

Designing Logical Sequence by Using Microcontroller as Security Tools

Nur Aminudin
Informatic Engineering
Aisyah University of Pringsewu
Tambahrejo, kec.Gading rejo
Lampung 35373
nuraminudin@aisyahuniversity.ac.id

Dwi Feriyanto
Electronic Engineering
Aisyah University of Pringsewu
Tambahrejo, kec.Gading rejo
Lampung 35373
dwiferiyanto@aisyahuniversity.ac.id

Salman Alfarisi Salimu
Information Technology Education
Aisyah University of Pringsewu
Tambahrejo, kec.Gading rejo
Lampung 35373
salman@aisyahuniversity.ac.id

Garda Arif Wicaksono
English Education Department
Aisyah University of Pringsewu
Tambahrejo, kec.Gading rejo
Lampung 35373
gardawicaksono@aisyahuniversity.ac.id

Septian Cahyadi
Technology Information
IBI Kesatuan
Rangga Gading, Bogor
Kota Bogor 16123
scahyadi@ibik.ac.id

Anton Sukamto
Technology Information
IBI Kesatuan
Rangga Gading, Bogor
Kota Bogor 16123
anton.sukamto@ibik.ac.id

Taufik Rahman
Technology Information IBI Kesatuan
Rangga Gading, Bogor
Kota Bogor 16123
taufikrahmansutarman@gmail.com

Abstract –The objective of this paper are 1) to tell how to design logical security tools by using microcontroller 2) to describe the sequence of designing logical using microcontroller toward security controller. To explain the sequence step by step the researcher used design electronic chain. An Embedded system usually consists of at least a system unit microprocessor its memory for the program, data also input or output interface simple system. The interface like floppy disk, keyboard, appearance or printer which are usually available on the personal computer exactly is not available at the micro control system. Microcontroller systems are used for important simple works like control motors, switch, variable resistor or electronic device, one of micro control used is box control or safe deposit boxes such as house, office, or bank for safe security. By utilizing micro control, the owner has valuables are not felt worried about the safe deposit box from stolen.

Keywords: Design logical security, Microcontroller, security tools.



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I. INTRODUCTION

The development technologies are amazing, and its shows on social media such as youtube, Pinterest, and many others. It's the effect of human purposes in the competition that created innovation so many the occur security problems. Previously they depend on humans for security which need many people, but right now used technology. There have been some previous

studies which related to microcontroller and security tools. The first of relevant study is done by Latif et al the title is *Implementation of line follower robot based microcontroller atmega 32A* with title Implementation of line follower robot based microcontroller atmega32a The development of technology in the field of robotics is very fast, but in the eastern regions of Indonesia, namely, the development of the development has not yet felt the impact. Especially in the Universitas Islam Sultan Agung learning media devices for microcontrollers are also not yet available. Therefore, the author wants to pioneer by implementing the simplest robot design, the line follower robot, where the robot only goes along the lines. This study uses an experimental method, by conducting a research process based on sequences, namely: needs analysis, mechanical chart design, electronic part design, and control program design, manufacturing, and testing. The line follower robot based on the ATmega32A microcontroller has been tested, and the results show that the line follower robot can walk following the black line on the white floor and can display the situation on the LCD. But this line follower robot still has shortcomings in the line sensor sensitivity process depending on a certain speed. At speeds of 90-150RPM, the line follower robot can follow the path, while more than 150 rpm, the robot is not able to follow the path.

The second paper which have been study done by [1] with title *Arduino at mega -328 microcontroller* Arduino ATMEGA-328 microcontroller has been

programmed for various applications. By using the power jack cable, arduino microcontroller has been programmed so that the execution of the program may takes place. Various kinds of arduino board are present in the market. In this paper, Arduino UNO ATMEGA-328 microcontroller is described in a detailed manner. Arduino software is installed in the computer and so that we can edit and upload the program according to the applications. Mainly these arduino software supports c and c++ programming languages. Various inputs and outputs are present in the arduino board and therefore simultaneously 8 input and output ports can be used for various applications. Some of the applications used by using arduino boards are rotating general motor, stepper motor, control valve open, etc.

