltage.

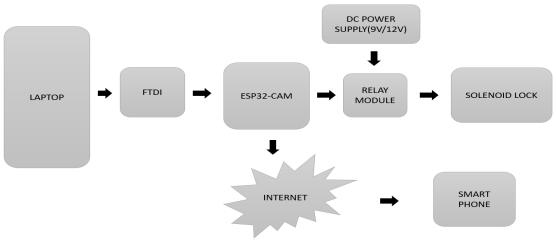


Figure 8 BLOCK DIAGRAM

The above block diagram represents the way in which the components are connected together for achieving the common goal or output for the system. Here, the FTDI board is used for serial interfacing of the ESP32-CAM module with the computer or laptop for writing/uploading the code into the ESP32-CAM module while the relay module is used to switch the Solenoid lock on or off. This is the way of designing and implementing the automatic door control system.

B. Working

Software Programming

In building the facial recognition-based door access system using the ESP 32-CAM module the program or the source code is written in c++ programming language in a free source software known as ARDUINO IDE software.

STEP 1: open the ARDUINO IDE software

STEP 2: choose file-> new file ->save

STEP3: write the source code/program code in the file(created just now)

STEP 4: go to file-> preferences -> add the URL

https://dl.espressif.com/dl/package_esp32_index.json,http://arduino.esp8266.com/stable/package_esp8266com_index.json -> Click OK

STEP 5: Go to tools-> Board settings

STEP 6: click on verify->no error and no warnings

STEP 7: Upload the code into the ESP32-CAM using the FTDI tool.

HARDWARE SETUP:

ESP32-CAM CONNECTION WITH FTDI

The FTDI board is used to flash the code into ESP32-CAM as it doesn't have a USB connector

VCC and GND pins of the FTDI board and Relay module are connected to the Vcc and GND pin of ESP32-CAM. TX and RX of the FTDI board are connected to RX and TX of ESP32 and the IN pin of the relay module is connected to IO4 of ESP32-CAM. Before uploading the code, connect the IO0 to the ground. IO0 determines whether the ESP32 is in flashing mode or not. When GPIO 0 is connected to GND, the ESP32 is in flashing mode.

The ESP32-CAM module cannot be connected directly with the laptop or computer hence FDTI board is used for serial interfacing between the laptop and the ESP32-CAM for uploading /programming the ESP32-cam module.

The circuit connections for the automatic door access system using ESP32-CAM is as follows:

After uploading the code into the ESP32 CAM module through the interfacing with FTDI board.

STEP 8: Open the serial monitor and choose 115200 baud rate.

STEP 9:Copy the IP address and paste it into the browser of any type and in any device such as a laptop or mobile phone. Then, the screen shows the options like start stream, enroll face, Face detection, Face recognition, etc in the manager bar.

STEP 10: If the intruder tries to enter through the door it shows as intruder alert.

STEP 11: Enrolling the faces into the ESP32-CAM, takes up to 5 samples to identify or to implement a facial recognition-based door control system.

STEP 12: after enrolment of the face it gives access to the authorized user and shows a "hello subject" message.

Based on the enrolled faces or authorized users the door gets locked and unlocked.

