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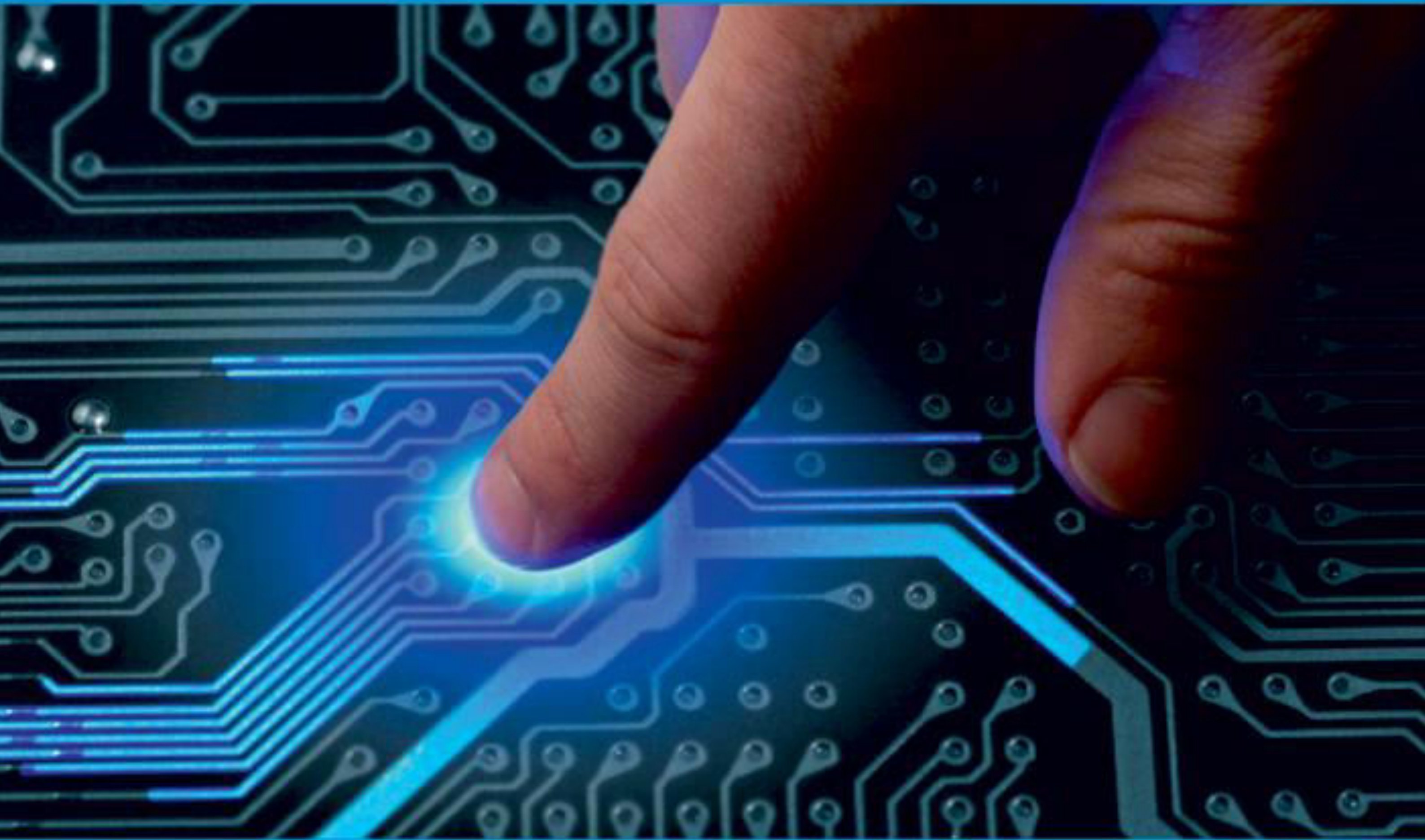

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IOT based Door Opener

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ABSTRACT: The primary goal of this project is to facilitate real-time data acquisition for security control and monitoring of access to secured areas. In industries and secure facilities, the processes of opening and closing gates occur frequently, making it crucial to oversee and manage these operations effectively. By utilizing IoT (Internet of Things) technology, this objective can be achieved more efficiently than relying solely on manual labor.

