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Design and Implementation of Door Security System

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***Abstract*—This research paper focus on the door security system which is relatively cheaper but more up-dated is explored. This system design is based on locally available materials with low cost. DC motors are used for specified motions. Code input is used 8-digit keypad, which is used to control the motor on or off. The motor is driven with special purpose motor driver IC. This security system is controlled by 8051 microcontroller. Each of the necessary hardware and software components has been designed and analyzed.**

***Keywords*— Security system, Microcontroller, DC motors, Liquid Crystal Display, Password**

I. INTRODUCTION

The automated security devices protect office or home resources from hazards such as crime and accidents. These security systems are often developed and implemented like a risk assessment, which determines what internal and external factors pose the greatest threat and proposes means to reduce this threat. Technologies to diminish risk include alarms, such as for fire and smoke, provide on-site or off-site warnings of potential risk. Access control measures such as password entry systems and keycards help prevent unauthorized access to facilities.

This paper discusses the hardwired security system with a digital key entry system. The password is keyed in by means of keypad entry system. Keypads are the simplest form of electronic access control. 8051 microcontroller is in charge of this system. When the door closes, the system will take one minute time delay and appropriate action should be taken. A liquid crystal display (LCD) module is used to monitor the system's status.

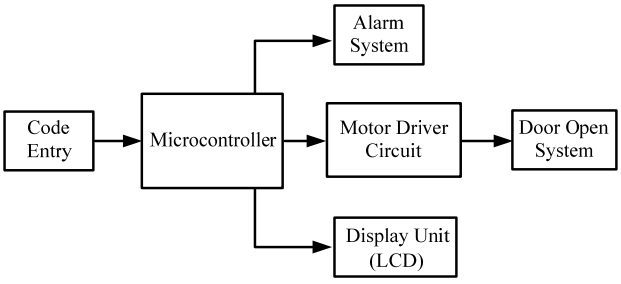

Fig.1 Block diagram of door security system

II. HARDWARE IMPLEMENTATION

Overall Circuit Operation

This security system is divided by keypad input system, control processing, motor driving and display unit. There are eleven keys in keypad input system, key 1 to 8 are used to enter password. SET, OK and ESC keys are used to reset the new password. Initially, the password is stored in serial EEPROM. Port 3, port 2.2, 2.3 and 2.4 are used as input pin and connect with keypad. Port 1.2 and 1.3 are connected with RS and E pin to initialise the LCD and Port 1.4 to 1.7 are used to send data. Motor is driven in forward and reverse by port 2.0 and 2.1.

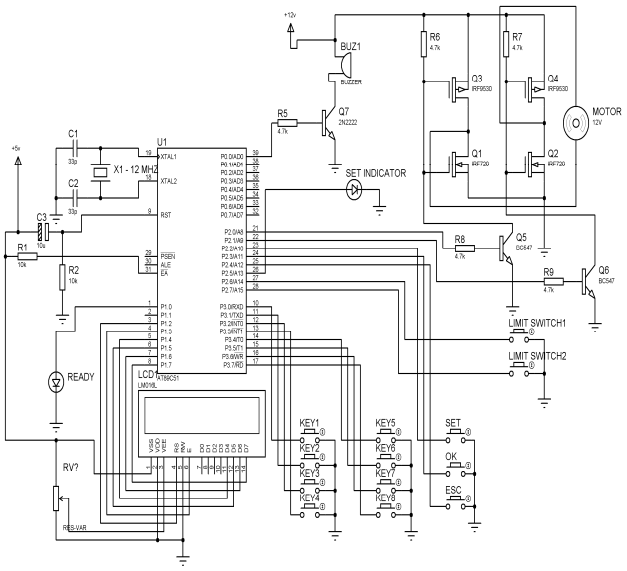

Fig. 2 Overall circuit diagram of security system

The materials used in this security system are shown in Table 1. In this circuit, the AT89S51 microcontroller was selected because of the easy access to its development tools and having enough features needed for this system. The entrance can be controlled by DC motor. Power supply in motor is restricted to 12V because of low cost and low power. In addition, motor is driven special purpose motor driver IC.

