International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 09 | Sep 2020 www.irjet.net p-ISSN: 2395-0072

IoT Based Application for Industrial Controller Machines

Pratik Joil[1], Prof. Indira Bhattachariya[2]

[1]*Student, Department of MCA, Vivekanand Education Society's Institute of Technology (VESIT), Mumbai, India.*
[2]*Associate Professor, Department of MCA, Vivekanand Education Society's Institute of Technology (VESIT), Mumbai, India.*

Abstract - *This paper gives details and a prototype for monitoring different parameters of electronic machines and controlling them using IoT. This prototype contains UI (User Interface), hardware devices, cloud (Web Server). Node MCU (Microcontroller Unit) for prototyping. The ESP8266 module is one of the low cost and high features modules which makes it an ideal candidate to use in the prototype. Not all manufacturing plants consist of automation of controlling machines, and some machine controlling systems are available but they are not very cost-efficient. This prototype will be giving them an opportunity to add automation to their manufacturing plants, at a very low cost.*

Automating low-level tasks like switching ON and OFF electronic machines will give cost-benefit for big organizations by removing human involvement. This proposed system will help the organization not only control the electronic machines but also monitor them so that they can get the maximum use of their machinery. This monitoring and controlling machines can be done remotely, this gives extra power to the organization. This system we can use in the Medicine Manufacturing industry where before storing anything they need to create an environment that's cool or hot. Also, we can use this in Metal, Plastic Moulding plants where we need to start machines early to get ready for work.

Key Words — IoT, Node MCU, Cloud, Relay, Webserver, Electronic Machines

Literature Survey - In the latest paper of Industrial Device Control Using the Wi-Fi Module by P. Srinivasarao, K. Vamsi Saiteja, K. Prudhivarj, N. Prasanth Reddy, Ramavath Tejaswini they proposed system for controlling devices using Wi-Fi module. There are drawbacks in this prototype which is it only provides controlling for devices and it can be only accessible using a smartphone. This prototype can only be accessible using a smartphone because it uses Third Party app as client-side for giving instruction. Third Party app has an In-app purchase, which provides free for prototyping but as we scale we need to pay for its use.

Our proposed system does not need an app for client-side, it can be accessed using a Laptop, Desktop, or mobile phone. This proposed system is a plus point over the Third Party app in which we have to pay for scaling. Our proposed system has to control of machines as well as monitoring them so we can use this data for further studies.

INTRODUCTION

The first Industrial Revolution is known for the shift from our dependencies on animals, human effort as a primary source of energy to the use of fuel and mechanical power. The second Industrial Revolution comes with major breakthroughs of electricity, wireless and wired communication and new form of energy generation. The third Industrial Revolution comes with the development of digital systems, communication, computing power, processing. Currently we are living in the Fourth Industrial Revolution which brings the "Cyber-Physical Systems" involving entirely new capabilities for machines. These capabilities are relay on new technologies such as Internet of Things (IoT).

This paper displays the design and prototype of a proposed system which monitors and controls electronic machine. In this paper we will present an overview of IoT phenomena as well as its application in the manufacturing industry. The basic concept of IoT is everything in the world can be computer that is connected to computer. The basic concept of this prototype is, we are providing web application for controlling and monitoring machines. This web Application can be used using a mobile phone as well as computer. This web application will send data to a cloud server. Cloud server will give that data to node module and node module will further provide that instruction to the Relay, and according to instruction Relay will perform a particular action on an electronic machine, which is either ON or OFF. This ON and OFF data will be saved on a database for further monitoring of machines.

COMPONENTS

ESP8266 (Wi-Fi Module)
Relay
Board Module
MySQL Database
LED (as machines)
Cloud

NodeMCU (Wi-Fi Module)

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller - unit). The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits. Both the firmware and prototyping board designs are open source.

The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua- cjson and SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially was based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications

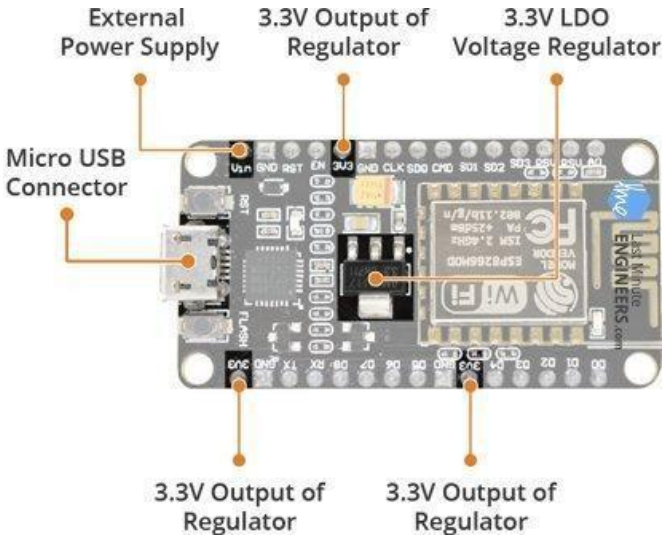

Figure 1: Node MCU

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). You can think of a relay as a kind of electric lever: switch it on with a tiny current and it switches on ("leverages") another appliance using a much bigger current. Why is that useful? As the name suggests, many sensors are incredibly sensitive pieces of electronic equipment and produce only small electric currents. But often we need them to drive bigger pieces of apparatus that use bigger currents. Relays bridge the gap, making it possible for small currents to activate larger ones. That means relays can work either as switches (turning things on and off) or as amplifiers (converting small currents into larger ones).

Figure 2: Relay

Block Diagram

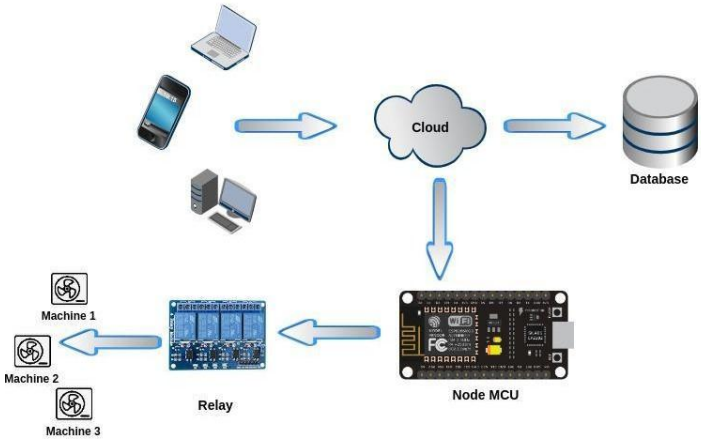

Figure 3: Solution Block Diagram

IMPLEMENTATION

The below flowchart represents the flow of implementation of our proposed system.

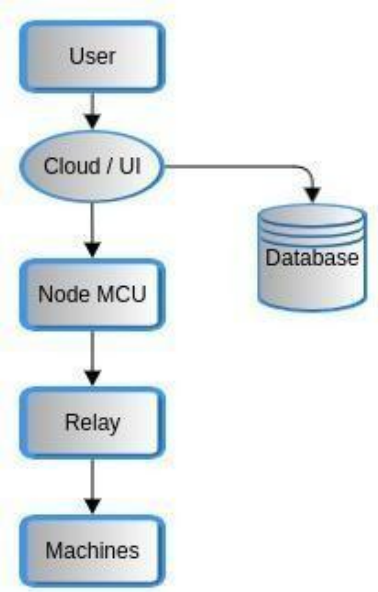

Figure 4: Implementation Structure

We are using GCP (Google Cloud Platform) as a cloud for prototyping, it gives one year free uses. To use our proposed system user has to go on the web application provided to them. They have to Log In to the system to use the web application this gives security, so only can authorized persons can use the system. At the time of sign up, the user will have the authority to add machines for automation. This will land to a page of, Number of machines are added to the system for automation.

Now, the user will have access to machines which are available for automation, user can also see which machines are currently in ON state and which machines are currently in OFF state. Using this User Interface users can now either ON a machine or OFF a machine according to their need. The data/instruction will send to a node module through a network. Node module will send a request to the server every five seconds for an update. After receiving data/instruction from the cloud, it will extract that instruction and perform an action on Relay. This instruction is in the form of 0 and 1. 0 (Zero) for switching OFF and 1 (One) for switching ON the machine. According to provided instruction Relay will perform that action on an electronic machine.

Advantages

- Access machine from anywhere and from any smart device
- Monitoring and report generation
- Inexpensive
- Flexible Design and Enhance Function

Disadvantages

- Needs continuous internet connection
- Needs dedicated server for rest API
- It does not have internal battery so it needs continuous power connection

Software Used

Dashboard is developed using HTML5, CSS3, JQuery, JavaScript and for backend PHP and mysql is for database. It has admin login which has functions to add new machines into dashboard, Remove previously added machines, Control machines, View machines ON/OFF logs.