The system comprises an Arduino, Wi-Fi module, motor driver, and keypad. It monitors the status of the gate—whether it is open or closed—and communicates this information via the Adafruit IO server. This setup enhances security by providing real-time updates about the gate's condition through the ThingSpeak server. There is a growing demand for remote control of electronic doors for both automation and security purposes. This project aims to address this need by implementing IoT technology in an electronic door locking system, transforming it into a highly advanced door opener and locking mechanism. The project achieves simultaneous automation and security through web connectivity with the IoT Gecko platform.

KEYWORDS: Microcontroller, Wi-Fi Module, Adafruit IO Server, Motor Driver IC, Arduino.

I.INTRODUCTION

This IoT-based secured gate access control system is an innovative solution designed to maintain security boundaries effectively. The system monitors the opening and closing of gates and reports their status via the Adafruit IO server. It utilizes an Arduino Uno board (or ATmega 2560 microcontroller), an LCD screen, and a Wi-Fi module to transmit data to the Adafruit IO platform. The system is powered by a 12V transformer.

The LCD screen displays the temperature readings from a sensor in the boiler, while data on the Adafruit IO server is presented in graphical or bar graph formats, showing all gate activity. Continuous monitoring of gate conditions is reflected on the LCD screen, providing real-time updates. This system enhances security by keeping users informed about gate statuses through the Adafruit IO server.

The Internet of Things (IoT) extends Internet connectivity to physical devices and everyday objects. By embedding electronics, connectivity, and other hardware (like sensors), these devices can communicate and interact over the Internet, allowing for remote monitoring and control.

II. INTERNET OF THINGS

The Internet of Things (IoT) refers to a network of physical devices, vehicles, and various items embedded with electronics, software, sensors, actuators, and network connectivity. This integration allows these objects to collect and exchange data. The IoT facilitates remote sensing and control of these objects through existing network infrastructure, enabling a more seamless connection between the physical world and computer-based systems.

This results in enhanced efficiency, accuracy, and economic benefits, while also reducing the need for human intervention When IoT is enhanced with sensors and actuators, it exemplifies a broader category known as cyber-physical systems, which includes technologies like smart grids, virtual power plants, smart homes, intelligent transportation, and smart cities. Each device within the IoT is uniquely identifiable through its

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embedded computing system and can interoperate with the existing Internet infrastructure. Experts predict that by 2020, the IoT will encompass around 30 billion connected objects.

Typically, IoT is anticipated to provide advanced connectivity among devices, systems, and services, extending beyond machine-to-machine (M2M) communications to include a wide range of protocols, domains, and applications. The interconnection of these embedded devices, including smart objects, is expected to drive automation across various fields and enable advanced applications like smart grids, while also expanding into areas such as smart cities.

In the context of IoT, "things" can encompass a diverse array of devices, such as heart monitoring implants, biochip transponders for livestock, cameras providing live feeds of wildlife, vehicles equipped with sensors, DNA analysis tools for monitoring environmental factors, and devices that aid firefighters in search and rescue missions. Legal scholars describe these "things" as a complex blend of hardware, software, data, and services.

III. KEY FEATURES OF THE SYSTEM

The proposed security system features several key components designed to enhance automation and safety. One of its main attributes is the ability to automatically notify users via text message regarding the status of the gate. The system is built around an Arduino, a Wi-Fi module, a motor driver, and a keypad. It continuously monitors the opening and closing of the gate and communicates this information through the Adafruit IO server, ensuring real-time updates.

This system significantly contributes to maintaining security by providing alerts about the gate's condition through the ThingSpeak server. There is a growing need for remote control of electronic doors for both automation and security purposes. This project aims to address that need by implementing IoT technology in the electronic door locking system, transforming it into an advanced door opener and locking mechanism.

