Advances in Engineering Research, volume 209
International Joint Conference on Science and Engineering 2021 (IJCSE 2021)

Design and Simulation of Automatic Car Parking Areas Based on Human Machine Interface Autonics LP-S070 Series

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ABSTRACT
The development of science, technology, and information at this time in the electrical field is very rapid, especially in the design of control system technology that can affect people's lives to move forward (modernization), practical, and semi-automatic. An automated system of equipment that overrides the role of humans as the subject of work has been found. In this research and paper, an automatic car parking area system is designed and simulated using Human Machine Interface Autonics. Also, the interface is also added so that the system can monitor the state of cars passing in the parking area and can provide special measures in the form of changes in time and conditions in the parking area. The interface in this study uses the LP-S070 Series.

Keywords: *Human Machine Interface, LP-S070 Series, Automatic Car Parking Areas.*

1. INTRODUCTION

The development of science, technology, and information at this time in the electrical field is very rapid, especially in the design of control system technology that can affect people's lives to move forward (modernization), practical, and semi-automatic [1][2]. An automated system of equipment that overrides the role of humans as the subject of work has been found. At present the number of vehicles such as cars is increasing, this will result in more and more vehicles becoming more congested for car parking areas. The problem of comfort is very worrying by car drivers [4].

This study designed an automatic car parking area simulation system using the Human Machine Interface Autonics Type LPS070 as an interface to display the simulation results of the control system [5][7]. The design of this automated car park simulation system aims as a simulation to implement the industrial revolution 4.0 era where the role of humans is replaced by robots or semi-automatic technology based on Human Machine Interface Autonics Type LPS070 using predetermined programming instructions. The method used in this research is the experimental method. This training module uses industry-standard control equipment namely Human Machine Interface Autonics Type LPS070. This paper is arranged in the following order: in the second part, the method used in this study is explained, both hardware and software system design is presented in the third part and in the fourth part the research results are presented, the conclusions will be presented in the last section [3][6].

2. METHODS

2.1. Real-Time System

Real-time is a system that uses the principle of real-time in conveying or sharing information so that the information displayed on the sender's side matches the information received on the receiver's side in terms of time and circumstances. A control system is said to be real-time if the control system can respond to input quickly and with the right logic [2]. Because, a system can be said to be a real-time control system if the response time matches the specified setpoint, so that when the response period exceeds the specified time the system is considered a failure. So a control system that has a response time that is fast enough so that it can respond to inputs within a limited period according to a specified setpoint, then the control system can be called a real-time control system [8].

PLC is an example of instrumentation that implements a real-time system because the output is generated from the response of the input conditions that have the time set in the specified setpoint. It can also be said that special computers are used for the control and operation of manufacturing processes and machinery. PLCs use programmable storage or memory to store command instructions and carry out their functions including on/off control, time, counting, sequencing, arithmetic and data handling commands. PLC can also be defined as "A special industrial computer in the industrial sphere whose job is to oversee and control industrial processes using a special program language in controlling industry (ladder diagrams), and is designed to be resistant to industrial environments that are resistant to various disturbances such as noise, vibration, shock, temperature, humidity [13][15].

At present automation instrumentation in the production process is very important for the industrial world, due to the lack of facilities related to industrial automation. This is very influential for the improvement of learning and understanding related to Programmable Logic Controller (PLC) [10]. For industrial automation control devices, this will be very influential because it will support the industrial world which requires expertise in the control field. Many advantages of using this control device compared to conventional process control systems, including the number of cables needed can be reduced, consume lower power, can quickly detect errors, and spare parts needed are not much, but the weakness of the control system also exists, namely the difficulty when done replacement, difficulty in tracking errors.

2.2. Hardware Overview

2.2.1. LP-S070

The LP-S070 series logic panel is a single package device that features HMI, PLC and I / O modules. This logic panel features a 7-inch wide color LCD with a touch screen function. This unit can control and monitor various devices connected through the communication port. There are 16 input and 16 output contact points. The logic programming memory supports up to 8,000 steps with screen editing memorabilia of 16 MB. The data logger function allows saving and backing up data from the control device. Users can also monitor various addresses and channels simultaneously. An extensive image library is provided with support for various fonts, printers and barcode readers [12].

