

Wireless Industrial Automation using PLC and Designing HMI Panel

Kurnella Spandana¹ Karnati Bindu Madhuri² Nallapaneni Naga Manasa³ Kodali Sai Jagathi⁴ Gaddam Santhi Sree⁵

^{1,2,3,4,5}Department of Electronics and Communication Engineering

^{1,2,3,4,5}Vasireddy Venkatadri Institute of Technology, Namburu(V), Guntur(dt), Andhra Pradesh, India

Abstract— In today’s industrial automated world, programmable logic controllers are the most dominant type of automatic controllers. And so engineers are trying to develop the best to increase the abilities of programmable controllers to maximize the outcome. Our project is to combine both IoT with Industrial automation in order to increase ease of controlling and monitoring remotely, reduce cost and increase data accuracy. We will connect arduino to PLC S7 1200 and using NodeMCU we are giving instructions to the arduino wirelessly and according to the commands received PLC performs the operations. We are controlling Distribution station to demonstrate the effectiveness of our idea. To control the station in the field we are designing a HMI panel and add security to it. Using this plan of action we can convert the present day wired communication with the PLC to a wireless one.

Keywords: IoT (Internet of Things), PLC (Programmable Logic Controller), HMI (Human Machine Interface), ENC28J60 (TTL to Ethernet Converter)

I. INTRODUCTION

In industries to start a machine, we usually have to switch on the button manually. There might be some emergency situations where we have to control the machines from a remote location. Also because of the conventional manual operation there are cables running throughout the industry which makes complex and there are several problems because of these cables like cable faults, short circuits, aging and we need replace old cables after certain period of time. With the help of our proposed project we can minimize all these problems and make the system wireless where we can introduce smart operation and maintenance.

Using our project we can send the commands to the PLC in a wireless manner so that one can control the operations in an industry where the PLC’s are involved in a remote way from anywhere across the world, to access remotely we are using NodeMCU and for passing the commands to PLC we are using an arduino in between the PLC and the NodeMCU.

The HMI panel also helps the operator to control the stations from the field. We added the lock to the screen only one who knows the username and password can give commands to, so it increases security also.

II. BLOCK DIAGRAM

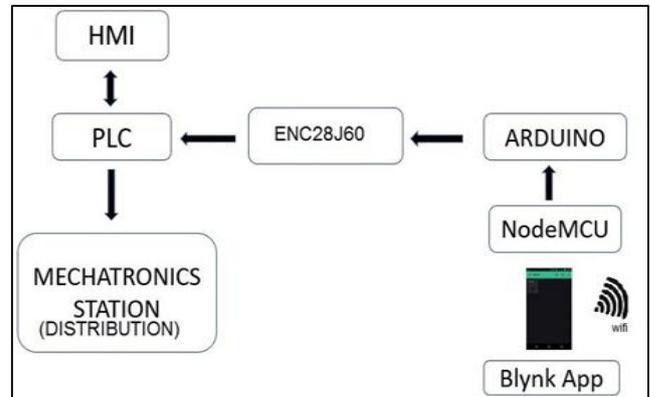


Fig. 1: Block diagram of proposed wireless model
 Here by using blynk app in the mobile we can give commands through wifi, they were first received by NodeMCU and NodeMCU passes data to the arduino. Arduino gives the data to the ENC28J60 which converts the ttl logic the the Ethernet cable which is connected to the PLC and according to the received commands PLC perform the operations. PLC programming was done by using TIA portal.

The hardware components we used are

1) *Siemens PLC S71200:*



Fig. 2: PLC S71200

A PLC is an electronic device that takes input from the plant via sensors and transmitters, executes the logic programmed in its memory and generates the useful output on actuators to control the plant. 1214C type is used.

2) *Arduino Uno:*



Fig. 3: Arduino Uno board

It is an open-source platform used for building electronic projects. Arduino boards are easy to read inputs and produce the outputs.

3) *NodeMCU*:

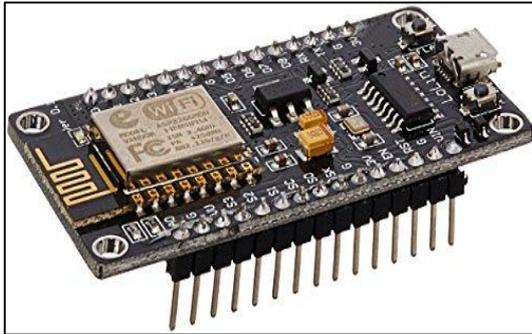


Fig. 4: NodeMCU

NodeMCU board consist of ESP8266 Wi-Fi enabled chip. NodeMCU is an open source platform which makes their hardware design easier to program. The NodeMCU development board is featured with Wi-Fi capability, analog pin, digital pins and serial communication protocols.

4) *ENC28J60*:

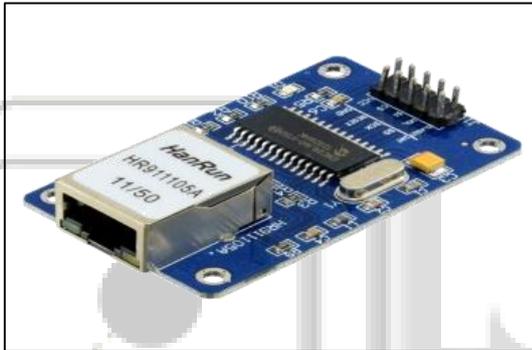


Fig. 5: ENC28J60

The ENC28J60 Ethernet Module is a board which contains an Ethernet port and converts Ethernet input into SPI.