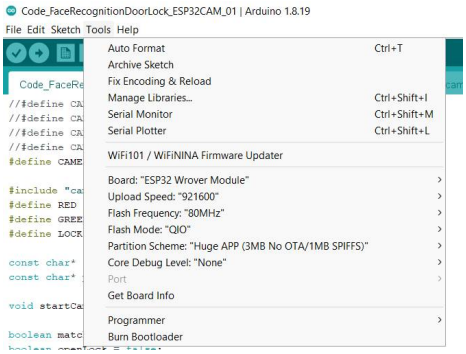


Figure 9

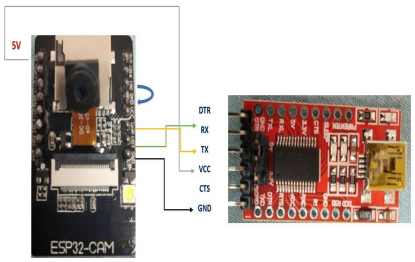


Figure 10

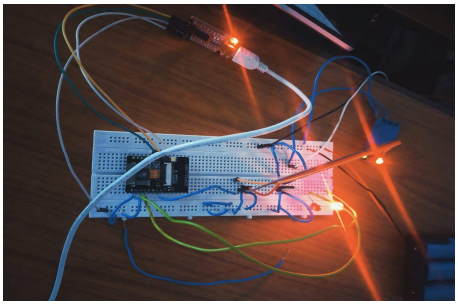


Figure 11

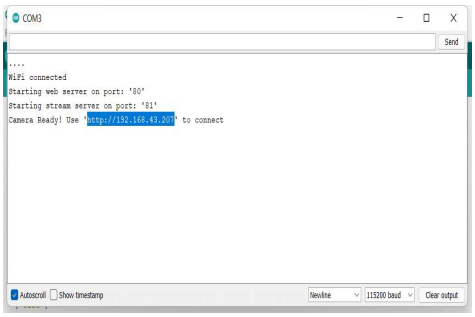


Figure 12

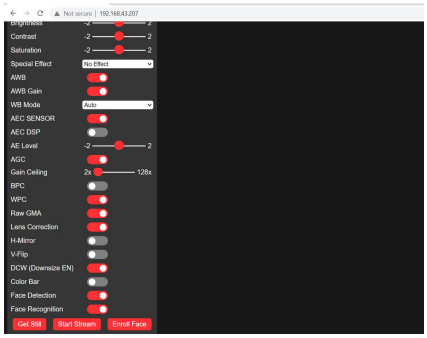


Figure 13

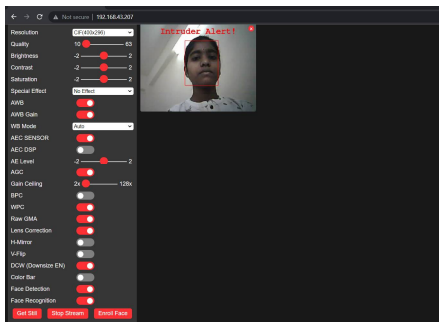


Figure 14

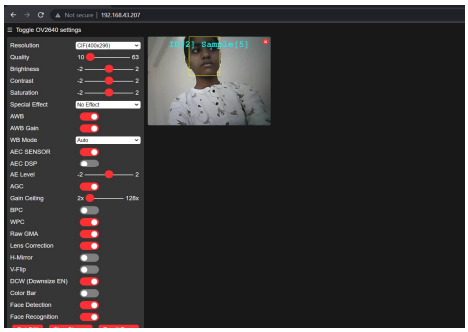


Figure 15

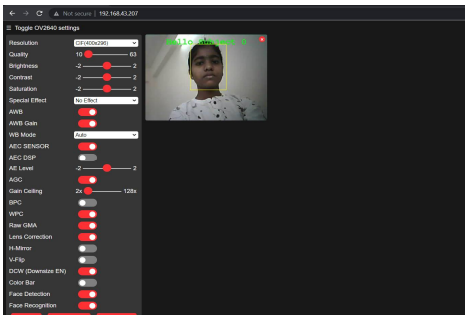


Figure 16

Step by Step excution procedure is also shown in figures from figure 9 to figure 16.

IV. CONCLUSIONS

On successful completion of this work, it is concluded that through IoT we can connect multiple input/output devices, multiple sensors and actuators in a network so that they can talk to each other. Each other, the data obtained from these can be used to log or monitor or control other things without human intervention and much more. As such, IoT is like global networks that provide communication between objects, objects, and people. IoT is an evolution of existing Internet means of managing everything that exists in the world or exists in the future. According to this work, surveillance is the conscious and rigorous process of awareness or close supervision that is maintained over an individual, group, etc., especially a patient under care or under suspicion. For the above purposes, here I have developed a system equipped with sensors, cameras, processors, relays, buzzers, LEDs and actuators as required by the application. The system works well in the local environment and meets the expectations well. Blynk cloud server is perfect for this type of application as it is the most popular IoT platform for connecting devices to the cloud, building applications to control and monitor them remotely, and manage thousands product is deployed. Blynk software helps individuals and organizations move seamlessly from connected product prototype to commercial launch. This software is very easy to use. It is compatible with Arduino, Raspberry Pi, Node-MCU and other microcontrollers. Very little coding is required and one can get a system up and running quickly.