Additional features include:
1. User Control: The system allows users to easily turn the door lock ON and OFF remotely, providing greater convenience.
2. Real-Time Monitoring: Users can access real-time data about the gate status from anywhere via a mobile application or web interface.
3. Historical Data Tracking: The system can store historical data about gate usage, allowing users to review access patterns and identify potential security issues.
4. Emergency Alerts: In case of unauthorized access attempts or gate malfunctions, the system can send immediate alerts to the user, enhancing security.
5. User-Friendly Interface: The keypad allows for easy manual control, while the LCD display provides clear status updates.
6. Integration with Other Systems: The device can potentially be integrated with other smart home systems, enhancing overall home automation.

Overall, this IoT-based electronic door opener and locking system not only improves security but also offers a high level of user control and convenience.

IV. SYSTEM SETUP

A. BLOCK DIAGRAM

The circuit requires a 12V DC supply for the Arduino board, while the motor driver and microcontroller IC need 5V. This power can be provided by a 12V step-down transformer equipped with a rectifier-filter to convert AC ripples into clean DC, along with a voltage regulator for the 5V output.

You may have noticed a tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11 on the Arduino UNO). These pins function as standard digital pins but can also be utilized for Pulse-Width Modulation

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(PWM).

Just beneath and to the right of the word "UNO" on the circuit board, there is a small LED labeled 'ON' (pin 11). This LED should illuminate whenever the Arduino is connected to a power source. If the LED does not light up, it likely indicates an issue, and it's a good idea to double-check your circuit.

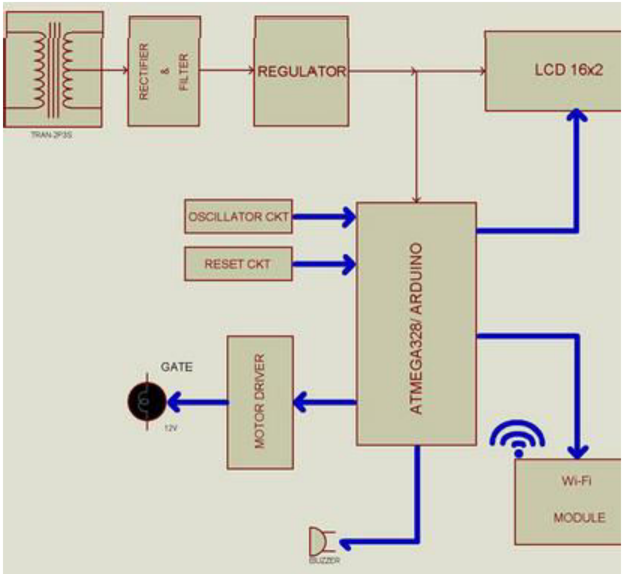

Fig 1 Block Diagram

TX stands for transmit, and RX stands for receive. These labels are commonly found in electronics to indicate the pins used for serial communication. On the Arduino UNO, TX and RX markings appear in two locations: next to digital pins 0 and 1, and alongside the TX and RX indicator LEDs (pin 12). These LEDs provide visual feedback whenever the Arduino is transmitting or receiving data, such as during the upload of a new program.

The Arduino board features an ATmega328 microcontroller with 28 pins, operating at a frequency of 16 MHz, which is used for timer configuration. Any unwanted frequencies produced are filtered out by a 27 pF capacitor. The reset pin is connected to a 10K resistor, which is activated by pressing a reset switch (a 2-lead push-to-on or micro push button switch).

The board also includes a 6-channel, 10-bit built-in ADC (Analog-to-Digital Converter), six PWM (Pulse-Width Modulation) pins, and multiple serial communication options, along with up to 20 programmable pins.

B. CIRCUIT DIAGRAM

This circuit requires both a 12V and a 5V regulated DC power supply. We use a 230V to 12V-0-12V step-down transformer. The 12V AC output from the transformer is rectified using a center-tap rectifier. The rectified output is pulsating and is smoothed into a pure DC signal with a 1000µF, 25V capacitor filter. The output from this capacitor provides a DC voltage in the range of 12V to 15V, which is then converted to 5V for other components in the circuit.

For this conversion, we use an LM7805 voltage regulator to obtain a stable 5V regulated DC supply for the microcontroller and other devices, including the LCD display and RFID reader. Additionally, we employ an LM317 regulator to provide a 3.3V supply for the Wi-Fi module.