The LP-S070 logic panel series is a type of HMI. The characteristics of the Logic panel series LP-S070 of this type are as follows.

a. All-in-one devices including functions of HMI + PLC + I / O Module
b. 7-inch widescreen true color analog touchscreen display
c. Standard I / O: 16 input points, 16 output points
d. Meanwhile, the functions and uses of the Logic panel LP-S070 series in the industry are as follows.
e. Packaging Industry: Potato chip manufacturing, and packaging process
f. Packaging Industry: Chip Bag Filling, Sealing, and Cutting
g. Elevator Industry: Parking Tower Entry / Exit
h. Semiconductor / Display Industry: Mobile LCD Manufacturing
i. Plastics / Rubber Industry: Rubber Shoe Sole Production

The LP-S070 Logic panel series consists of three main parts namely the input/output section, the processor section and the programming device in Fig.1.

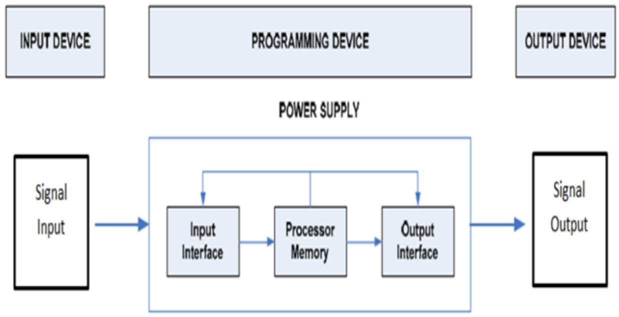

Figure 1 Proses programming device.

2.2.2. Smart Studio

Smart Studio is computer software used in the field of programming Logic panel LP-S070 series that functions to create, monitor and change from various programs or ladder. Smart Studio can be run with a minimum standard 486 MHz computer processor with a Windows XP operating system [11]. The following image is a view of Smart Studio Ver 2.0 in Fig. 2.

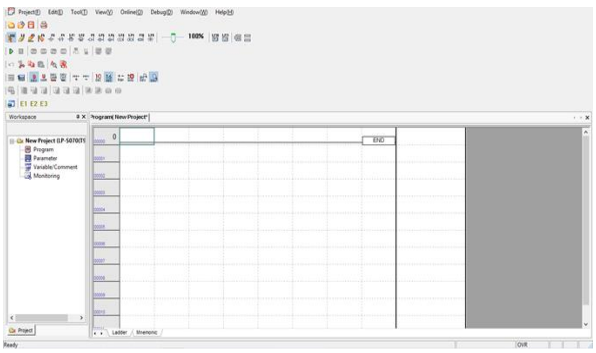

Figure 2 Programming Smart Studio Ver2.

3. DESIGN

3.1. Hardware Design

The block diagram of the overall automatic car parking area control system in the design of this simulation can be seen in Fig 3.

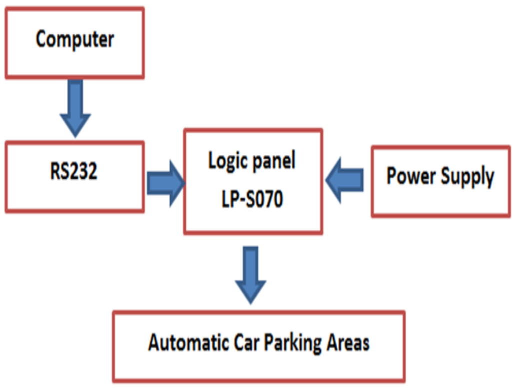

Figure 3 Hardware Design Logic Panel LP-S070.

3.2. Automatic Car Parking Area Series

The design of this automatic Parking Area circuit uses 7 inputs and 4 outputs on the LP-S070 Logic I / O panel panels. The following is a picture of a series of automatic Parking Areas arranged in a Logic panel module LP-S070 series in Fig. 4.

