

Industrial Device Control Using Wi-Fi Module

P.SRINIVASARAO¹, K.VAMSI SAITEJA², K. PRUDHVIRAJ³, N.PRASANTH REDDY⁴,
RAMAVATH TEJASWINI⁵

^{1,2,3,4} B.Tech, Electronics and Communication, Vasireddy Venkatadri Institute of Technology, Andhra Pradesh, India.

⁵Assistant Professor, Electronics and Communication, Vasireddy Venkatadri Institute of Technology, Andhra Pradesh, India

Abstract -- This paper presents a design and prototype implementation of new industrial automation system that uses Wi-Fi technology as a network infrastructure connecting its parts. The proposed system is better from the scalability and flexibility point of view than the commercially available industrial automation systems. In Industry we have different types of loads at different locations. We can control all loads at a same time from one place (control room) without connecting any physical wire between loads and control room, in this project we are using WI-FI module, IOT, relay. In this project Wi-Fi is being used by phone and the loads are operated with it. In this project we should not connect AC loads directly to microcontroller since AC may enter into controller due to this our controller may be destroyed. To avoid such type of drawback we need some drivers. In this project we are using relay as load controller (as a switch)..

Index Terms: Internet of Things (IoT), Node MCU, DC motors, Relay, Blynk app.

I. INTRODUCTION

Industrial Automation is the process of connecting various loads in different locations to a Wi-Fi (LAN) network to perform the tasks automatically and handles different processes and machineries in an industry to replace a human being. It increases the Quality and Flexibility in the Manufacturing Process. Traditionally Manpower and Bluetooth are employed in industries. In hazardous conditions there will be no production line safe for the employees and in case of the Bluetooth the coverage range is very less. So by using Internet of Things (IoT), Node MCU and Blynk application the above disadvantages can be turned into advantages.

II. INTERNET OF THINGS

The Internet of Things (IoT) can be described as connecting everyday objects like smart-phones, Internet TVs, sensors and actuators to the Internet where the devices are intelligently linked together enabling new forms of communication between things and people, and between things themselves. Building IoT has advanced significantly in the last couple of years since it has added a new dimension to the world of information and communication technologies. It is expected that the number of devices connected to the Internet will accumulate from 100.4 million in 2011 to 2.1 billion by the year 2021, growing at a rate of 36% per year. In the year 2011, 80% machine to machine (M2M) connections were made over mobile networks such as 3G and 4G and it is predicted that by 2021, this ratio will increase to 93% since the cost related with M2M over mobile networks are generally cheaper than fixed networks. Now anyone, from anytime and anywhere can have connectivity for anything and it is expected that these connections will extend and create an entirely advanced dynamic network of IoT. The development of the Internet of Things will revolutionize a number of sectors, from automation, transportation, energy, healthcare, financial services to nanotechnology. IoT technology can also be applied to create a new concept and wide development space for smart homes to provide intelligent, comfort and improvement in quality of life.

III. PROPOSED METHOD

Previously, the loads (Bulb, Fans, Motors etc...) in industry are controlled manually, it will increase cost and time. In order to overcome these difficulties we are proposing a new method by using Internet of Things (IoT). By connecting all the loads in industry to a Wi-Fi network and switching ON and OFF through mobile phone where mobile hotspot is used as a Wi-Fi network. Different loads in the project are dc motors. To control these motors we are using Blynk app and Node MCU. Node MCU is a device which contain inbuilt Wi-Fi module. The block diagram is shown below.

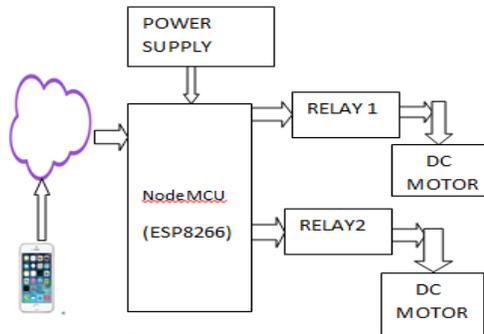


Figure: Block Diagram

IV. STATEMENT OF SCOPE

Currently industrial motors and engines are controlled using IoT, their speed and other parameters are not being controlled. This application can be further extended to control the speed and other parameters of the motors. Detecting the errors in the engines and motors can also add some advantage if applied.