TABLE I
PART LIST

Materials	References	Quantity	Value
3 Capacitors	C1,C2	2	33p
	C3	1	10u
1 Integrated Circuit	U1	1	AT89S51
7 Transistors	Q1,Q2	2	IRF720
	Q3,Q4	2	IRF9530
	Q5,Q6	2	BC547
	Q7	1	2N2222
20 Miscellaneous	BUZ1	1	BUZZER
	LCD1	1	HD44780U
	Motor	1	12V
	RV?	1	RES-VAR
	X1-12MHz	1	Crystal
	Ready, Set Indicator	2	Red-LED
	ESC, OK, SET, Key1-Key8, Limit Switch1, Limit Switch2	13	

III. SOFTWARE IMPLEMENTATION

The sequential operation of software for this system is shown in Fig. 3. Firstly, initialized process is started. The 8051 controller and LCD must be initialized. The message will appear on the LCD. And then it will check system ready or not. If the set key is pressed, the system will go set new password subroutine. If the number keys are pressed, the system will go keypad scanning subroutine and then it will check the pressed key is password or not. If the valid password is pressed, the motor will start rotating and open the door to give the permission to enter the building. Limit switch 1 and 2 are used instead of door sensor. When the limit switch 1 is pressed, the motor will stop and wait 30s for entering time of the person. And then the motor will rotate reverse direction. When the limit switch 2 is pressed, it is assumed the door closes and the motor will stop. Otherwise, if the password was not valid, another message will be displayed showing that the password was wrong, and the user will be given three times trial and after that a message will show that retry after 10s. And then the program will restart.

