

A Smart System for Mulberry Garden Watering using PLC and Wireless Sensor Networks

Woranant Tungkasopa¹, Benchalak Maungmeesri², Dechrit Maneetham³

¹(Technology Management, Valaya Alongkorn Rajabhat University, Pathumthani, Thailand)

²(Technology Management, Valaya Alongkorn Rajabhat University, Pathumthani, Thailand)

³(Mechatronics Engineering, Rajamangala University of Technology Thanyaburi, Pathumthani, Thailand)

*corresponding author: woranant.tungkasopa@gmail.com

Abstract: Programmable Logic Controller (PLC) equipped with wireless sensor are controlling popularity of in mulberry garden automation. The research is to design and integrate more functions for mulberry garden watering and monitoring via wireless sensor networks control system utilizing with PLC control. The propose system consist of watering control, temperature control, humidity control and microbial fertilizer control. Finally, the system can real time monitor and smart phone with all sensors changes, can improve, save time and high efficiency.

Keywords: mulberry garden, plc control, wireless network control, remote control.

I. BACKGROUND/ OBJECTIVES AND GOALS

At the present, mulberry plant was carried out and respective in three difference sessions. Mulberry trees grow in the wild and abundance almost still in the northern of Thailand that has fastest growing temperature plants and is a source of high price and high quality [5]. Actuary, there are many benefits such as excellent fruit and generally very sweet and then mulberry fibre are particularly suitable for papermaking [8]. While mulberry are always need water and soil but not only serves its. Mulberry trees needed most essential nourishment from it but also must provided an automatic control system together [3].



a) mulberry trees



b) automatic control system

Fig 1: Mulberry garden watering plant

II. METHODS

In this research we are using PLC and touch screen via wireless networks. PLC brand of Mitsubishi FX1N-40MR is used converting 220 volt to 24 volt. Input is connected via sensors such as temperature sensor, humidity sensor and flow sensor and then output is connected via relay card such as solenoid valve and motor controlled by programing and is directly monitoring through a touch screen monitor and mobile phone together. PLC has define programming language via Ladder Diagram (LD). Then the LD programming of controlling the process is done.

1. PLC Operation

In this project, PLC can be divided into many functions as follows:

- 1.1 Digital Input: push button, switch
- 1.2 Analog Input: flow sensor, pressure switch, temperature sensor, humidity sensor
- 1.3 Digital Output: motor, solenoid valve
- 1.4 Power Supply

2. Wireless Networks

Wireless networks purpose of configuration with human machine interface (HMI), alarm, reporting and operator control of remote or an automatic control system.

- 2.1 Touch screen and mobile phone
- 2.2 Camera
- 2.3 Protocol and cable connection
- 2.4 Internet router

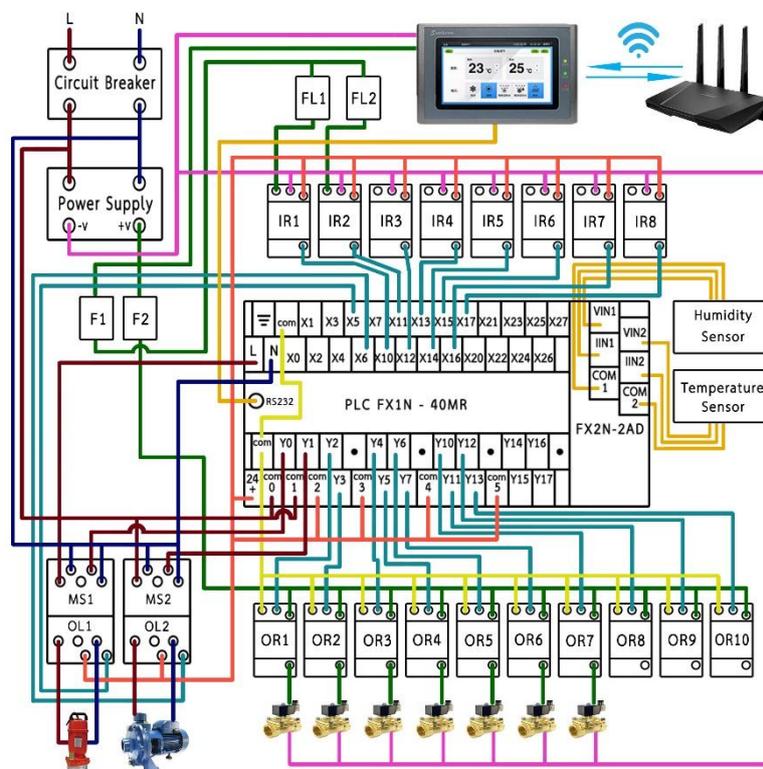


Fig 2: Mulberry garden watering plant

3. PLC Programming

LD diagram has program language and complex programming control so now were programmed in ladder logic more than 100 rang because PLC take a look at each input, output analog input and connected with touch screen via wireless networks and other communicate hardware modules [1],[9].

