Design and Build an Electronic Device Controller Using the Haiwell Series A8 Programmable Logic Controller with Wireless Communication Based on Internet of Things

Heri Liamsi[1], Sholihin[2*], Siswandi[3], Imas Ning Zhafarina [4], Eka Susanti[5],Putri Nabila[6]

[1-6]*Politeknik Negeri Sriwijaya*
Srijaya Negara Stret, 30139,Indonesia
sholihin@polsri.ac.id

Abstract. Electricity is one of the main needs that supports people in their activities. However, many people ignore the adverse effects of excessive use of electricity. Technological advances are growing rapidly, making it easier for people to do things remotely. One of them is an electronic device control system.Controlling this electronic device is assisted by an intelligent device, namely a programmable logic controller. In its development, PLCcan already be connected to wirelesscommunication technology so that by applying it it can make it easier to control electronic equipment that can be done from anywhere. The main components used: Haiwel A8 PLC, 24 VDC Power Supply, Stop Contact, and Push Button. This wireless communication utilizes the local network that is available from the PLC by entering 192.168.1.112 in the browserURLbarandtheinternetnetworkviatheHaiwellcloudservice,aftertestingthe results obtained that the output can still respond even though it is a tagreat distance aslong as the PLC has internet access and the laptop or smartphone to control also has internet access.

Keywords: Electricity, Electronic Devices, Programmable Logic Controller, Wireless Communication

1. Introduction

One of the primary necessities for individuals to support their activities is electricity, which is used in everything from working and studying to using electrically powered electronic devices for amusement. However, a lot of individuals are unaware of the harmful effects of using energy excessively. Using electricity that is turned on continuously can result in wastage of electricity so that expenses increase because bills increase. Other bad impacts can occur for children whose parents work and cannot monitor the child's use of electronic devices. One of them is the continuous use of television, which will have an impact on children's eye health.

Technological advances are currently developing rapidly, making it easier for people to do things remotely. One of them is an electronic device control system that can not only turn it on and off manually. But it can be controlled remotely and can even be regulated for how long the electronic item is used. Controlling this electronic device is assisted by an intelligent device that can use Arduino, microcontroller, PLC and other intelligent devices.

N. L. Husni et al. (eds.), *Proceedings of the 8th FIRST 2024 International Conference on Global Innovations (FIRST-ESCSI 2024)*, Advances in Engineering Research 261,
https://doi.org/10.2991/978-94-6463-678-9_10

In this research an automation system will be designed that uses a PLC. Logic circuits are the foundation of PLC, a control device that has more uses and functions than logic circuits due to its growth in response to industrial demands. Digital equipment that employs programmable memory to store specific functional instructions like logic, sequencing, timing, counting, and arithmetic in order to manage digital or analog input or output as a machine type is known as a PLC [1].

Wireless communication is a communication system whose transmission medium is non-physical or wireless with a transmission system using electromagnetic waves. Using wireless communication is more effective and efficient than using cables in certain conditions. The Internet of Things is one technological advancement that uses wireless connectivity to link everything. The Internet of Things (IoT) is a concept that uses the internet as a link to enable all real-world devices to communicate with one another as a single integrated system [2].

So in this research a wireless WiFi network connection will be carried out using a Haiwell A8 PLC which already has its own WiFi module. To control it, you don't just use a PC but can do it remotely using a smartphone.

2. Method

The block diagram below can be explained, namely: 220 volt PLN electricity will supply power to the power supply. The power supply functions to supply electric current to components or hardware in electronic device controllers using a PLC with DC current, the electric current that enters the power supply is in the form of AC and then converted into current D.C. Push Button acts as a device that connects or disconnects the flow of electric current when the button is pressed. Programmable Logic Controllers are used in automation systems to control various processes. This device is designed with the aim of replacing use of electromechanical relays which require complicated wiring and more difficult maintenance. Haiwell Cloud is a cross-platform Internet of Things platform. The PLC output is used for testing so that the PLC produces output that is suitable for controlling output devices.

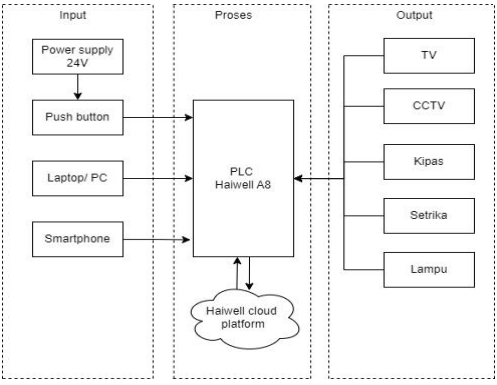

Fig.1. Blok Diagram Design and Build an Electronic Device Controller Using the Haiwell Series A8 PLC with Wireless Communication Based on IoT

Since PLCs do not yet have a wireless system, the TP-link WA901N access point serves as a wireless data transmission medium for them. The PLC is the last component that will transmit data to the PC via Modscan 64, and the power supply serves as the primary voltage source for the PLC.