The third of previous study have been research by [2] with title *Developing a low cost Microcontroller Based Model for Teaching and Learning* Recently, as low-cost microcontrollers such as those developed by Arduino and Raspberry Pi have become widely available, the term maker education has emerged as a hot topic in education. Teachers are increasingly using low-cost microcontrollers in their classes, but conducting a class that focuses on using a microcontroller may cause difficulties or problems, for the learner or for the instructor. To solve these problems, it was necessary to design a teaching and learning model for the use of low-cost microcontrollers to be applied at school sites. Accordingly, this study aimed to develop a teaching and learning model for using low-cost microcontrollers. As a result of this study, the author proposes a teaching and learning model that consists of six stages: topic selection, exploration of implementation methods, experimentation, production of teaching and learning materials, implementing lesson plans, and improvement. According to this procedure, teaching and learning materials were created and applied for the subject matter of a middle school unit on "Making Arduino Automobile." The model developed in this study may provide a guideline for teachers who want to apply low-cost microcontrollers in their classes.

The fourth of previous studies have been research by [3] with title *Bridging the Gap Between Security tools and SDN Controllers* Software Defined Networking (SDN) is a promising paradigm to improve network security protections. However, current SDN based security solutions can hardly provide sufficient protections in a real SDN network, due to several reasons: 1) they are implemented at either the centralized SDN controllers or the decentralized network devices, which are subject to a performance limitation; 2) their designs are confined by the SDN network characteristics and can only provide limited security functions; and 3) many solutions have deployment challenges and compatibility issues. In this paper, we propose Sec-Control, a practical network protection framework combining the existing security tools and SDN

technologies, to produce a comprehensive network security solution in an SDN environment. We implement a Sec-Control prototype with Open flow and evaluate its effectiveness and performance. Our experiment shows that Sec-Control can cooperate with many mainstream security tools and provide effective defense responses over SDN-supported networks.

The fifth of previous study have been research by [4] with title *SMART: security model adversarial risk based tool for systems security design evaluation*. As development and deployment of secure systems continue to grow at scale, there is an equal need to evaluate these systems for vulnerabilities and other problems. However, the process of evaluating these designs is complicated and mainly proprietary to the group performing the evaluation. Generally, one follows the generic risk equation of probability and impact. In addition, one should examine the costs related to the adversary and the defender of a system.

Without accounting for all of these different aspects, one cannot expect to properly assess the security of a system model or design. This work presents a security model adversarial risk based tool (SMART) for systems security design evaluation. Our tool reads in a systems security model an attack graph and collects the necessary information for the purpose of de-termining the best solution based on a calculated security risk represented as a monetary amount. The advantage of the tool is the level of automation provided in the evaluation of security attack trees while providing meaningful metrics that are effortless to compare.

The journals have been written by [5]; [2]; [1] are written with details and systematically and easy for understanding. On their research microcontroller can be used not only used for one purpose but can be used for others purpose like microcontroller can developing a low cost, Arduino Atmega-328, robot used atmega 32a.

On other journals have been written by [3] and [4] about security system the authors written by systematically on their journals. Based on the previous studies about microcontroller and security control the purpose of the research is to know how to design logical sequence by using microcontroller as security tools.

II. BASIC THEORY

The security-based technology already filled a lot used at government agencies, banks, or private agencies, and many houses are used. the security using technology show efficiency and effectiveness levels, which are high security as the main reference in the runs of the simple activity. The effectiveness level and security got from the availability of the automatic system and control. Automatic technology systems and control can be run by electronic chains and computer technology. On the other hand electronic technology, it's basic to developing the chain which consists of the related components connected.

computer technology it's one of a system that controls the way of electronic chains by the procedure to programming our data on the chain.

One of the technologies used by using micro control (microcontroller AT89S51) for safety. Especially in banking must have a high-security system, especially for a safe deposit box as a valuable depository. it can be done for a micro controller used AT89S51 as a security gate safe deposit box.

Many control situations need action to begin. While the condition of the function is realized on the logic controller program or PLC [16]. one of the contacts can be used for the implementation of logical chains. If used gate logically.

Ideally logically 0 is 0 voltage and logically 1 is in the form of 5 volts on in line and the out, if used a contactor (push button), the pressure of the button is input, and the contractor is output. A button that is pressed has meaning as logical 1 otherwise if not pressed have mean input as 0 logical. The condition of the button in the connected condition has meant that the out is logical 1 and if the open contactor has means that the output is 0 logical. Bellow shows the correlation between contactors for realizing the logical gates AND, OR, NOT, NAND and NOR.

The picture bellow shows one of the conditions in which the output does not give the energy except for the 2 switches in which the condition normally opens become closes. Switch A and switch B of them must be closed, it caused give logical AND condition. We can describe a control system with 2 inputs A and B which same active so the output is active too or will any output. So, if used number 1 show on the signal on and 0 represent off signal. Then, to produce number 1 in output we must have number 1 over A and B.

