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## GSM Based Door Lock Security Controlled System with Microcontroller

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**Abstract**—This paper expresses design of a microcontroller-based GSM-based door lock security control system. The system primarily incorporates a GSM SIM 900A module, which enables communication via GSM technology, allowing the system to send and receive data, voice calls, and text messages (SMS) over a mobile network. A microprocessor is interfaced with the GSM module to regulate the door's locking and unlocking mechanism. The system was tested using a mobile phone and a DC motor, with a specific focus on the password functionality. When the correct four-digit password (1234) is entered, it is displayed as asterisks on an LCD screen for security purposes. The system is designed to be operated remotely from the owner's authorized mobile phone, providing enhanced convenience and security and eliminating the need for traditional keys, especially in cases where a key is lost or stolen. The implementation of this system offers great potential in terms of both safety and ease of use. Future improvements include replacing SMS with voice calling for even greater security. This GSM-based door lock security control system holds significant applications in various sectors, including education, safety, and economic settings. The results show 98% accuracy in door lock security while 95% success rate in opening the door to the designated areas.

**Keywords**—GSM technology, Door lock system, Microcontroller, DC motor, Remote access.

### I. INTRODUCTION

Security is regarded as one of the most prevalent problems that people worry about [1]. These days, one must reserve a room at our house or place of business (perhaps a covert Dexter's lab). to guarantee protection against theft or loss of the user's valuable belongings and accessories, to prevent anyone from entering the room without our consent. There are two varieties of

security systems: Wireless and wired security systems. Installing wireless networks in homes or workplaces is incredibly simple and efficient [2]. The password is the foundation of wireless security systems, including the inexpensive one. Therefore, an Arduino-based security door lock system may be installed on any user's existing doors and secured with a digital password. The strong security infrastructure of a GSM network in a home security system offers optimum dependability, preventing third parties from monitoring the data provided or received. The key aspect of a smart home is security, which plays a vital role in protecting lives and property [3]. Every single person must feel safe. An integral component of an Arduino-based security door system is access control. Since crime rates are rising daily, most individuals often don't feel comfortable until they can guarantee their safety, whether it be at their homes, workplaces, or banks. Therefore, for security purposes, a better electronic system needs to be selected. Designing a low-cost system with good security is the aim of this system. Businesses, residences, banks, offices, and families are all protected by security systems. Now and before, security is one of the major concerns in places like homes, offices, institutions, laboratories, etc. to keep our data confidential so that no other unauthorized person could have access to them [4].

### II. MATERIAL AND METHODS

#### A. Microcontroller

There are various types of microcontrollers available on the market. Among these, the three most popular microcontrollers are the Arduino MEGA, PIC and Raspberry PI. The capabilities of various

microcontrollers vary and are entirely dependent on the end-user application [5]. When choosing a microcontroller, it's essential to consider factors such as processing power, input/output options, and compatibility with different programming environments. These elements can significantly influence the success of a project, whether it's for hobbyist applications or professional development.

Arduino is an open-source platform that includes programmable and physical circuitry. To write and upload computer code to the actual board, it has an IDE (Integrated Development Environment) that runs on a computer [6].

The most frequently utilized Arduino are the Arduino Uno 328P and Arduino Mega 2560 models. Arduino Uno 328P's target is a wide variety of use cases, from simple educational projects to more advanced prototypes, interactive systems, and cost-effectiveness, so it is used in this paper. Table I lists the key differences between Arduino Uno 328P and Arduino Mega 2560.

Table I. Comparison of Arduino Uno 328P & Mega 2560.

| Feature              | Arduino Uno     | Arduino Mega     |
|----------------------|-----------------|------------------|
| Microcontroller      | ATmega328P      | ATmega2560       |
| Digital I/O Pins     | 14              | 54               |
| Analog Input Pins    | 6               | 16               |
| Flash Memory         | 32 KB           | 256 KB           |
| SRAM                 | 2 KB            | 8 KB             |
| EEPROM               | 1 KB            | 4 KB             |
| Clock Speed          | 16 MHz          | 16 MHz           |
| USB Connection       | ATmega16U2      | ATmega16U2       |
| Power Supply         | 7-12 V          | 7-12 V           |
| Serial Communication | 1 UART          | 4 UARTs          |
| Size                 | 68.6mm × 53.4mm | 101.5mm × 53.3mm |

### B. GSM Module

The global system for mobile communication is known as GSM [7]. One well-known GSM module that is frequently utilized in embedded systems for cellular connection is the SIM900A. It can send and receive SMS messages, make phone conversations, and send data via a cellular network because it supports GSM/GPRS standards (2G network). The GSM 850/900/1800/1900 MHz frequency bands are supported, making it compatible with 2G networks in many countries. GPRS (General Packet Radio Service) provides packet-based data communication, suitable for low-speed applications such as SMS, voice calls, and basic IoT data transfer. Figure 1 displays the diagram of the GSM module.