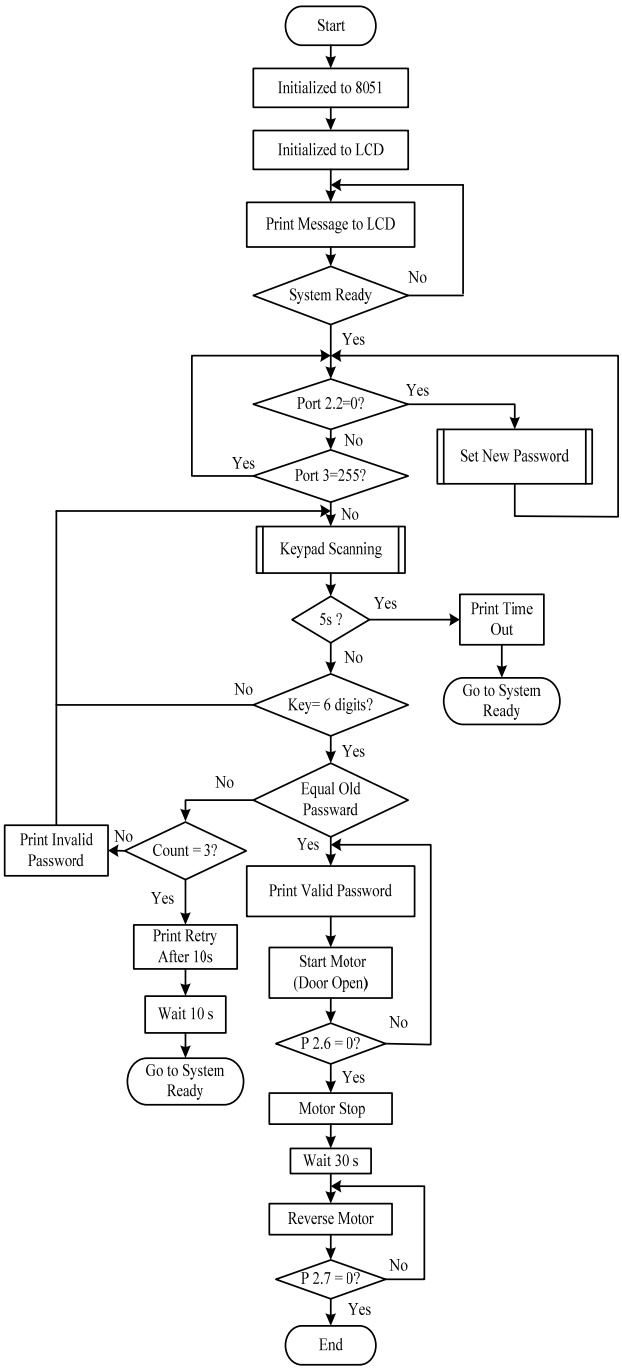

Fig. 3 Software flowchart of main program

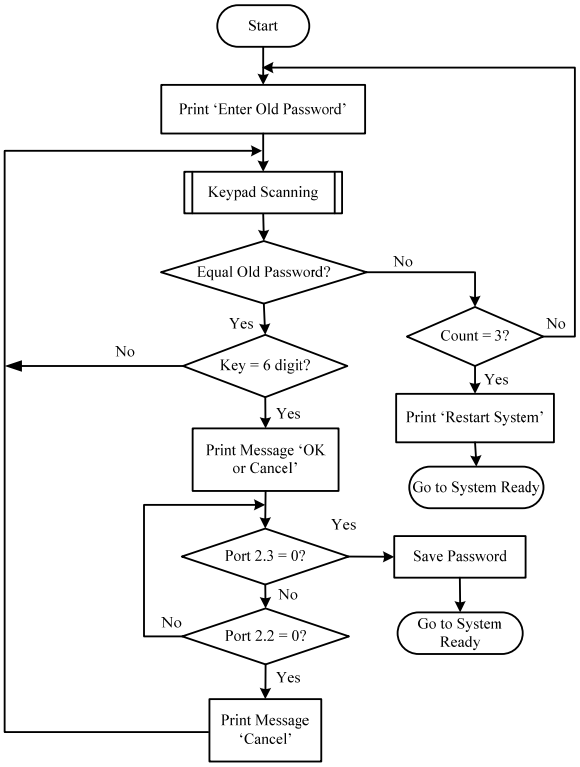

Fig. 4 Subroutine for set new password

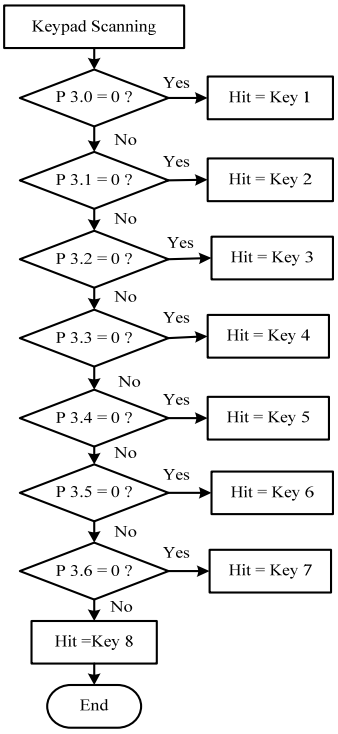

Fig. 5 Keypad scanning flowchart

The subroutine of set new password is shown in Fig. 4. Firstly, old password message will appear and the system will go keypad scanning subroutine. It will check whether the pressed key is old password or not. It allows three times to press. If there are over three times, it will go back to system ready. When the user presses the new password, "OK or Cancel" message will appear. If the OK key is pressed, the system will save the new password and will go to the system ready. If the ESC key is pressed, "Cancel" message will appear and it will call the keypad scanning subroutine. And then the system will continue to get new password.

The subroutine of keypad scanning is shown in Fig. 5. The system checks step by step to get the correct pressed key.

IV. Test and Results

For security system, the testing circuit is simulated with Proteus 7.0 Professional software. Prior to circuit construction, user must first identify the necessary components required in the circuit. After completing the circuit assembly and configuration, now its time to verify whether the source code compiled is virtually accurate or not. The testing of keypad operation with Proteus software is shown Fig. 6. And then Fig. 7 illustrates the photo of constructed project keypad.

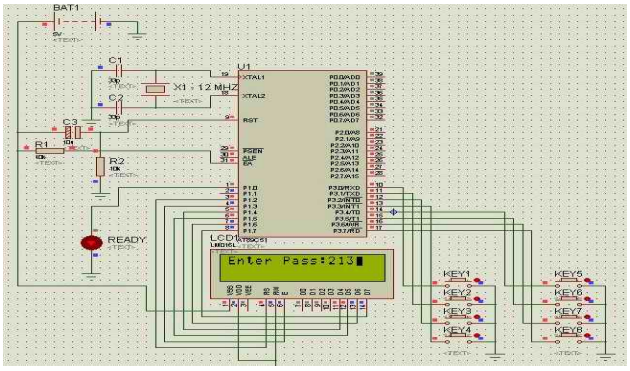

Fig. 6 Testing of keypad operation with Proteus software

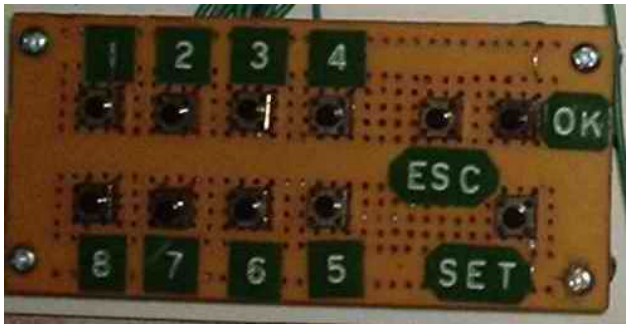

Fig. 7 Photo of constructed keypad

The testing of new password setting subroutine program is shown in Fig. 8.