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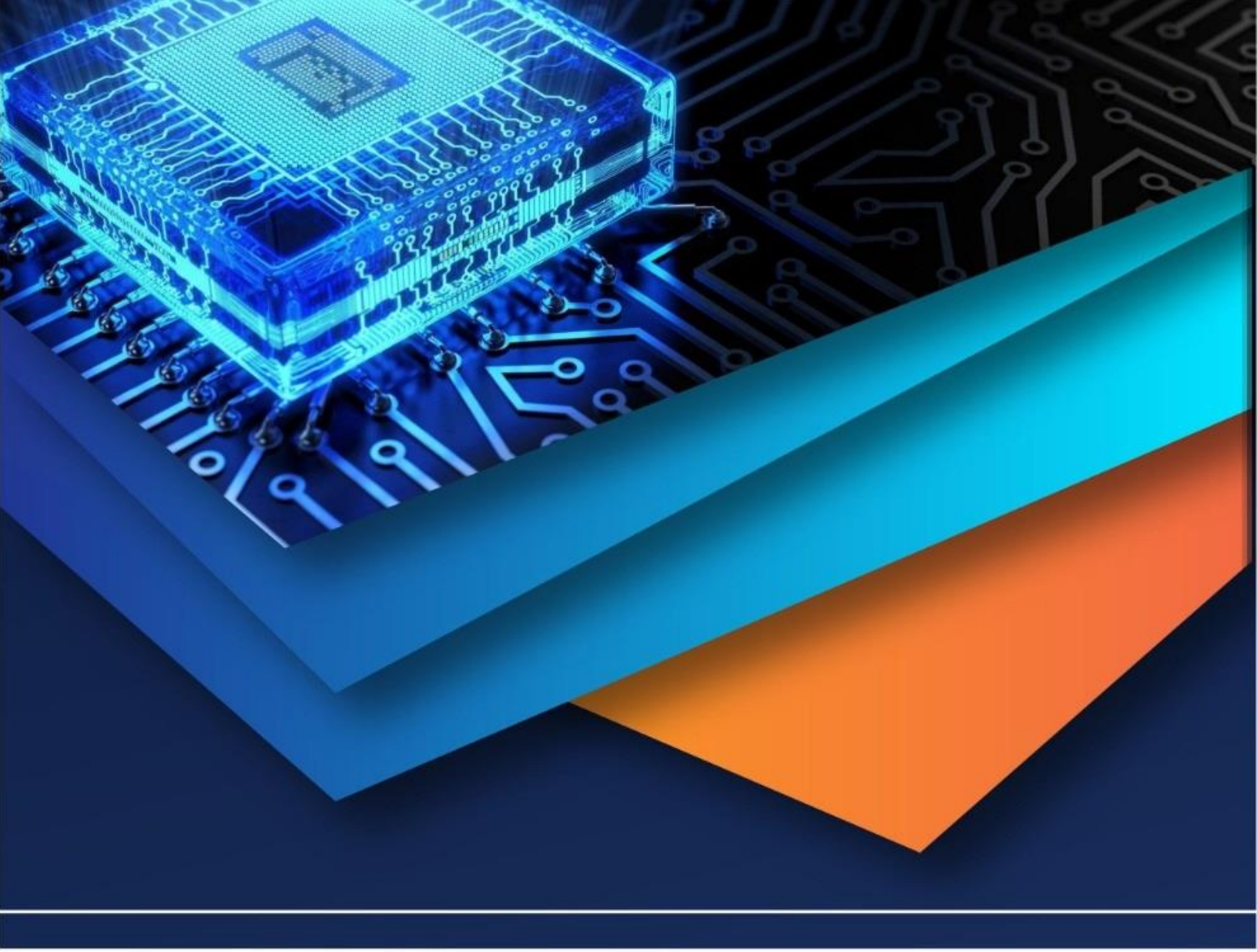
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