The SIM900A can send and receive SMS messages, making it useful in applications where text messaging is required (e.g., remote monitoring, alarms, or control systems). The purpose of adding a

GSM system is to employ its security features to boost system dependability. It is a digital mobile phone system that is used in almost every country and territory [8].



Fig. 1. GSM module diagram [9].

### C. Block Diagram of the System

This door lock security system is based on Arduino. It was the user's idea to design a door lock system that required a password that could be entered with a keypad. The user starts with the Arduino board, which is the brain of the paper. The Arduino board has an LCD, and a DC motor connected to it. The DC motor pushes (locks) or pulls (unlocks) the door latch. A  $16 \times 2$  LCD, or one with 16 columns and 2 rows, is required for the Arduino to display the message. Customized door lockers are made with a 12 V DC motor. Attach a 12 V power source and an Arduino digital pin to the DC motor. An automatic door must be able to open or close the door by itself. To accomplish this, a fence needs to be linked to a control system that can direct the fence on when to open and retract [10]. The block diagram of the security door lock system using Arduino Uno 328P is displayed in Fig. 2.

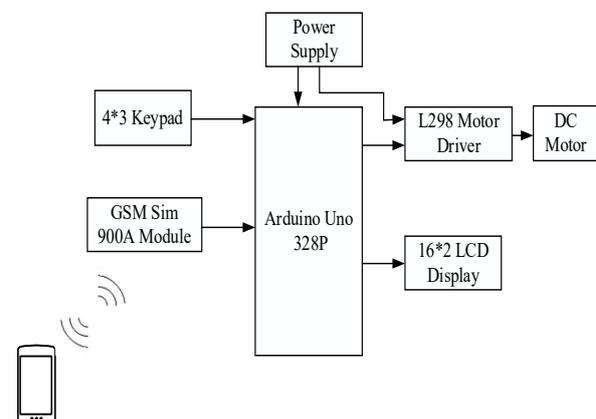


Fig. 2. Block diagram of the system.

### D. Flow Chart of the System

The flowchart of the system is as shown in Fig. 3. When the power switch is pressed, the ports of the controller are first initialized. Someone presses the 4digit password on keypad. The LCD displays "\*\*\*\*" when the keypad is pressed. Arduino determines whether the password is correct. Buzzer alerts whenever the password is changed. And then GSM module sends SMS as "Security Alert" to authorized phone. The GSM module receives an SMS from the

authorized phone owner that reads "Door Lock." The door is therefore open. The door is closed after a 15-second wait. If the password isn't changed, GSM module sends SMS as "Unlock Alert" to authorized phone. Authorized phone owner sends SMS as "Door Unlock" to the GSM module. Finally, the door is never opened.

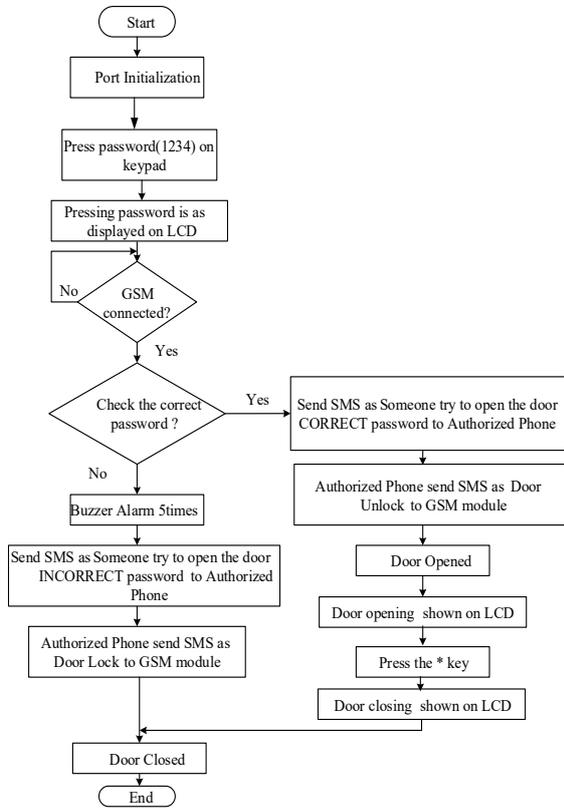


Fig 3. Flow chart of the system.

