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RFID Based Smart Door Lock Security System

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ABSTRACT: For every household, security is one of the main concerns. In this age of constantly increasing count of crime, various attempts have been made to secure the entrance and control the accessibility of the household. Traditional mechanisms such as lock and key, Deadbolts, Door chain and Mortise locks; they all have their limitations. Some of them are heavy in weight but fragile. Some others are more of an inconvenience than being a thing of actual benefits. This paper proposes a RFID-based secure door lock system and tries to draw upon its various advantages over traditional door security systems. Radio frequency identification (RFID) is a wireless technology that allows the development of scalable control systems with flexibility. The goal of this work is to develop a system in which ease of use comes together with better security but without any extra cost.

Keywords: Arduino Uno, RFID, GSM Module, Door lock system, Password-based, Security.

I. INTRODUCTION

The need for safety has been one of the primary factors behind people's attempts to build homes of their own. Every house comes with one or more main entrances. The main doors are one of the vital points of security. Having mechanisms or security measures in place to control the access to the house has been proved to provide the aspired safety and security [1].

As every house comes with doors, doors come with locks. In an attempt to ensure security, various kinds of door locks such as mechanical or electronic, have been implemented. Even after using those kinds of locks, the crimes do happen due to the fact that such locks have well-known weak points of their own. Some locks can be picked and others can be disabled in some way. So there is a need to invent other kinds of locks which cannot be easily broken and even if they can be broken, the task won't be so easy as it is for other kinds of locks [2].

Various control systems have been designed over the years. The main aim in designing those systems includes –

Ease of Control: The system should be easy to control for the household owners.

Durability: The system should be durable enough.

Security: The system itself should be secure to provide security.

The purpose of this paper is to present a secure smart door lock which is intended to offer high security, easy access, and control. Therefore, the proposed system makes use of RFID tags and GSM modules to implement a secure but easy-to-use system. It has the possibility to replace the traditional door lock system. By using the proposed method, the security of the household can be enhanced at a very low cost.

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Figure 1: Block Diagram of the System

The block diagram representation of the system is shown in Figure 1 above. Here, the system has an AC-to-DC converter in order to provide constant power supply for the circuit.

Arduino Uno is a microcontroller board based on the ATmega328P. Users can simply power it with an AC -to-DC adapter or battery to get started.

Next the keypad, 4X4, is used only for putting numbers for the password. The complete circuit diagram for RFID and Keypad based Door lock and Alert System using Arduino is shown at Figure 2.



Figure 2: Connection of the system

In this paper, RFID & Keypad Module has been used for verifying that only the authorized user can open the door. The GSM module adds additional security and control to the whole project. The 16x2 LCD module is connected to the board using the pin connection.

II. OPERARION OF THE SYSTEM

Like all other RFID systems, the one presented in this paper contains three basic components, the RFID tag, the RFID reader and the backend. The code had to be modified to include the RFID tag's UUID. The passive RFID tag powers up passively and exchanges commands/responses. If the RFID tag is read successfully, the user has to proceed with entering the keycode on the matrix keypad.

Matrix keypads or thin membrane keypads are built on a film membrane and are rectangular in shape. We have used a library available for Arduino for keypad. Though, it is important to note that, one can program the keypad to enable the user to input symbols as a code, which will provide even better than simple alphanumeric code, specifically if the code is noticeably short in length.

SIM900 is a quad band GPS solution and it can be even embedded in client applications. It gives voice notice, sms and text. The user can send a message to the board in order to control the behavior of the door lock. If the user sends "close" to the board, the lock will suspend its regular application and it will wait for the confirmation message with "open" as its content.

During this period, the scanning for RFID tags will halt too and only messages to the board will be looked for. On scanning the wrong tag or on entering the wrong password, it will send the owner an alert. On scanning the right tag and on entering the right password, it will send the household owner a confirmation message that the door has opened. The owner can halt the system by sending a 'close' message to Arduino and it will only go back to normal mode when the 'open' message is sent to Arduino. During halt time, it won't scan for any tags and it will only look for messages. It is possible to open the door by sending a message to Arduino. Practical circuit diagram is represented in Figure 3 below.



Figure 3: Practical Circuit

III. RESULTS AND DISCUSSIONS

Initially the door is locked. The user is reminded about scanning the tag in order to open the door. The initial condition of the system is described in the following Figure 4.



Figure 4: Initial condition

After scanning the tag, there can be two possible scenarios which are depicted in Figure 5 and Figure 6 below. In one of them where the tag matches, the user is confirmed about it via a message from the system on the LCD display.



Figure 5: Confirmation when tag matches

Alternatively, if the tag doesn't match, the user will be informed about it via an sms to his phone number and the system will deny access to the person who has tried to open the door.



Figure 6: Message informing the tag being the wrong one

For the first scenario, i.e., if the tag matches, the user will be then asked to enter the password which is shown in Figure 7. If the password matches, then the system will confirm the user about it and let the user proceed on further to open the door (Figure 8).



Figure 7: Prompt for password

Figure 8: Confirmation on entering the correct password

During the whole operation, the user will be informed via sms if the door is unlocked/someone attempts to open the door using the wrong tag or password. The whole alerting system by sms is depicted in Figure 9.



Figure 9: Information received by user

IV. CONCLUSION

In this paper, an attempt has been taken to make the secure door lock system which provides some effective security measures and also easily accessible for the users. The components that were used can be changed with similar types of components without bringing any major change to the program itself. For example, use an Arduino Nano board to achieve the same thing in a much smaller package size will be tremendously useful in practical usage.

Security

When the lock and key system is concerned, security is very poor compared to other improved security systems as any key can be duplicated at any time. RFID cards provide good authentication compared to the traditional system.

The keypad works as an extra layer of security. Even if the RFID tag gets misplaced or falls into some unauthorized personnel's hand, the keycode will make sure that the door remains locked.

Cost

Lock and key system is, without any doubt, the cheapest among security systems and is available to all users. RFID readers and tags are a little bit more costly yet also provide considerable security than lock and key systems. Actually, the cost of the RFID is not that much costly if the price of a good quality lock is taken into consideration. But the project, as it consists of various components, is reasonably costlier than traditional alternatives.

Several features can be added in this project to make it more users friendly. For example, fingerprint input feature can be added. It is also possible to create an android app client for the project, which will inform the user if someone else except the actual user breaches the door. Finally, taking the limitations discussed above into consideration, the project might get benefited by some newer digital technologies like iris scanning, retinal scanning, voiceprint identification to authenticate users. That way, this Arduino based door locking system will be able to provide more advanced and faster accessible security with ease of use for home doors and gates.

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