Design and Analysis of a Smart Door-lock System Supporting Automatic Time Schedule

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Abstract

Doors are to be the most basics of our lives from opening, closing and even keeping our property. Hence, doors have been innovated to blend in and make our daily lives more convenient. However, we find it difficult to open and close the doors manually of offices or tour zones, where they open and close at a precise time everyday. To solve this, we added a dimension of time to previous Door Locks. By this, every door with this specific door lock will open and close at a certain time we want them to open or close. Also, through the application you can control the time or use it to open and close the doors remotely

Keywords: door lock, application, smart phone, Automatic Time Schedule, Smart Door-lock System

1. Introduction

Doors are the most basics of our lives from opening, closing and even keeping our property. With the interests of security increasing, various products have been developed. Door locks have become the most common product, and they have many good points. However, compare to normal locks, it is expensive and can only open doors by using the key-pad. We find difficulties to open and close doors manually of offices or tour zones, where they open and close at a precise time every day.

The door lock in this study is not just a simple format like opening and closing doors with a key. By applying the concept of time in the common door lock in conjunction with a smart phone, when setting time comes, the lock is implemented for the system through ATmega128.

## 2. Implementation and Evaluation of Smart Door Lock by Utilizing Time

In this paper, the smart door lock system utilizing time is called the TTL door lock. ATmega128, used as MCU of the TTL door lock, is a 8-bit megaAVR microcontroller family which includes a variety of peripherals well suited for programming device control [1]. Ultrasonic sensors to secure effectiveness, motors to lock doors, and control lines to the LCD that will display the situation, bluetooth communication helps the user to control the application of the smart phone.

The basic configuration of the door lock is servo motor and ATMEGA128. Motors to control the portion of the door is locked and held by using the servo motor. In addition, using the door lock is more convenient, by using smart phone application to the UART communication via bluetooth between the smartphone and ATmega128 configured to easily control the servo motor and an ultrasonic sensor was used to enhance security. By mounting LCD to see each of the process, each of the process was designed to be output to the situation with a letter.
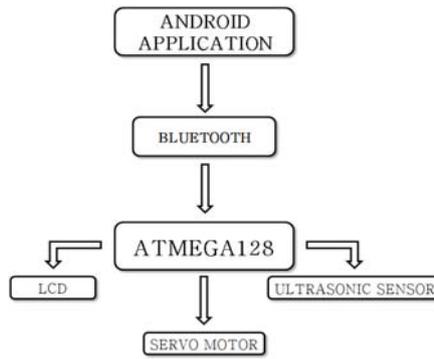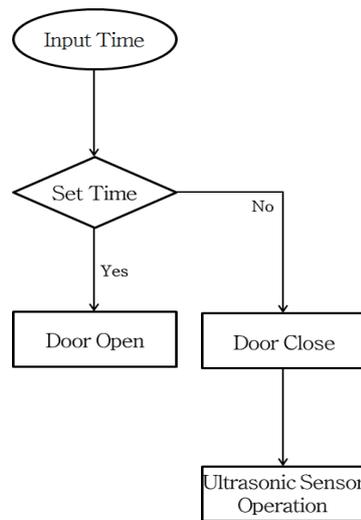
Figure 1. TTL door lock block diagram

Figure 2. TTL door lock algorithm

As shown in Figure 1, Android application and ATmega12 communicate USART through bluetooth ATmega128 mainly controls the servo motor and the LCD, and an ultrasonic sensor.

ATmega128 is designed with servo motor, ultrasonic sensor, LCD display, bluetooth communicate portion to the software from the AVR Studio.

Servo motor is a DC motor for rotating the gearbox and is connected to the remote to change the PWM pulse width to a voltage in a particular direction [2]. Briefly, by specifying a value for the motor that can be rotated to any angle. Since Regular DC motors are difficult to utilize the concept of angle control, the rotation angle value of the servo motor is designed for easy open and lock of the door.

Ultrasonic sensor detects an object appearing in the range you have set. By ultrasonic sensor, it will not operate when door is open. Sensor is operating when the door is locked to detect inside object and it is designed to strengthen the internal security.