To indicate the status of the power supplies, a red LED is used for the 5V supply and a blue LED for the 12V supply, each connected with current-limiting resistors of 2.2kΩ and 1kΩ, respectively.

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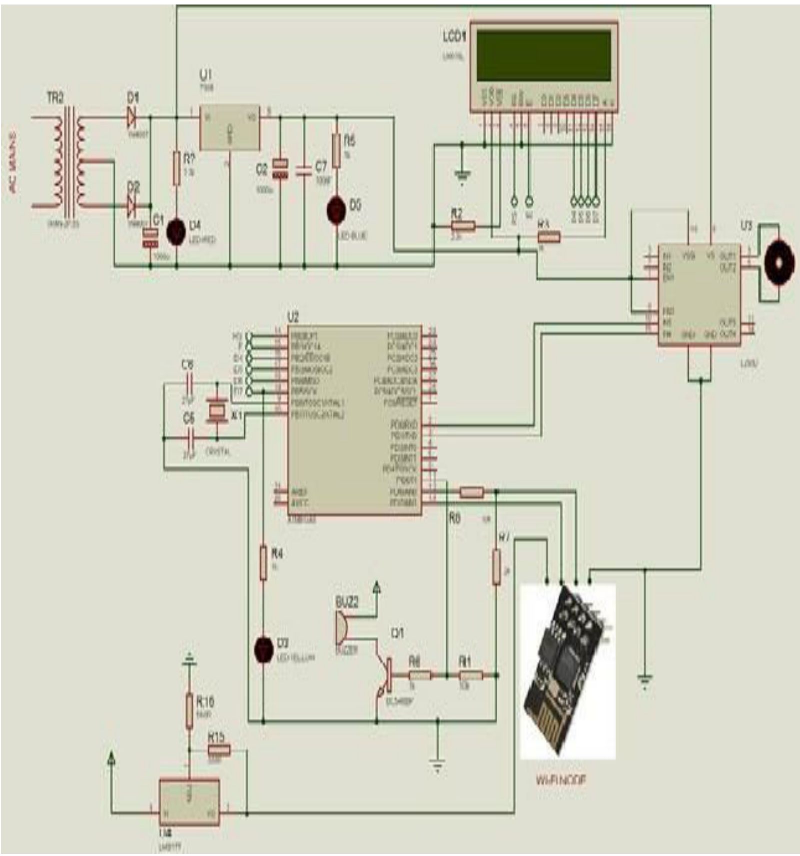

Fig 2: Circuit Diagram

The MCU (ATmega328 microcontroller) operates at a frequency of 16 MHz, which is used for timer configuration. Any unwanted frequencies produced are filtered out by a 27 pF capacitor. The reset pin is connected to a 10kΩ resistor, and a reset switch (a 2-lead push-to-on switch or micro push button) is used to trigger the reset function when needed.

Pins 14, 15, 16, 17, 18, and 19 of the ATmega328 microcontroller are connected to the LCD as RS, E, D4, D5, D6, and D7, respectively. The LCD displays text based on the programming conditions.

The motor driver (L293D) connects pins 10 and 15 with the microcontroller via pins 2 and 3, allowing control of the motor in both clockwise and counterclockwise directions.

The Wi-Fi modem (ESP8266) connects to pins 12 and 13 of the microcontroller, serving as the TX and RX pins. It requires a 3.3V supply, which is provided by an LM317 variable voltage regulator, using 330Ω and 560Ω resistors. To mitigate unwanted voltage spikes in the circuit—caused by inductive loads or sparking contacts—capacitors of 0.1 μF and 100 μF are employed. Additionally, a 1000 μF, 25V capacitor is connected at the regulator output to help minimize the loading effect.

V. MODULES WITH WORKING PRINCIPLES

The circuit requires a 12V DC supply for the Arduino board, while the motor driver, microcontroller IC, LCD display (16x2), and sensors need 5V. This power supply can be sourced from a 12V step-down transformer equipped with a rectifier-filter to convert AC ripples into clean DC, along with a 5V voltage regulator.