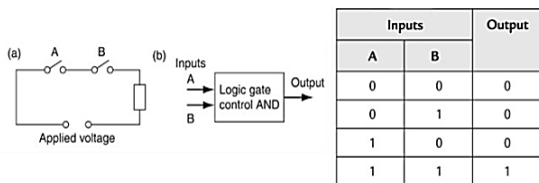


Figure 1. Logic gate AND

Likewise at the output that emits energy. Switches A and B which were originally open become closed or normally closed. It means an OR logic gate where input A or input B must be active. So that the output can provide energy or active energy [14]

The electric circuit controlled by two switches can show a normally closed condition. When input is given to the switch, the condition will change to open normally and no current will flow and the output will not get energized [15]

For example using one of the AND gates with a NOT gate next to the AND gate. The result of using the NOT gate is to invert our output from the AND gate. This is an alternative use that gives similar results to placing a NOT on each input and an OR gate after use [16]

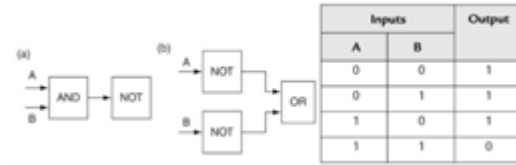


Figure 2. Logic Gate AND

To suppose used a gate OR with a gate NOT (picture 2). The consequence from used logic gate NOT is reverse the output from gate OR. One the other alternative is give the similar re-sult is putting gate NOT on each input then, used gate AND [15] [12].

Microcontroller is small computer which packages in Chip IC form/ integrated circuit then, design in order to do task or certain operations. Basically a micro controller IC which consists of one or more main processor (CPU), memory (RAM and ROM) as well as device input and output which are contained at the program.

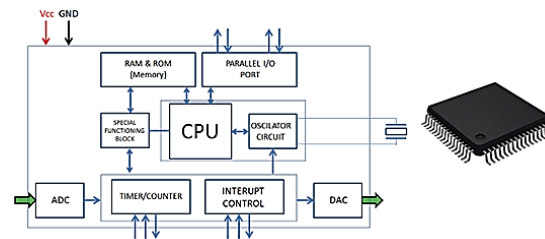


Figure 3. Microcontroller Block Diagram Micro controller AT89C51

Microcontroller AT89C51 is microcontroller ATMEL its full compatible with family microcontroller MCS-51, need low power have high performance and computer micro 8 bit completed 4 kyble EPROM (Erasable and programable read only memory) and 128 byte internal RAM. Memory program can reprogram in the system or by used Nonvolately program conventional memory [13]

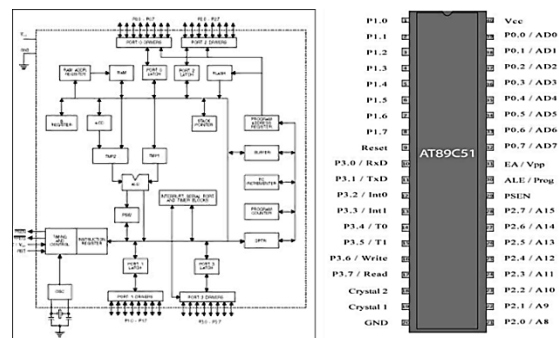


Figure 4. Microcontroller AT89C51

Stepper motor is one kind of motor many used right now. For example, in printer 3D and CNC mecine Engraving [6]. If noticed stepper motor have many differences, main input terminal. If usually DC motor have 2 input and servo motor have 3 inputs so, stepper motor have 4 or 5 [2]. The step control from construction reel which is arranged become multiple groups its called phase. Stepper motor move in the step

by arrange. Stepper motor move in the step by arrange. You can control step on the motor used microcontroller nor digital circuit. Torque from Stepper motor not as big as DC motor. However, motor types have high precision in the round. High speed in the stepper declare in the step per second or number of seconds per step. Types of the motor stepper based on the motor structure its variable reluctance (VR), Permanent Magnet (PM) and Stepper Hybrid.