On the MCB, one of the N (Neutral) and L (Live) terminals is connected to the PLN 220V electricity voltage and the other N and L MCB terminals are connected to the N and L terminals of the power supply then the N terminal is also connected to socket 1, socket 2, socket 3, socket 4 and the lamp then the socket is connected to the PLC output section. For terminal L, it is connected to the com section of the PLC. On the power supply, the positive terminal is connected to the positive PLC and is also connected to the positive push button 1 to push button 5, then the negative terminal of the power supply is connected to the negative terminal of the PLC and is also connected to the negative terminal or SIG push button terminal(see figure 2).

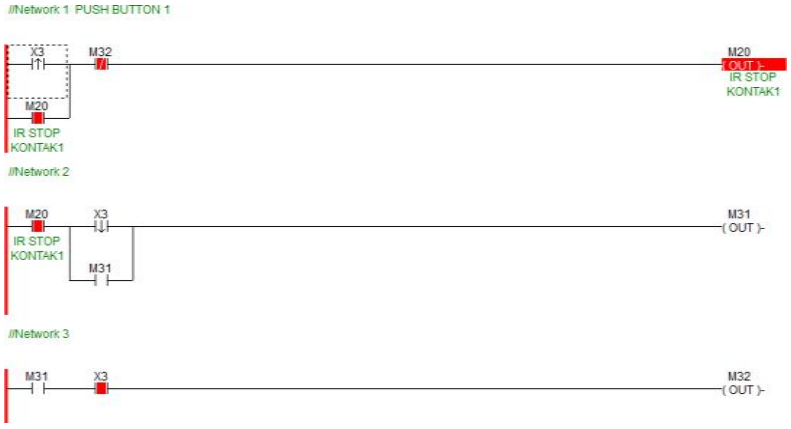

Fig.2. Circuit Scheme

3. Results and Discussion

This test was carried out to test the success of the simulation program connection that was created in the Haiwell Happy application to the Haiwell A8 PLC that was used. The aim is to ensure that there are no errors or deficiencies in the program that has been created to turn on or run the PLC output. By carrying out simulations on the program that has been created. The results of the program's response to the success of the simulation program can be seen in the Haiwell Happy Application below.

This test is carried out so that when the circuit is commanded to access or turn on the output it can run according to its function, the test is carried out by looking at the output if it runs correctly:

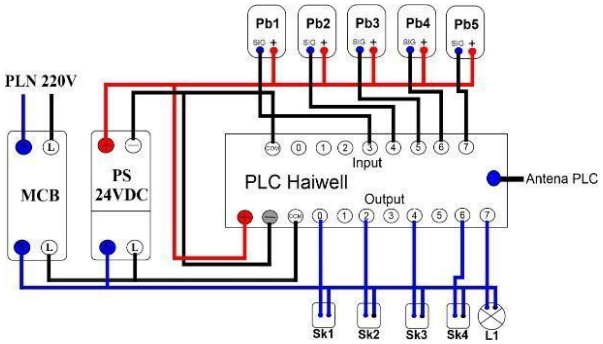

Fig.4. Simulation Saclar1 with push butoon1 ON

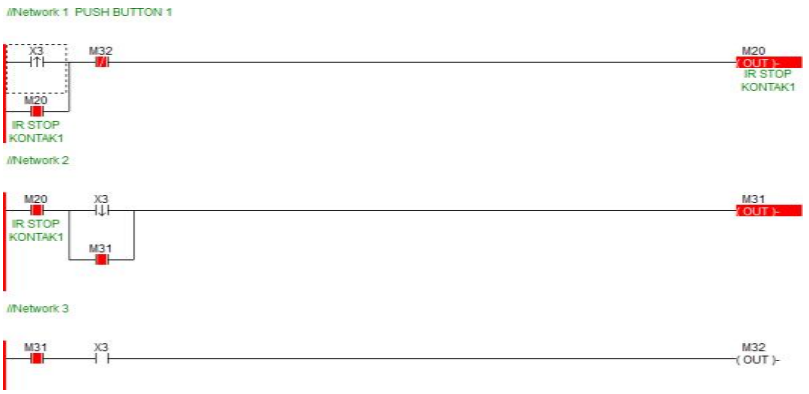

Fig.5. Simulation Saclar2 with push button1 ON

Fig.5. Output Simulation push button1 ON

To determine the quality of the network, researchers used Wireshark to measure parameters to determine the quality of the network on the PLC according to QOS. Throughput measurements are carried out using the Wireshark application which aims to determine the effective data transfer speed (rate) which is measured in bps (bits per second). For more complete data on throughput measurement results, see table below.