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POWER (USB / BARREL JACK):
Every Arduino board requires a connection to a power source. The Arduino UNO can be powered via a USB cable from your computer or a wall power supply connected through a barrel jack. In the accompanying diagram, the USB connection is labeled (1), and the barrel jack is labeled (2). The USB connection is also used to upload code to the Arduino board.

PINS (5V, 3.3V, GND, ANALOG, DIGITAL, PWM, AREF):
The pins on your Arduino serve as connection points for wires to create a circuit, often in conjunction with a breadboard or PCB. They typically have black plastic headers that allow you to plug wires directly into the board. The Arduino features several types of pins, each labeled on the board and designated for different functions.

GND (3):
GND stands for 'Ground.' There are multiple GND pins on the Arduino, and any of them can be used to ground your circuit.

5V (4) & 3.3V (5):
The 5V pin provides a power supply of 5 volts, while the 3.3V pin supplies 3.3 volts. Most simple components used with the Arduino operate effectively at either 5V or 3.3V.

ANALOG (6):
The pins labeled 'Analog In' (A0 through A5 on the UNO) are analog input pins. These pins can read signals from analog sensors (such as light sensors) and convert them into digital values that can be processed.

DIGITAL (7):
Adjacent to the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input (e.g., detecting if a button is pressed) and digital output (e.g., powering an LED).

LCD DISPLAY:
LCD stands for Liquid Crystal Display. These displays come in various sizes, including 8x1, 8x2, 10x2, 16x1, 16x2, 16x4, 20x2, 20x4, 24x2, 30x2, 32x2, and 40x2. Many companies, such as Philips, Hitachi, and Panasonic, manufacture their own specialized LCDs for their products. All LCDs perform similar functions (displaying characters, numbers, special characters, ASCII characters, etc.) and follow the same programming principles. They typically feature either 14 pins (0-13) or 16 pins (0-15).

MOTOR DRIVER:
The microcontroller has a low current output and cannot directly drive high-current devices, such as relays. Therefore, a relay driver circuit is needed. This can be implemented using transistors or relay driver ICs.

VI. RESULT

The outcome of our project allows us to control the door remotely. If the door is open, we can close it; if it is closed, we can open it from anywhere. This functionality is made possible through an Internet of Things (IoT) server, enabling us to manage the door's opening and closing from any location.

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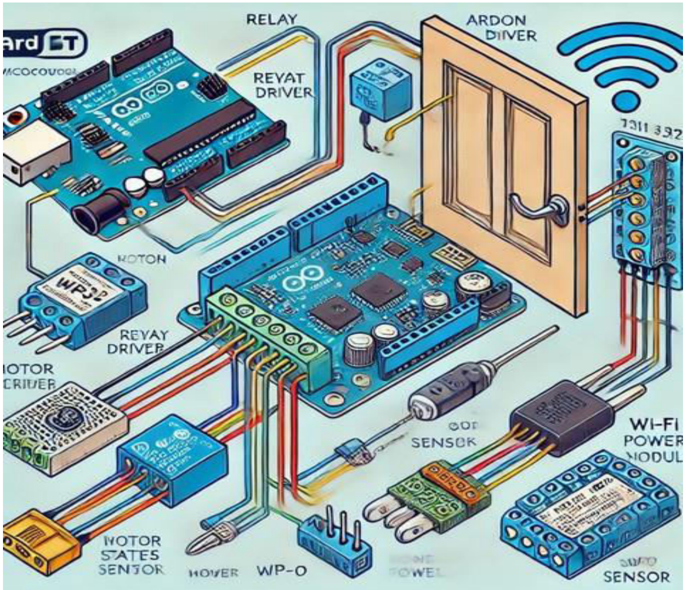

Fig 3 :The hardware setup

VII. CONCLUSION

The process involves accessing the Adafruit IO server or any other compatible server through our mobile phone or PC to control the door. This is achieved using the ATmega328 Arduino IC, a Wi-Fi module, and a motor driver IC. One of the main advantages of this project is that it allows us to know whether the door is ON or OFF, as illustrated in the figure above.

The proposed IoT prototype has been successfully tested and implemented on a door. This project can also be connected to other application domains. The two figures represent the results of our project.

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