5) *HMI*:

The user interface that connects an operator to the controller for an industrial system is the Human Machine Interface(HMI). HMIs are usually deployed on windows-based machine, communicating with PLC and other industrial controllers

The following are the softwares used.

- a) TIA portal:
Totally Integrated Automation(TIA) portal, we can configure the hardware and do the programming. Ladder logic is used to program the PLC.
- b) Arduino:
Arduino software is used to program Arduino and NodeMCU.
- c) Blynk:
Blynk is a platform that allows to quickly build interfaces to for controlling and monitoring hardware projects from IOS and android devices.

III. FLOW CHART

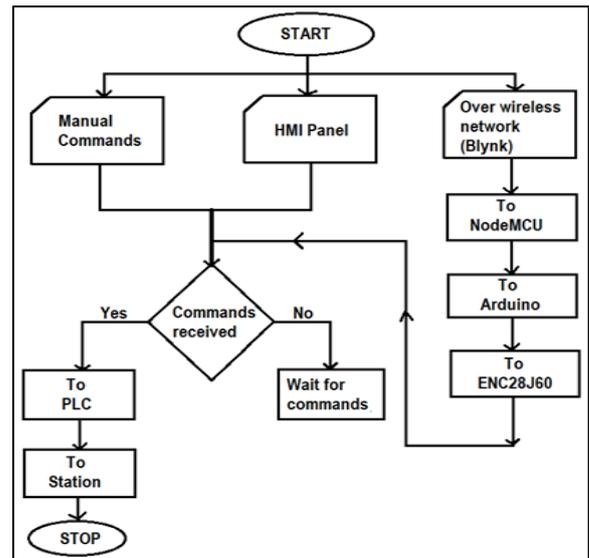


Fig. 6: Flow chart

As shown in the flowchart using our proposed model we can control the PLC in 3 ways. One way is manually, the other is through HMI panel and the other is through wifi using blynk app.

IV. EXPERIMENTAL SETUP



Fig. 7: Experimental setup

Distribution station is used to place the work pieces that comes to it to the successive stations using the picking hand present in the station.



Fig. 8: Distribution station (Mechatronics station)
Controlling using blynk app

The experimental setup for remote controlling is as follows

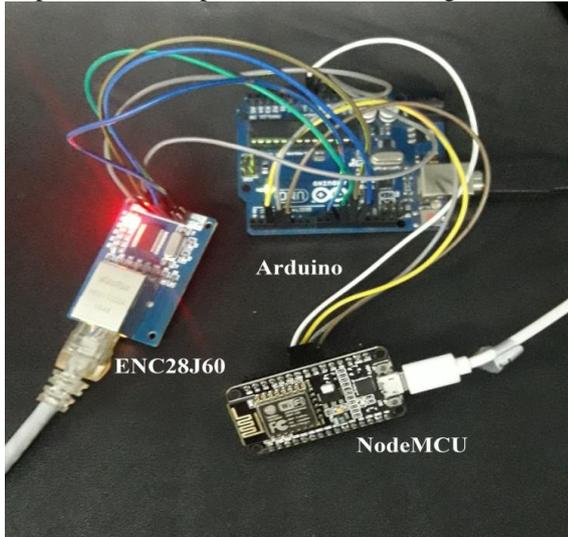


Fig. 9: Circuit helps for remote controlling of PLC

The designed HMI(Human Machine Interface panel) for controlling the distribution station is as shown. It has start, stop and emergency stop buttons. One can access those buttons only after logging in.

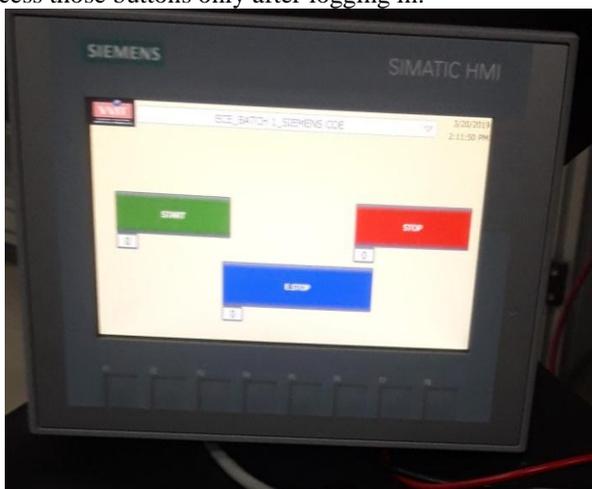


Fig. 10: HMI panel showing buttons for controlling.

V. CONCLUSION

Using our proposed remote controlling model we can convert the present wired communication with the PLC to the wireless one and HMI screen locking will give additional safety and security for controlling in the field.

VI. FUTURE SCOPE

Additional implementation to this project can be done by adding the two way communication between the PLC and arduino. So that we can send and monitor the data from PLC using cloud.

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