MAJOR CONSTRAINTS:

- Authenticated people only control the device.
- User must know about the authenticated key to which network devices are connected.
- Devices must connect to the Wi-Fi network to control.
- No need to connect the both mobile phone and devices to same network.

V. HARDWARE COMPONENTS REQUIRED

Node MCU:

Node MCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi system on chip (SOC) from Espressif Systems and hardware which is based on the ESP-12 module. Node MCU firmware is a companion project to the popular Node MCU dev kits, ready-made open source development boards with ESP8266-12E chips. The firmware uses the Lua scripting language. The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

The NodeMCU is an open-source firmware and development kit that helps to Prototype IOT product within a few Lua script lines or 'C' codes. NodeMCU is like Arduino Hardware with a Input and Output built in the Board itself. It has also a Wifi built in to connect directly to internet to control things online using Node js style network API for digital network applications, which facilitates developers to code running on the Board, Greatly speed up Internet of Things application development process. The Development Board based on ESP8266 Chip, integrated GPIO(General Purpose Input Output), PWM(Pulse with Modulation),IIC(Interconnected Integrated Circuit), 1-Wire and ADC all in one board to power up development board in fastest way combined with the NodeMCU Firmware.

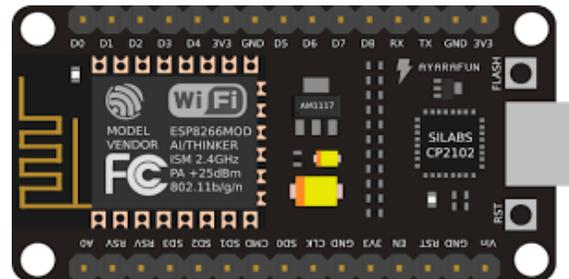


Figure 2: NodeMCU

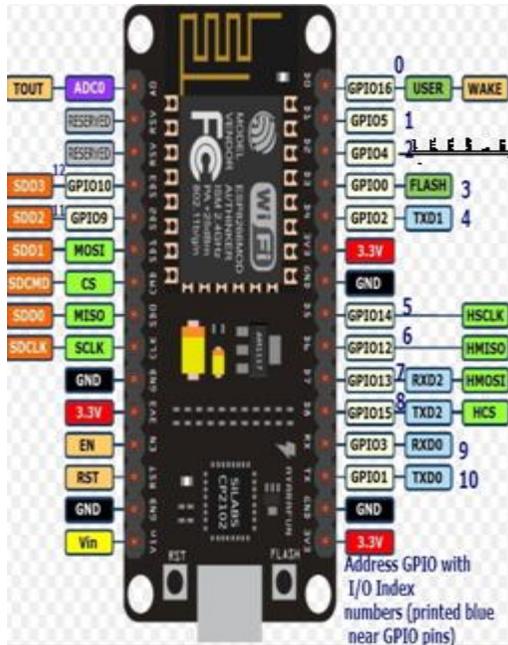


Figure 3: Pin Description

RELAY:

A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current. The heart of a relay is an electromagnet (a coil of wire that becomes a temporary magnet when electricity flows through it). The control circuit functions as the coupling between the input and output circuits. In electromechanical relays, the coil accomplishes this function. Relay Output Circuit is the portion of the relay that switches on the load and performs the same function as the mechanical contacts of electromechanical relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one s

Normally Open Contact (NO) – NO contact is also called a make contact. It closes the circuit when the relay is activated. It disconnects the circuit when the relay is inactive.

Normally Closed Contact (NC) – NC contact is also known as break contact. This is opposite to the NO contact. When the relay is activated, the circuit disconnects. When the relay is deactivated, the circuit connects.

Change-over (CO) / Double-throw (DT) Contacts – This type of contacts are used to control two types of circuits. They are used to control a NO contact and also a NC contact with a common terminal. According to their type they are called by the names break before make and make before break contacts.

APPLICATIONS:

1. Relays are used to realize logic functions.
2. Home Automation projects to switch AC loads.
3. To Control Heavy loads at a pre-determined time.
4. To control motors, glass doors etc. in automobiles.

