International Journal of Engineering Research and Applications *www.ijera.com*
ISSN: 2248-9622, pp. 01-04

RESEARCH ARTICLE OPEN ACCESS

IOT Industrial Automation Using Raspberry Pi

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ABSTRACT
This page contains the concept of IOT , Industrial automation using IOT and Raspberry pi. In previous few years, Internet of Things or IOT plays a vital role for new generation automation companies. It helps to connect everything around you to internet including wearable devices, metering devices and environmental sensor. Here we can remotely control and monitor industrial device parameters by using IOT and Raspberry Pi . The Raspberry Pi is used as computer and server, and the coding is done in Python. Raspberry Pi is a portable, reduced computational platform that can handle a wide range of applications.
Here we propose efficient industry automation system that allows user to efficiently control industry appliances/machines over the internet.
Keywords – *Industrial Automation, Internet of Things, Raspberry pi, Python Language*

I. INTRODUCTION

There are many things we hear about industrial internet of things as it is new emerging technology. We use sensors to continuously monitor industry appliances which is highly impossible to manage by human.

Today worldwide multitude of Internet connections are devices used directly by humans like computers and mobile handsets, in other words we can say it's a human to human communication. In not a distance future, it's possible that we can have not only human-human communication but also device-device communication which is called "Internet of Things" where Things refers to various electronic devices. The term 'Internet of Things' was firstly coined by Kevin Ashton in a presentation in 1998, he described a IoT as a system where the digital world is connected to the physical world forming a global network. With IoT not only we can access the information from anyplace, at any time, by any person, but we can also control and monitor various devices from anyplace, at any time, on any network, by any authenticated person, this technology is called Internet of Things (IoT).

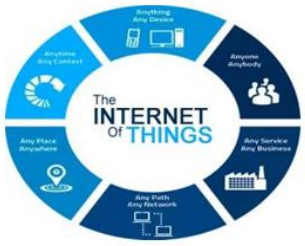

Figure 1: Internet of Things

The concept of IoT aims in making Internet more ubiquitous and immersive. Thus accelerating the internet to make it enable by any authorized person for easy access and to have an interaction with enormous variety of devices for instance, home gadgets, spying cameras, monitoring sensors, actuators, automobiles, displays, and so on, the IoT will nurture the development of a number of applications that make use of the virtually enormous amount and variety of data generated by Things to provide new benefits to citizens, industry, and government sectors.

And Industrial automation is the use of control systems, such as computers or robots, and information technologies for handling different processes and machineries in an industry to replace a human being. It is the second step beyond mechanization in the scope of industrialization.
Automation is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching in telephone networks, steering and stabilization of ships, aircraft and other applications with minimal or reduced human intervention.
In this project we propose efficient industry automation system that allows user to efficiently control industry appliances/ machines over the internet. We are also using Different sensor(Temperature sensor, Humidity Sensor, camera, Gas Sensor) to monitor industry appliances with the help of smartphones.

II. METHODLOGY

1. OVERVIEW

The Raspberry Pi single board computer is used as the main device controller in the project. It is used to establish communication with the remote IOT server using the IOT protocols over the WiFi connection.

The power supply on the circuit board provides 5VDC to the Raspberry Pi controller and the LCD.. The Raspberry Pi controller has built-in WiFi, USB, and A/V ports. The programming of the Raspberry Pi controller is done is Python scripting language. The Raspberry Pi controller runs the Raspbian OS which is a distribution of Linux OS.

There are four relays connected to the output pins of the Raspberry Pi controller. Four different industrial devices are connected to these relays. And a four different sensors are also connected to Raspberry pi. The Raspberry Pi board communicates with the remote server based IOT platform by means of built-in WiFi. The control commands are provided by the user in the IOT platform. These commands are then communicated to the Raspberry Pi controller over the WiFi using IOT protocols. According to these commands, the Raspberry Pi controller turns the relays on and off. An LCD is also connected to the Raspberry Pi controller which is used to display the device statuses as well as other messages.