When the door open and close, LCD prints out 'open' or 'close' by character. When door is locked and ultrasonic sensor detects objects, 'CLOSE' in the text of that statement is designed to output as 'WARNING'.

Just like the algorithm shown in Figure 2, android application configures the software using the Eclipse which is based on Javascript Using Bluetooth USART (Universal Synchronous and Asynchronous Serial Receiver and Transmitter) communication and is designed for easy operation with a smart phone application.

UART communication refers to a communication scheme which can exchange data frames between two different data terminal [3].
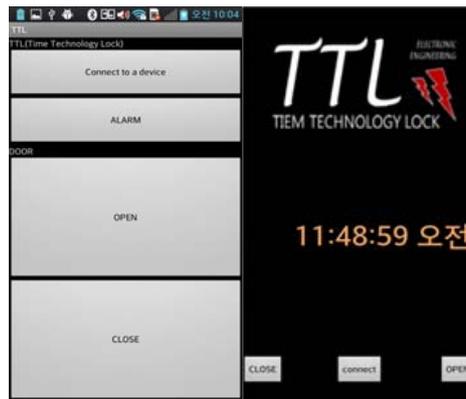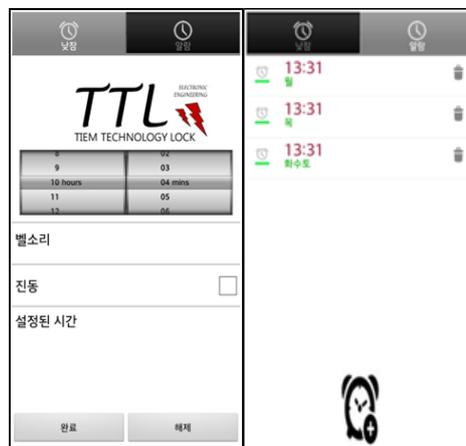
Figure 3. TTL door lock application

Figure 4. TTL door lock application time setting

As shown in Figure 3, respectively selecting the 'OPEN' and 'CLOSE' in the application by sending a zero. And one value in ATmega128, operates the 'CLOSE' receives the value of 0, receives a value of 1 'OPEN' is a servo motor the operation was designed to be a character for it to LCD output.

As shown in Figure 4, by designing the application in structure to set the alarm clock easy to use configuration menu allows anyone set the desired time. It is designed to open the door by desired setting time, and time setting is enabled by daily and weekly basis also to be used more usefully.

Table 1. Comparison of door-lock systems

	security	*timer scheduling*	*remote operation*
digital door lock	doorlock only	no	no
TTL door lock	doorlock + ultrasonic sensor	yes	bluetooth

The comparison of the door-lock systems in Table 1 shows that the functions and remote operation of the TTL door lock is enhanced than the existing one.

3. Conclusion

In this paper, we propose a new smart door lock applying the time concept to the form of the conventional door lock model. The proposed TTL doorlock has become a daily necessity in the modern world. Now you can remotely lock and unlock the door from your smartphone, and also manage the time setting to lock and unlock your door.

The TTL door lock will eliminate any inconvenience of carrying around bundle of keys and it will also lock and unlock doors at your specified time for places such as school classrooms, companies, tourist spots. In addition, if the security aspects can be further complemented, the smart door lock can be applied and utilized in various spaces and critical facilities, such as the army and the guardhouse.

The TTL doorlock is not only applied to general doors, but also to lockers and storages.

If the Wi-Fi connection, instead of a bluetooth communication, is used in the future, the remote control of door locks will be possible and bring about various effects. Ultrasonic sensors and cameras will also be used to strengthen security, or by using more advanced sensors, including human body sensors can also take a big effect. When emergency occurs, the SMS service or email alerts system applied, security in terms of the current TTL door lock have greater effects.

Neither MCU or ATmega128, but use same MCU as Raspberry Pi, it would be more simple, convenient and effective. Smart door locks can be expected to be able to take advantages of a wider range of aspects.

7. References

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