BLYNK APP

Blynk is a Platform with IOS and Android apps to control Arduino, Raspberry Pi, NodeMCU and the likes over the Internet. It's a digital dashboard where we can build a graphic interface for our project by simply dragging and dropping widgets. Every time when we press a Button in the Blynk app, the message travels to space into the Blynk Cloud, where it magically finds its way to our hardware. It works the same in the opposite direction and everything happens in a Blynk of an eye. Blynk Server is an Open-Source Netty based Java server, responsible for forwarding messages between Blynk mobile application and various microcontroller boards and SBCs (i.e. Arduino, Raspberry Pi, NodeMCU etc..). Blynk server is working based on Virtual Pin concept. Virtual Pin is a concept invented by Blynk Inc. to provide exchange of any data between hardware and Blynk mobile app. Virtual pins are different than Digital and Analog Input/output (I/O) pins. They are physical pins on microcontroller board where we can connect sensors and actuators.



Figure 4: volts relay with pin description



Figure 5: Blynk app

IMPLEMENTATION:

The flowchart represents how the flow of implementation of our project takes place in step by step. User has to install the Blynk app in android mobile and also install the Arduino IDE along with packages for ESP8266 and NodeMCU. In Blynk app we have to login first and create new project. We will get an authentication token to our mail which can be used in the program.

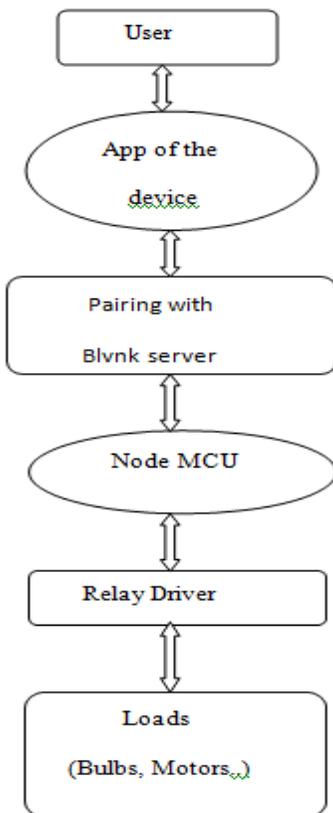
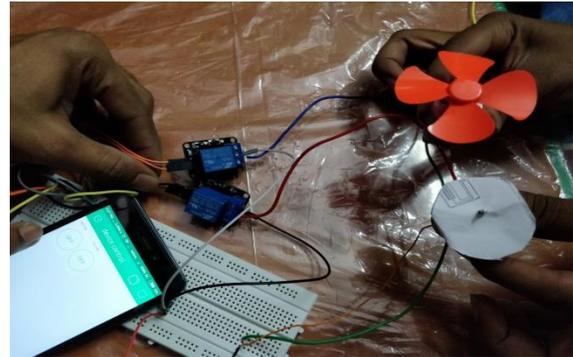


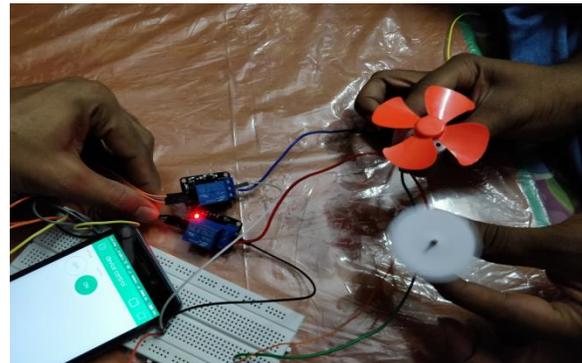
Figure 6: Flow chart

VI. RESULTS

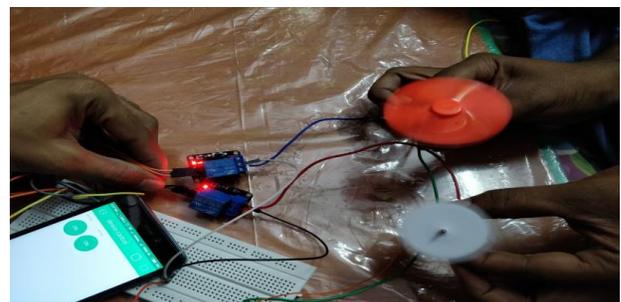
This result shows that two loads are connected to Wi-Fi network using nodeMCU and in Blynk app we have two buttons to control the two relays.