Tabel 1. Results Throughtput

Distance (M)	Throughtput (kbit/s)	Explain
10	27	Verry good
20	26	Verry good
30	23	Verry good
40	26	Verry good
50	26	Verry good
60	26	Verry good
70	22	Verry good

Table 2 will show the results of jitter measurements on network connections using Wireshark where the maximum jitter is 24.35892. The measurement results are categorized as good at almost all measurement distances. Packet loss measurements were carried out using Wireshark with the number of packets processed being 25. Packet loss measurements aim to see the wireless capability in sending data packets. The following are the results of packet loss measurements using the Wireshark application.

Tabel 2. Results Jitter

Distance (M)	Jitter (ms)	Explain
5	24,35892	Good
15	0,065486679	Verry good
30	0,670616	Verry good
40	0,13557	Verry good
60	0,06456087	Verry good
70	0,144373	Verry good

Tabel 3. Results Paket Losses

Distance (M)	Packet Loss	Persentage (%)	Explain
10	0	0	Verry good
20	0	0	Verry good
30	1	0,2	Verry good
40	1	0,2	Verry good
50	0	0	Verry good
60	1	0,2	Verry good
70	1	0,2	Verry good

From the measurement results that can be seen from table 3, the local network in sending packets is categorized as very good, with the highest number of packet losses, namely 2 with a percentage of 0.2% which occurs at a distance of 30 meters, 40 meters, 60 meters, and 70 meters.

Tabel 4. Results Delay

No.	Distance (m)	*Delay* (ms)	Explain
1	5	24,52426	Good
2	10	23,78655	Verry good
3	15	23,61236	Verry good
4	20	24,10876	Verry good
5	25	22,79444	Verry good
6	30	29,31346	Verry good
7	35	23,72368	Verry good
8	40	24,48631	Verry good

4. Conclusion

Filling the software uses Haiwell Happy to create a project program with input and output components that support sending and receiving wireless communications on the Haiwell A8 series PLC. In controlling electronic electronics, there are 5 outputs, namely TV, CCTV, fan, iron and lights with AC voltage.

The electronic device controller uses the Haiwell A8 Programmable Logic Controller. Overall the device has been realized using the A8 type PLC as the electronic device controller and Haiwell Cloud as the Human Machine Interface medium for remote control.

References

1. S. M. Metev and V. P. Veiko, *Laser Assisted Microtechnology*, 2nd ed.,R. M. Osgood, Jr., Ed. Berlin, Germany: Springer-Verlag, 1998.
2. J. Breckling, Ed., *The Analysis of Directional Time Series: Applications to Wind Speed and Direction*, ser. Lecture Notes in Statistics. Berlin, Germany: Springer, 1989, vol. 61.
3. S. Zhang, C. Zhu, J. K. O. Sin, and P. K. T. Mok, "A novel ultrathin elevated channel low-temperature poly-Si TFT," *IEEE Electron Device Lett.*, vol. 20, no. 11, pp. 569–571, Nov. 1999.
4. M. Wegmuller, J. P. von der Weid, P. Oberson, and N. Gisin, "Highresolution fiber distributed measurements with coherent OFDR," in *Proc. ECOC'00*, 2000, paper 11.3.4, p. 109.
5. R. E. Sorace, V. S. Reinhardt, and S. A. Vaughn, "High-speed digital-to-RF converter," U.S. Patent 5 668 842, Sept. 16, 1997.
6. (2002) The IEEE website. [Online]. Available: http://www.ieee.org/
7. M. Shell. (2002) IEEEtran homepage on CTAN. [Online]. Available: http://www.ctan.org/tex-archive/macros/latex/contrib/supported/IEEEtran/
8. *FLEXChip Signal Processor (MC68175/D)*, Motorola, 1996.
9. "PDCA12-70 data sheet," Opto Speed SA, Mezzovico, Switzerland.
10. A. Karnik, "Performance of TCP congestion control with rate feedback:TCP/ABR and rate adaptive TCP/IP," M. Eng. thesis, Indian Institute ofScience, Bangalore, India, Jan. 1999.
11. J. Padhye, V. Firoiu, and D. Towsley, "A stochastic model of TCP Renocongestion avoidance and control," Univ. of Massachusetts, Amherst,MA, CMPSCI Tech. Rep. 99-02, 1999.

12. *Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification*,IEEE Std. 802.11, 1997.