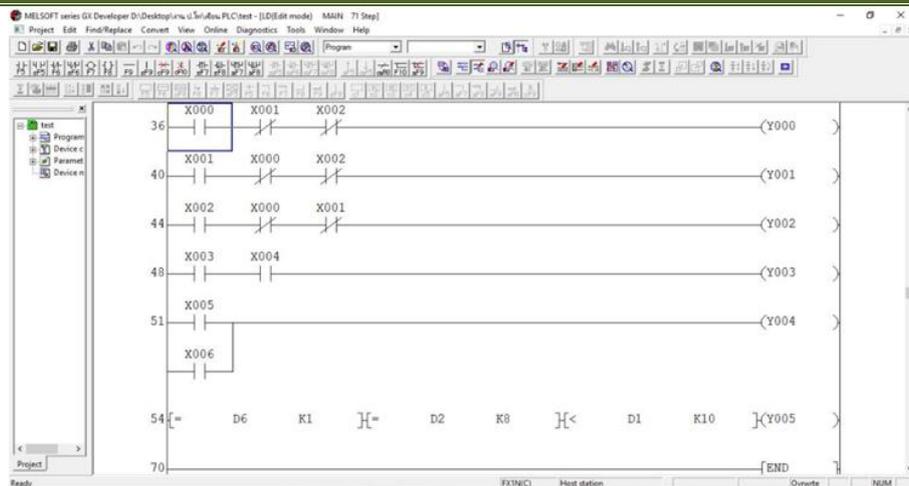


Fig 3: Ladder Diagram

4. Remote Unit

Remote unit had communication module connecting with camera and control via touch screen are testes to ensure the highest reliability for automatic and any hard environment such as temperature, humidity and watering check. It can be found of monitoring and controlling applications.



a) control box



b) camera and touch screen

Fig 4: Remote unit

5. Controlling and Monitoring Unit

Touch screen model of Samkoon type AK-043AW-R is used ensure controlling and monitoring system while connect local HMI directly to serial port. Touch screen have multi features graphical for control hardware by connecting with port, ip address and subnet mask and so front.