2. BLOCK DIAGRAM

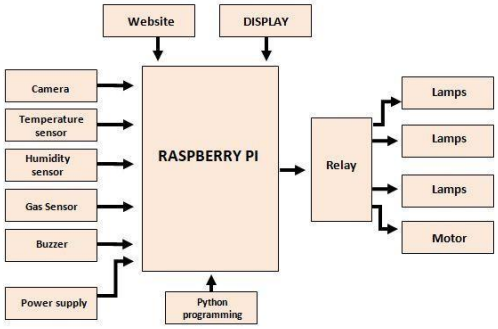

Figure 2: Block Diagram

3. HARDWARE USED:

Raspberry Pi, LCD Display, Wifi Module, Relay Temperature sensor, Humidity sensor, Gas sensor, Camera, Rectifier, Regulator, Resistors, Capacitors, Transistors, Power Supply, Cables and Connectors, Diodes, LED, Transformer/Adapter, Switch. IC, IC Sockets, Motor, Lamps.

Some of Hardware descriptions are given below:

i. Raspberry Pi:

Raspberry Pi is a low cost, credit- card sized computer that plugs into a computer monitor or TV and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing and to learn how to program in languages like Scratch and Python. It is capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games. Raspberry Pi 4 is the latest iteration of the Raspberry Pi product family and it offers the fastest performance when compared with the previous generations.

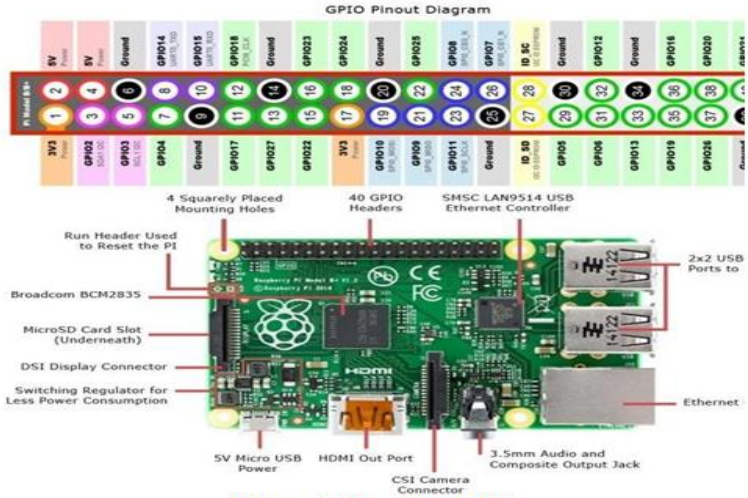

Figure 3: Raspberry Pi

ii. RELAY:

In layman terms, a relay is a switch. Technically speaking, a relay is an electromagnetic switch where a small control signal (usually from a microcontroller) at the input of the Relay will control a high voltage supply (usually AC mains).

Since this is a Raspberry Pi based project, let us talk with respect to Raspberry Pi. The Raspberry Pi computer, although a powerful device, works on a 3.3V Logic.

If you want this powerful computer to control your electrical loads, like an LED strip running along your garden or kitchen, you cannot interface them directly as the electrical loads work on AC Mains supply and the Raspberry Pi works on 3.3V DC (technically).

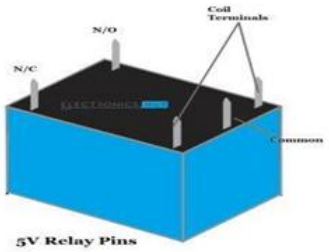

Figure 4: Relay

iii. RELAY MODULE:

Even though the Relay Coil needs a small current in order to get energized, driving it directly from Raspberry Pi (for that matter, any Microcontroller like 8051 or Arduino) is not a good idea.

A simple way is to drive the Relay Coil through a Transistor. The following image shows the connections required with respect to a Relay.

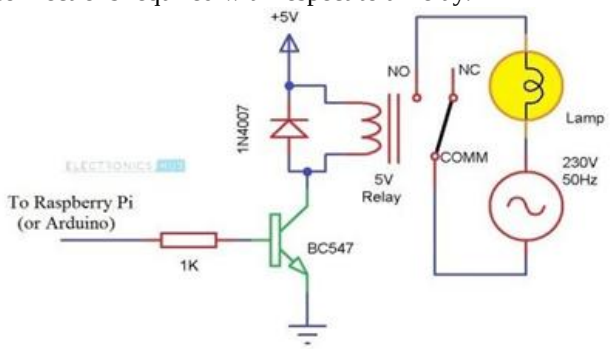

Figure 4: Circuit Diagram of Relay Module

The circuit shown above will drive a relay with minimum number of components (a Transistor, a current limiting resistor, a Relay and a Diode).

A Relay Module is a simple circuit board that consists of the relay itself and all the necessary components that are required to drive a relay and also the required connectors to connect the load.

I have used a four channel relay module in this project. It is basically, four relays with all the circuitry on a single board.