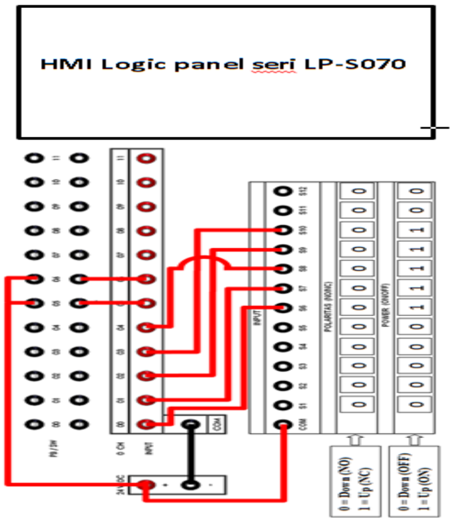

Figure 4 Design Automatic Car Parking Area Series.

3.3. Software Design

The ladder diagram design uses Smart Studio Ver2.0 software. In designing this ladder diagram, the I / O requirements used are first determined. The determination of the I / O number is important to make it easy to make ladder diagrams, so there is no error in programming. The following is the Smart Studio Ver2.0 software ladder diagram shown in Fig 5.

4. RESULTS AND DISCUSSION

This chapter will discuss the testing and analysis of the system by looking at the program, parameters, variables/comments, and monitoring on ladder diagrams in Smart Studio Ver.2.0.

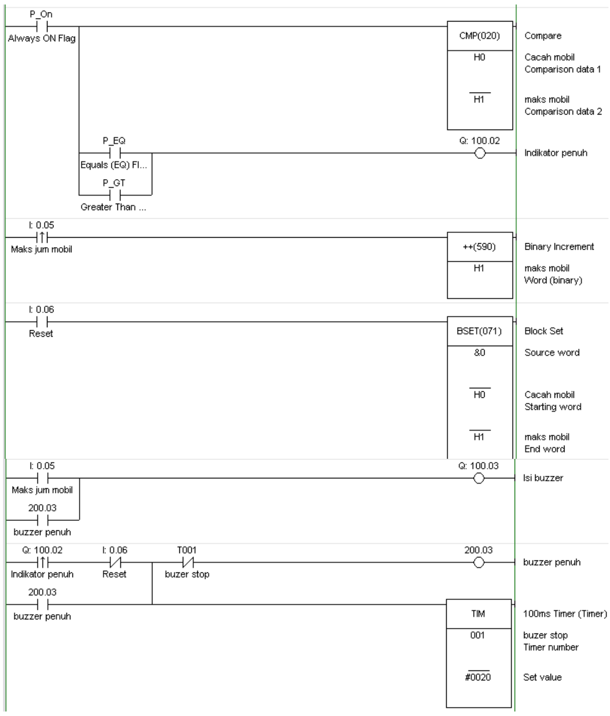

Figure 5 Design Software.

4.1. Communication Test

In this test, a host link communication is carried out between the laptop and the Logic Panel. Host Link Communication is communication between HMI and Personal Computer in which ladder software is installed. The computer can be connected to a peripheral port or RS-232C PLC port. This PLC port operates only in LP Series mode. Then set the PLC network type to LP-S070 (T9D7) so that communication can be connected according to the PLC series and type in Fig 6.

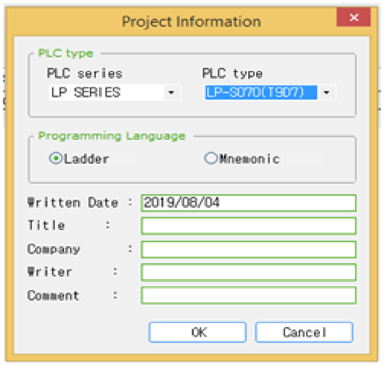

Figure 5 Communication Test.

4.2. Working Test on input and output usage

Usage test work and testing simulations on the inputs and outputs used can be explained in the following input and output allocation in Table 1.

Table 1 Working test on input and output usage.

Input	Hardware	Ouput	Hardware
0.00	S6/sensor	100.00	M5A/motor1
0.01	S7/sensor2	100.01	M5B/motor2
0.02	S9/LS1	100.02	LAMP2
0.03	S10/LS2	100.03	BZ
0.04	S8		
0.05	PB5		
0.06	PB6		

The information from the above table is as follows.

Input: 0.00 is S6 / sensor; 0.01 is S7 / sensor; 0.02 is S9 / LS; 0.02 is S9 / LS1; 0.03 is S10 / LS2; 0.04 is S8; 0.05 is a push button; and 0.06 is a push button.