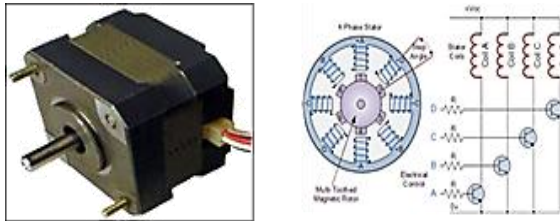


Figure 5. Motor and Motor Stepper Diagram

Electricity motor is electromagnetic device which change electromagnetic energy become mechanic energy. Mechanic energy its used such as impeller pump spin, fan or blower, move compressor, lifting material [3]



Figure 6. DC Motor

Power supply it's the importance of electronics chain its voltage source or power supply. The voltage of voltage source for electronic chanin in the generally its in the direct current. Other thing need to noticed on power supply in chains it's the stability [10]

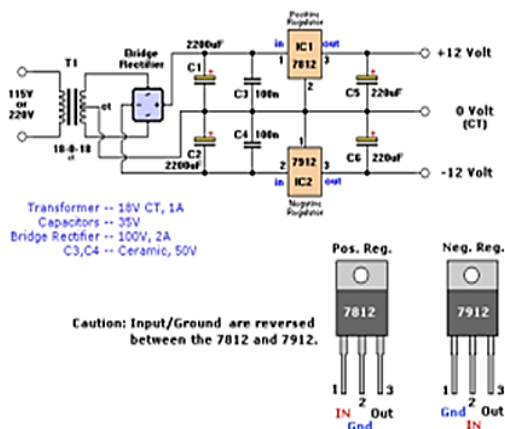


Figure 7. Power Supply and the Diagram

III. METHOD AND DESIGN

This research uses a chain electronic design which is described as follows:

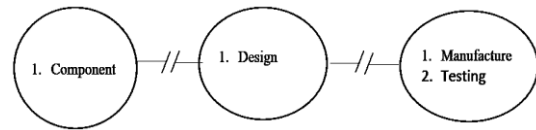


Figure 8. Logical Sequence Design with electronics chain. Source: [Siemens Digital Industries Software](#)
The Step of Software Instalation

1. Copy software application ISP Programmer 2.0 universal and software complier
2. Make listing program used notepad and save in format (.asm)

Hardware installation conducted by some of step, which first step its block diagram draw from the system will be make. Block diagram is one of the statement corelated which arranged from one component to other component which have the related performance system.

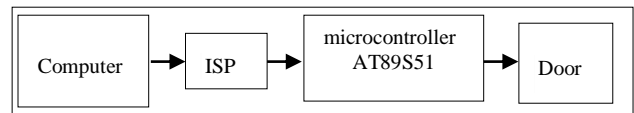


Figure 9. Hardware Design

Based on Figure 9 it can be explained as follows:

1. The function of the computer as a media for input message will show likes code in micro controller code.
2. The function of ISP as the downloader with used port USB as function communication series for connected computer with micro controller.
3. The function of microcontroller as central processor such as:
 - Safety control in safe deposit box
 - Micro controller memory as place storage program
4. Door as place will make by safety

IV. RESULTS AND DISCUSSION

The components used in Logical Sequence Design are: Micro controller AT89C51, Stepper Motor, DC Motor, Power Supply, ISP, Computer, and safe box.

A. Micro controller Diagram

In the door safety chain need microcontroller chain used as the central data manager and safe data or the program from the computer have function control safety door in safe deposit box. Bellow the Microcontroller diagram as the basic safety in safe deposit box.

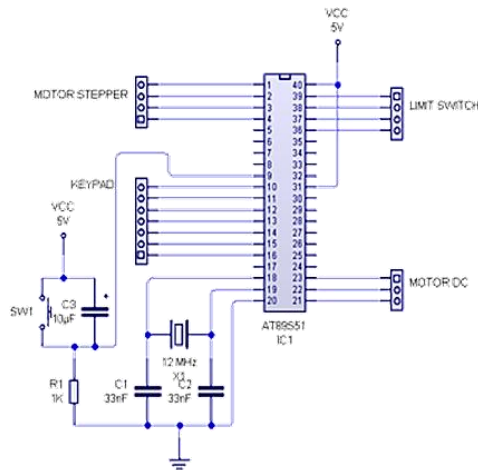


Figure 10. Micro controller Diagram

B. Safety Door Chain

Safety door chain is used switch, the function is give instruction at microcontroller, every switch connected by the micro controller bellow the system safety used switch 4.2.

C. Driver Motor Stepper Chain

In this chain consist of the component such as : transistor D400, D313, resistor and diode. In this driver have function for to swith on motor stepper that can open and close the door which have connected by micro controller on the port p 1.0 until p1:3. In speed motor control stepper can set from micro controller program.

D. Driver Motor DC Chain

In this chain consists some of electronica component, the function of driver for to changes the motor DC spin so, can kept the door, each motor driver DC connected by the micro controller foot on pin p2.0 and p2.2

E. Input Program

The process in input program by “Software Universal ISP program 2.0” the things need to be attention is inputing program in input program in micro controller is make sure that in the computer have ready universal ISP programmer 2.0 and Compiler. The Compiler is software used by change assembly program become hexa program can be received micro controller.