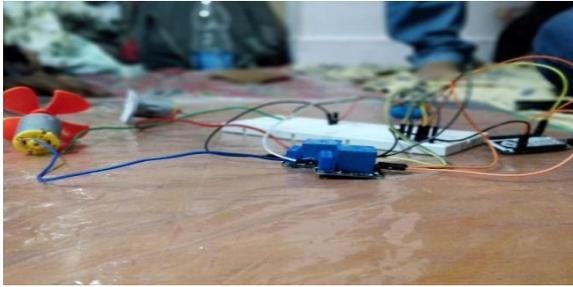


This result shows that when a button is turned on the corresponding relay is turned ON and load is operated. Here load may be anything. In our project we used DC motors as loads.



This result shows that when two or more buttons are turned ON at a time corresponding relays are turned ON and loads are operated. We can connect any number of loads. Here we had just shown two loads.





VII. CONCLUSION

The proposed Industrial Device Control method can reduce man power and disadvantages over implementing using Bluetooth module. This is one of the innovative method to control loads using android mobile. By using this method we can control any of the loads in industry located in various locations from a control room at a time. This method very secured. Authenticated persons can only control the loads. We can control the appliances from anywhere using mobile phone.

ACKNOELEDGEMENT

I would like to thank each and every anonymous referee for their guidelines which increased quality of this paper.

REFERENCES

- [1] Espressif system (December 30, 2013). "IoT Wi-Fi 802.11b/g/n integrated SoC implementation of volume production". Retrieved 2 April 2015.
- [2] Jump up to: a b NodeUSB. "An open IoT platform that simply works". NodeUSB. Retrieved 2 April 2015.
- [3] Rajeev Piyare and Seong Ro Lee " Smart Home-Control and Monitoring System Using Smart Phone " ICCA 2013, ASTL Vol. 24, pp. 83 - 86, 2013 © SERSC 2013
- [4] Jinsoo Han, Chang-Sic Choi, Wan-Ki Park, Ilwoo Lee Green home energy management system through comparison of energy usage between the same kinds of home appliances 2011 IEEE 15th International Symposium on Consumer Electronics
- [5] S.d.t. Kelly, n.k. Suryadevara and S.C. Mukhopadhyay Towards the Implementation

- of IoT for Environmental Condition Monitoring in Homes,IEEE Paper 2013
- [6] Jinsung Byun, Insung Hong, Byoungjoo Lee, and Sehyun Park, Member Intelligent Household LED Lighting System Considering Energy Efficiency and User Satisfaction,IEEE paper February 2013
- [7] Gopinath Shanmuga Sundaram, Bhanuprasad Patibandala, Harish Santhanam Bluetooth Communication using a Touchscreen Interface with the Raspberry Pi 978-1-4799-0053-4/13/31.00 2013 IEEE
- [8] Li Da Zu "Internet of Things in Industries: A Survey" IEEE Transactions on Industrial Informatics, vol. 10, no. 4, November 2014
- [2] Sadeque Reza Khan Professor Dr. M. S. Bhat "GUI Based Industrial Monitoring and Control System "IEEE paper, 2014
- [9] Ayman Sleman and Reinhard Moeller "Integration of Wireless Sensor Network Services into other Home
- [10] Mark D. Sen Gupta, CSIA Executive Conference San Diego, April 2014
- [11] M. Kim and K. Kim, AUTOMATED RFID-BASED IDENTIFICATION SYSTEM FOR STEEL COILS, Progress In Electromagnetics Research, Vol. 131, 1–17, 2012
- [12] S.d.t. Kelly, n.k. Suryadevara and S.C. Mukhopadhyay Towards the Implementation of IoT for Environmental Condition Monitoring in Homes,IEEE Paper 2013
- [13]. Jinsung Byun, Insung Hong, Byoungjoo Lee, and Sehyun Park, Member Intelligent Household LED Lighting System Considering Energy Efficiency and User Satisfaction,IEEE paper February 2013
- [14] Li Da Zu "Internet of Things in Industries: A Survey" IEEE Transactions on Industrial Informatics, vol. 10, no. 4, November 2014
- [15] Sadeque Reza Khan Professor Dr. M. S. Bhat "GUI Based Industrial Monitoring and Control System "IEEE paper