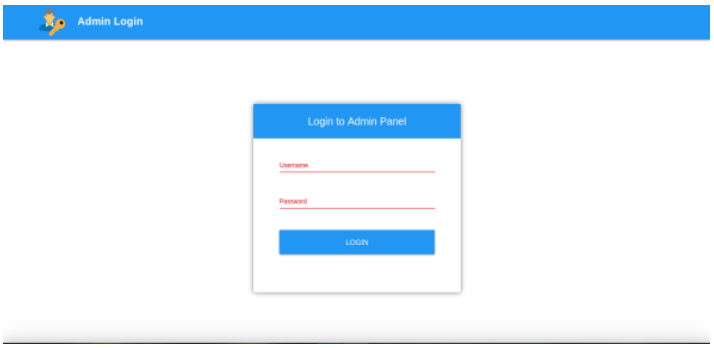

Figure 5: Admin Login Page

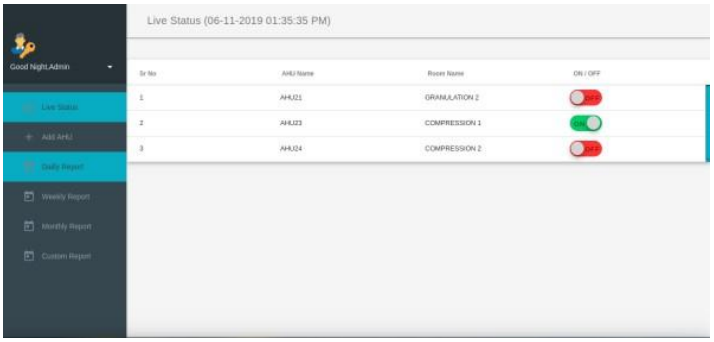

Figure 6: Machine Control Page

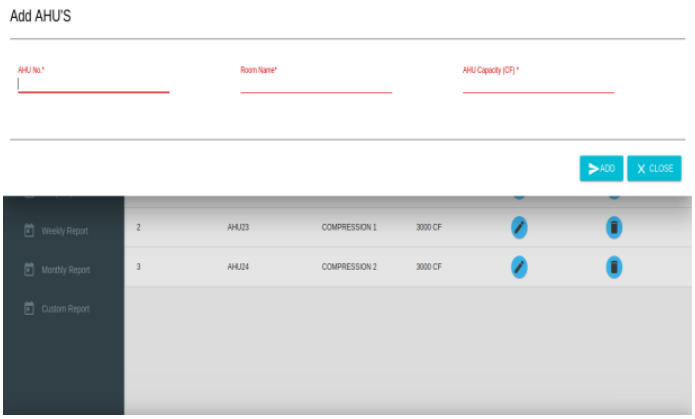

Figure 7: Add New Machine Page

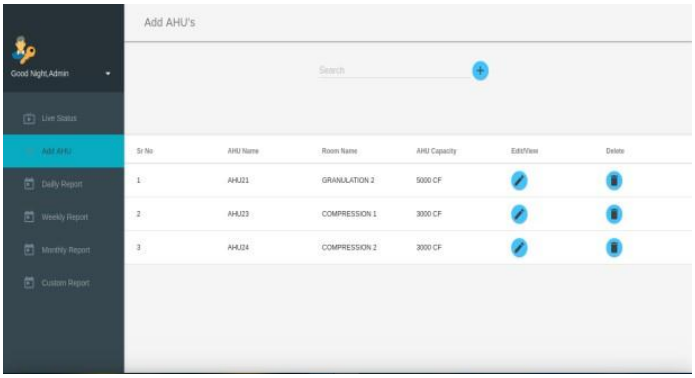

Figure 8: All Machines List

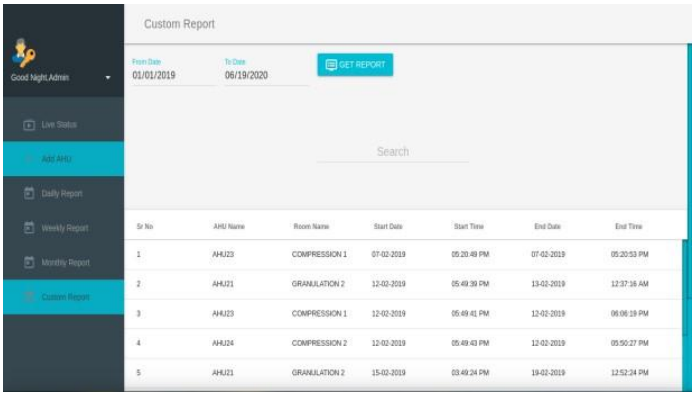

Figure 9: Machine Logs

CONCLUSION

This proposed system will play an important role in manufacturing industries to automate task which requires human involvement. Due to this methodology, industrial manufacturing machines will get controlled and monitored. In point of reducing human involvement, this will also reduce cost. This method is very secured and only authenticated persons can control the system.

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