F. Writing Program

Writing program conducted by notepad which available on the computer. Language program the researcher used micro controller AT89S51 to make door safety. In this research, program language is assembly by name software ISP Programmer 2.0

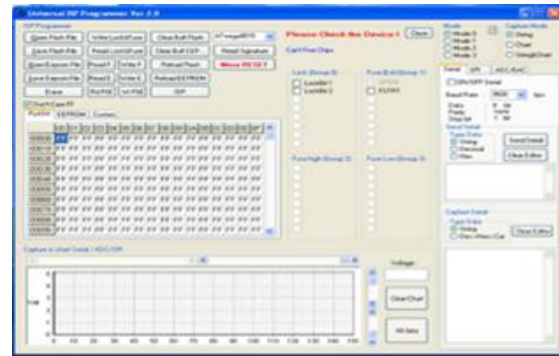


Figure 11. Writing Program

The following is the coding for designing a logical sequence as a security tool:

```

;inialisasi port
;motor stepper d1 :p1.0
;motor stepper d2 :p1.2
;motor stepper d3 :p1.3
;motor stepper d4 :p1.4
;relay motor open key:p2.0
;relay bell :p2.1
;relay motor close key :p2.2
;limit switch open door max :p0.0
;limit switch close door max :p0.3
;limit switch open key max :p0.2
;limit switch close key max :p0.1
;control line keypad p3.0
;keypad number 1:p3.1
;keypad number 2:p3.2
;keypad number 3:p3.3
;keypad number 4:p3.4
;keypad number 5:p3.5
;keypad number 6:p3.6

ORG 00H
START: MOV P0,#0FFH
MOV P1,#0FFH
MOV P2,#0FFH
MOV P3,#0FFH
SJMP CLOSE

CLOSE: MOV P2,#0FFH
mov p1,#10001000b
call delay
mov p1,#00010001b
call delay
mov p1,#00100010b
call delay
mov p1,#01000100b
call delay
jnb p0.3,R4
sjmp CLOSE

SCAN: MOV P1,#0FFH
MOV P2,#0FFH
MOV P3,#0FFH
    
```

```

CLR    P3.0
X1:    JB    P3.1,X4
        call X2
X2:    JB    P3.2,X2
        call X3
X3:    JB    P3.3,X3
        call HAKIM
X4:    JB    P3.4,X5
        call ALARM
X5:    JB    P3.5,X6
        call ALARM
X6:    JB    P3.6,R2
        call ALARM
R2:    SJMP  SCAN
HAKIM: mov    P2,#11111011B
        call  delay
        jnb  p0.1,DI
        sjmp HAKIM
DI:    JMP   OPEN
OPEN:  mov    p2,#0FFH
        mov    p1,#10001000b
        call  delay
        mov    p1,#01000100b
        call  delay
        mov    p1,#00100010b
        call  delay
        mov    p1,#00010001b
        call  delay
        jnb  p0.0,R1
        sjmp  OPEN
R1:    JMP   SCAN
ALARM: MOV    P2,#11111101B
        Call  delay
        Sjmp  ALARM
R4:    MOV    P1,#0FFH
        MOV    P2,#11111110B
        jnb  p0.2,SCAN
        sjmp  R4

delay:
        mov    r7,#03fh
loop1:  mov    r6,#03fh
loop2:  mov    r5,#03fh
        djnz  r5,$
        djnz  r6,loop2
        djnz  r7,loop1
        ret
        end
    
```

In this study, the researchers focused on how to design logical security tools using a microcontroller and their sequence. Which in this study researchers discuss a process that starts from scratch or starts from designing a microcontroller that is used in security devices and a coherent sequence. Which logical design sequence using a microcontroller as a security device which portrays.

1. Assembly

The components that have been collected are then assembled and then installed in the following door box:



Figure 12. safe deposit box door

Installation of these components must be done carefully and carefully to reduce the risk of errors and installation errors.

2. Test equipment

The test of this tool follows the flowchart in Figure 15. In this figure there are 2 processes, namely opening and closing. In each process, use the password that has been previously set. Based on the components, design and assembly that have been carried out, the creation of a logical sequence tool as a security tool uses electronic components that are widely sold in electronics shops or online shops, so that the costs incurred to make this tool are still affordable.

V. CONCLUSION

Based on the results and discussion in this study, it can be concluded that the use of a microcontroller as a security tool using a safe deposit box stringer system with an AT89S51 microcontroller as a controller on a safe door controller can function effectively and can save costs.

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