Specification of Touch Screen

5.1 Samkoon model AK-043AW-R

5.2 Display Size 4.3 inch

5.3 Resolution 480x272

5.4 Color 16,770,000

5.5 Control panel 4-wire high-precision electric resistance touch screen

5.6 CPU Cortex A8 800MHz



a) touch screen



b) software control

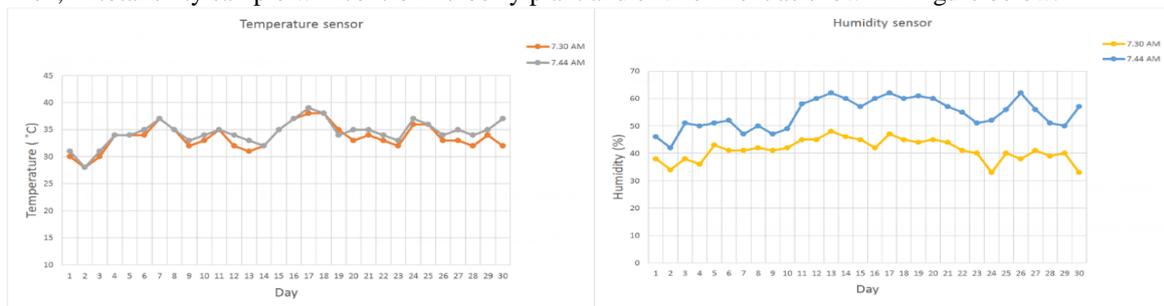


c) connecting hardware

Fig 5: Controlling and Monitoring Unit

III. EXPERIMENTAL AND RESULTS

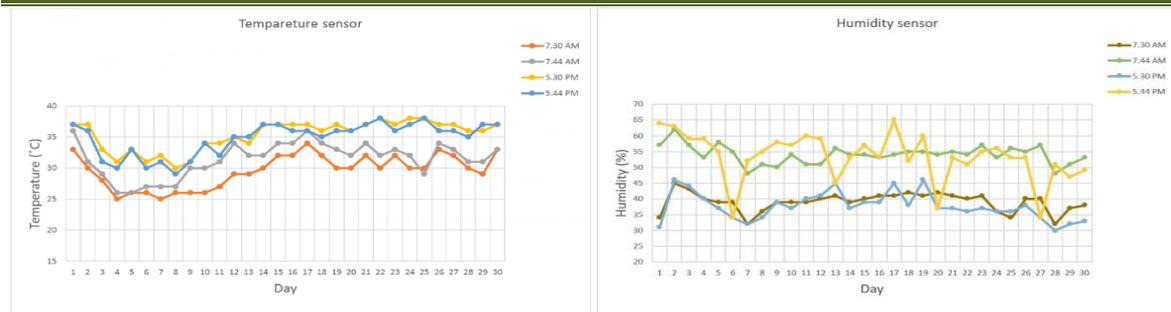
Mulberry garden was carried out outdoors with controlled watering control, temperature control, humidity control and microbial fertilizer control. The sixty sample trees were randomly from mulberry garden. Then, in total sixty sample will control mulberry plant and environment as shown in Figure below.



a)temperature control

b) humidity control

Fig. 6: Temperature and humidity control at morning



a) temperature control b) humidity control
 Fig. 7: Temperature and humidity control at morning and evening

IV. CONCLUSION

This research gives automation and advances control by PLC, wireless networks and IoT invention. The proposed system facilities and feature to control and conduct the environmental by control with the values for parameters such as temperature sensor, humidity sensor, microbial fertilizer, water and so front that can observe the environment of mulberry plant. The proposed system can remote control by mobile phone and monitoring the system every time. While can reduces the worker and reduces the system error. An IoT control system is easy to implement and monitor control. Framer can controlling and monitoring through mobile phone and can check status directly every time. Overall, from validation analysis showed that Figures 6-7. The model is feasible to adjust and transfer for each devices and mulberry plant.

Acknowledgements

This support of this work by Valaya Alongkorn Rajabhat University under the Royal Patronage (VRU) is gratefully acknowledged.

REFERENCES

- [1]. K. J. Y.Mohammad,H. V.Chintan,A. J. Rajat,& M. D. Manan,PLC and SCADA Based Load Security System. *International Journal of Engineering Development and Research*, 5(2),2017, 115-119.
- [2]. K. Praphaporn, Internet of Things: Current Technology Trends for Future, *EAU Heritage journal Science and Technology*, 2016,
- [3]. L. Miller, (2000). Paper Mullberry, *Broussonetia papyrifera*, Invasive Plant Species. USDA Forest Service, *Southern Region, National Forests in Florida*. Protection Report R8-PR 46.
- [4]. M. Anirach, S. Wipoo, & T. Panya, IoT Services Agent Platform: A Case Study in Network Monitoring, *Department of Information Technology, Faculty of Industrial Technology and Management, King Mongkut's University of Technology North Bangkok*, 2018,
- [5]. N. C. Coile, A Paper on Mulberries and the Invasive Paper Mulberry. *In: 16th Annual Symposium, Florida Exotic Pest Plant Council, ed. anonymous. September 11-14,2001, St. Augustine*, p. 18. (abstract).
- [6]. P.Tamarai, & R. Amudhevalli, Energy Monitoring System using PLC & SCADAS. *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering*,3(2),2014, 7127-7133.
- [7]. A. Anandakumar1, K.Anagha, M. Aswini, & I. Jayabharathy, Implementation of Iot Based Smart Energy Meter Using Plc and Scada for Industrial Applications. *International Conference on Emerging Trends in Engineering and Technology Research*, 2019, 25-30.
- [8]. D. L. Tuan, & H. T. Dat, Design and Deploy a Wireless Sensor Network for Precision Agriculture. *2nd National Foundation for Science and Technology Development Conference on Information and Computer Science*,2015.
- [9]. D. P.Kadam,P. M.Sonwane, S. C.Landge, V. P. Dhote, & S. S. Thorat, PLC & SCADA, Case Study: Autoclave Automation. *Proceeding of International Conference PSACO, India*, 2008, 830-836.
- [10]. G. Sushanth, & S. Sujatha, IoT based Smart Agriculture system,*IEEE*,2018.
- [11]. F. H. Fahmy, H. M. Farghally, N. M. Ahmed, & A. A. Nafeh, Modeling and Simulation of Evaporative Cooling System in Controlled Environment Greenhouse. *Smart Grid and Renewable Rnergy*, 2012, 67-71.
- [12]. G. Martinovic, & J. Simon,Greenhouse microclimatic environment controlled by a mobile measuring station, *NJAS-Wageningen Journal of Life Sciences*, 2014, 61-70.