E. Keypad

A password must be entered into the keypad module to access the door lock, as illustrated in Fig. 4. Once the correct password is entered, the lock will disengage, allowing entry into the secured area. It is crucial to ensure that passwords are kept confidential to maintain security.



Fig. 4. Keypad module.

This component receives a voltage from the Arduino Uno microcontroller [11]. This component's 4\*3 matrix provides input data to the project. An electronic door lock requires automation features, like a keypad, to unlock the door instead of a key [12]. The

component's seven terminals are controlled by the module's twelve buttons. The Arduino and keypad door security system offers a few benefits and purposes in its implementation, such as enhancing security [13], being simple to use because no key is required, and allowing the password to be changed to suit individual needs.

III. TEST AND RESULTS

Tests and results are conducted following the design and construction of the entire circuit. Figure 5 shows the whole hardware diagram for the GSM-based door lock security-controlled system with a microcontroller.



Fig. 5. Complete hardware of GSM based door lock security-controlled system with microcontroller.

When the user presses the four-digit password, the pressed passwords are displayed on the LCD as "\*" And an SMS as "Someone tried to open the door with the CORRECT password" is sent to the authorized phone. Figure 6 shows entering a password and waiting for SMS shown in LCD in Fig. 7.



Fig. 6. Test and results of entering password.



Fig. 7. Test and results of waiting SMS condition.

SMS as "Someone try to open the door with CORRECT password" received from the authorized phone with the help of GSM sim900A module in the system. If the door wants to open, authorized phone

sent SMS to the GSM sim 900A module as “OPEN”. Figure 8 shows incoming SMS alert on authorized phone.

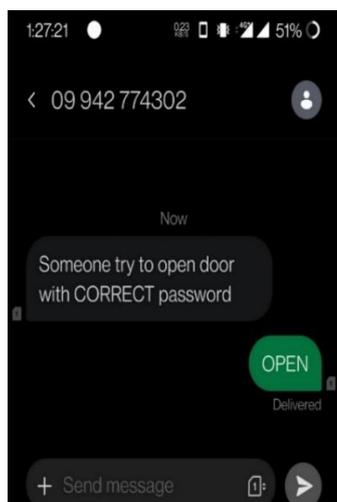


Fig. 8. Incoming SMS alert on authorized phone.

After receiving the SMS, the authorized phone sent the SMS as “OPEN.” So, the door is opening at the security door lock at home. Figure 9 shows results of the door opening condition of the security door lock-controlled system.



Fig. 9. Results of door opening condition of security door lock-controlled system.

If the user wants to close the opening shutter, press the \* key on keypad. Figure 10 shows the result of the door closing of security door lock-controlled system.



Fig. 10. Result of door closing of security door lock-controlled system.

#### IV. CONCLUSION

Arduino Uno and GSM module serve as the foundation for the door lock security control system described in this paper. The central component of the entire automation system is the Arduino Uno. The advantages of using Arduino are that it is user-friendly, affordable, open source, and low power consumption. This system takes only a few minutes to run the entire process. Therefore, the door lock security control system saves operation time, convenience, no need to change the door lock when a key is stolen or misplaced, and safety lives for human society. The door lock security control system can be advanced by calling a phone instead of sending messages to unlock the door. Face recognition and a fingerprint scanner might be incorporated into this system as a future development. Furthermore, as the receiver operates on direct current (DC), which is the power source supplied by solar power, the power supply can also be supplied by a solar power system. Sensor systems can be supplied via energy harvesting techniques, which eliminate the need for maintenance and batteries. The estimate cost is 80 US dollars. Therefore, a door lock security control system has become an indispensable part of most developing countries in the world. According to this system, the door lock security is never opened without receiving the SMS from an authorized phone. As a result, SMS verification provides greater security than conventional security techniques.

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#### AUTHOR CONTRIBUTIONS

Myo Su Su Theint: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Validation, Visualization, Writing–Original Draft Preparation;

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Atar Mon: Project Administration, Resources, Supervision, Writing–Original Draft Preparation;

Lwin Ma Ma Maung: Methodology, Validation, Writing–Original Draft Preparation;

Soe Htet Htet Shein: Project Administration, Writing–Review & Editing.

## CONFLICT OF INTERESTS

No conflict of interests was disclosed.

## ETHICS STATEMENTS

Our publication ethics follow The Committee of Publication Ethics (COPE) guideline.  
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