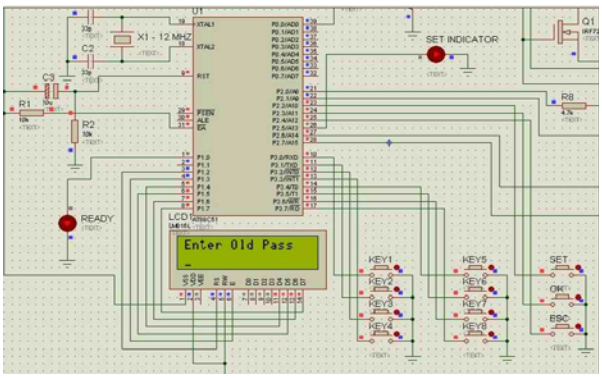

Fig. 8 Testing of set new password with Proteus software

After testing the hardware and firmware with Proteus software, physical prototype is constructed with printed circuit board. The photos of complete circuit prototype are shown in the following figures.

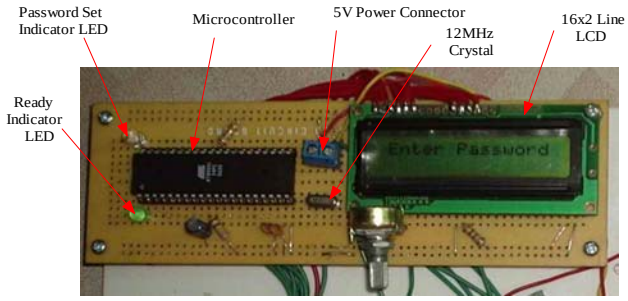

Fig. 9 Photo of constructed controller and LCD

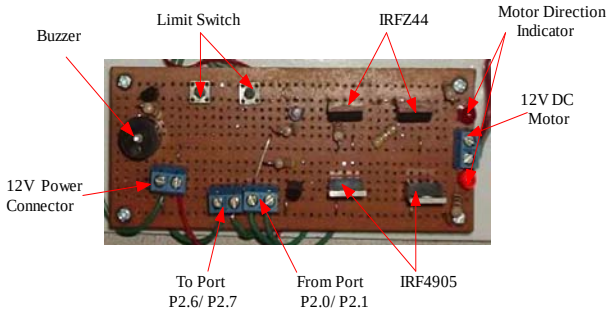

Fig. 10 Photo of constructed motor control circuit

Fig. 11 Photo of constructed power supply

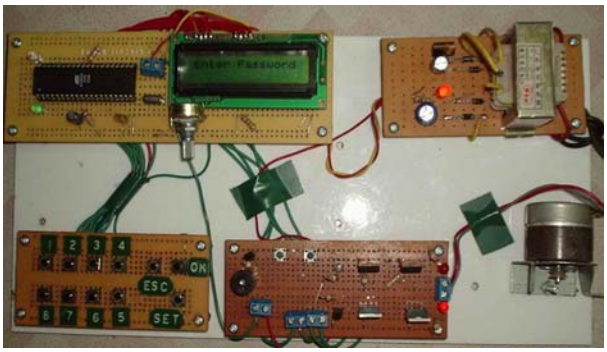

Fig. 12 Photo of constructed circuit for door security system

V. Discussion and Conclusion

This research has not covered the protection scheme and further research is necessary for development. The permission time needs to be monitored and levels of user can be permitted to open the door. This system should be used in many areas such as electronic door, vertical or horizontal lift gate, etc. This security system can be used in mini- or super- markets, industry and modern home. For security alarm systems, alarm can be used when the pressed key is wrong. It can access multilevel of user by using control area network (CAN). The system can access to any person who has an authorized user ID and password, records and compares the information such as person name and entrance time of that person in a data base using Microsoft Access in a Personal Computer (PC).

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