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Figure 5: Relay Module

iv. Temperature Sensor

A **temperature sensor** is an electronic device that measures the **temperature** of its environment and converts the input data into electronic data to record, monitor, or signal **temperature** changes.

The DS18B20 **temperature sensor** is perfect for projects like weather stations and automation systems. these **sensors** are easy to set up on the **Raspberry Pi**. They're the same size as a transistor and use only one wire for the data signal.

Figure 6: Temperature Sensor

v. Humidity Sensor

The DHT11 is a low-cost temperature and **humidity sensor**. It isn't the fastest **sensor** around but its cheap price makes it useful for experimenting or projects where you don't require new readings multiple times a second. The device only requires three connections to the **Pi**. +3.3v, ground and one GPIO pin.

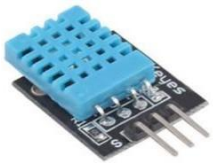

Figure 7: Humidity Sensor

vi. Pi Camera Module

The **Pi camera module** is a portable light weight **camera** that supports **Raspberry Pi**. It communicates with **Pi** using the MIPI **camera** serial interface protocol. It is normally used in image processing, machine learning or in surveillance projects.

vii. Wifi Module

Low-power, low-cost Wi-Fi modules have changed the landscape of wireless sensor networks. Autonomous, Wi-Fi sensors connect to common, widely available wireless network infrastructure. They send sensor data over standard TCP/IP making their information anywhere in the world from any computer or smart phone.Previously, wireless sensors networks have been built on top of proprietary protocols running on sub- gigahertz radios. These systems have the benefit of covering long distances however they are closed systems. Likewise sensors networks based Zigbee radios are also closed system. Both of these wireless sensor networks require additional gateway hardware devices to get sensor data onto the internet or users LAN. Gateways introduce a single point of failure and additional cost.

viii. LCD display

This display is a cool way to display some information from the Pi without needing any expensive or complicated display setup.

A 16×2 display unlike a touchscreen or a regular LCD screen is best used to display short messages or information.

4. SOFTWARE USED

i. **Raspbian OS**: Raspbian is a free working framework in based on Debian. It is based on the Raspberry Pi module. A working framework is the arrangement of fundamental programs and utilities that make your Raspberry Pi run. It gives essentially speedier execution to applications that make substantial utilization for floating point arithmetic operations. Every single other application will likewise increase some execution speed because of advanced instruction of the ARM11 CPU in Raspberry Pi.

ii. **Apache HTTP Server**: The Apache HTTP Server which is called as Apache is the world's most famous web server software. It is based on the NCSA HTTP server. Apache has a big role in the initial growth of the World Wide Web. An open community of developers under the auspices of the Apache Software Foundation have developed and maintained Apache. This is most commonly used on a Linux; this software is available for a wide variety of operating systems, including UNIX, FreeBSD, Linux and Solaris.

iii. **TCP IP Protocol** : The same layered structure as used in the TCP/IP protocol suite is used by the software running on the embedded web server. The TCP/IP protocol suite permits PCs of all sizes, running distinctive operating systems to communicate with each other. The TCP/IP protocol suite is a blend of various conventions at different layers as appeared in Figure. Figure demonstrates Layers of TCP/IP protocol suit. Each layer is independent from each other. The Link Layer generally incorporates the device driver in the operating system and corresponding network interface (card) in the PC. An Ethernet controller driver controls the Ethernet interface and the network layer controls the communication.

III. APPLICATION

Sensors can be used in manufacturing and the workplace. over a vast area of devices and instruments Artificial Intelligence and the Internet of Things are used to manage and track components.

Hospitals and laboratories: We can position sensors on the patient's body, and the doctor can check the patient's current status on his Android phone, as well as take the required actions and decisions.

At Home: we can use sensors to track and control our heating and cooling systems.

IV. FUTURE SCOPE

With reference to this system we add the various parameters and make the industry is fully automated. We use weight sensor, PH sensor, color sensor, length and domination sensor. Using this sensor to reduce the time, effort of employ and authorized person take quick decision and improve the production. The overall this thing can be done by Internet Of Thing (IOT).

V. CONCLUSION

We concluded that by applying these platforms, we will be able to access real-time data and monitor the devices that are linked to our system. This is one of the groundbreaking projects that uses a smartphone to intelligently monitor our home or workplace. Nowadays, a smartphone is an inevitable unit. As a result, the cost of additional hardware units will be greatly reduced, as well as the project will be easier to handle.

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