Output: 100.00 is M5A / motor1; 100.01 is M5B / motor 2; 100.02 is LAMP2 / indicator lights; and 100.03 is BZ / buzzer.

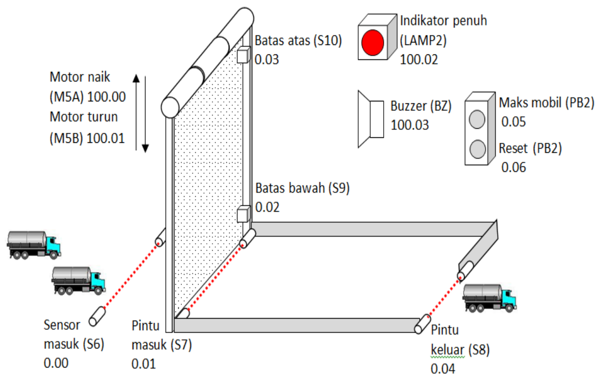

Figure 6 Simulation of Automatic Car Parking Areas.

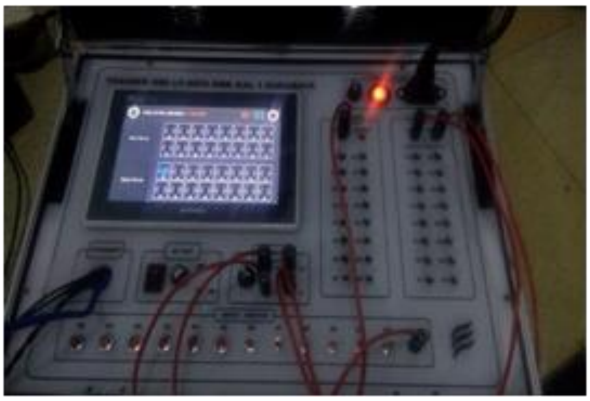

Figure 7 Module LP-S070 of Simulation Automatic Car Parking Areas.

In Fig 6 and Fig 7, shows the design and simulation of an automated car parker area that has been tested and programmed in the Smart Studio Ver2.0 software. The following are the empirical summation test results:

1. If the max number of cars has not been set using PB5, then there is a car that will enter the parking lot and cross S6, how is the door? (closed)
2. If PB5 is pressed 5 times, what is the state of the full indicator light (LAMP2)? And with each PB5 emphasis, what is the state of the buzzer (BZ)? (LAMP2 goes out and at each PB5 buzzer (BZ) press sounds)
3. After step number 2, then a car enters and crosses S6, how is the door? (open)
4. After step number 3, then the car continues to drive until it crosses S7. Shortly after crossing S7 how was the door? (closed)
5. After step number 4, if 4 next cars are entering in sequence, just after the last car crosses the S7 entrance, what is the state of the LAMP2 and buzzer (BZ) indicator lights? If the buzzer (BZ) sounds, how long does the buzzer sound? (LAMP2 goes out and at each PB5 buzzer (BZ) press sounds)
6. After step number 5, if more cars will enter and cross S6, how will the door be? (closed)
7. After step number 5, then there are 3 cars coming out across S8, how is the LAMP2 indicator light? (extinguished)
8. After step number 7, if more cars will enter and cross S6, how is the door? (closed)
9. After step number 7, how many cars can come in so that the full indicator light (LAMP2) can light? (3 cars)
10. When pressing the PB6 button, what is the state of the LAMP2 indicator light? And what is the value of setting the number of cars in-memory H0 and H1? (10. LAMP2 is on. Memory values for H0 and H1 are & 0).

5. CONCLUSION

In empirical work testing PLC-HMI type LP S070, Autonics can be concluded that the PLC-HMI type LP S070 has been well integrated and can work by the working principle of the automatic car parking area. The Smart Studio Ver2.0 program provides a real picture by displaying the inputs and outputs used in the simulation system.

From the results of empirical research on the design and manufacture of automatic car parking area simulations that have been carried out, it can be given a suggestion that when creating a program with Smart Studio Ver2.0 you must first learn basic logic such as OR, AND, NOT logic and also must understand parameters, variables/comments, and monitoring on ladder diagrams in Smart Studio Ver.2.0. For further research, it is necessary to have a prototype of an automatic car park area so that the implementation of the system can be more detailed in its application

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