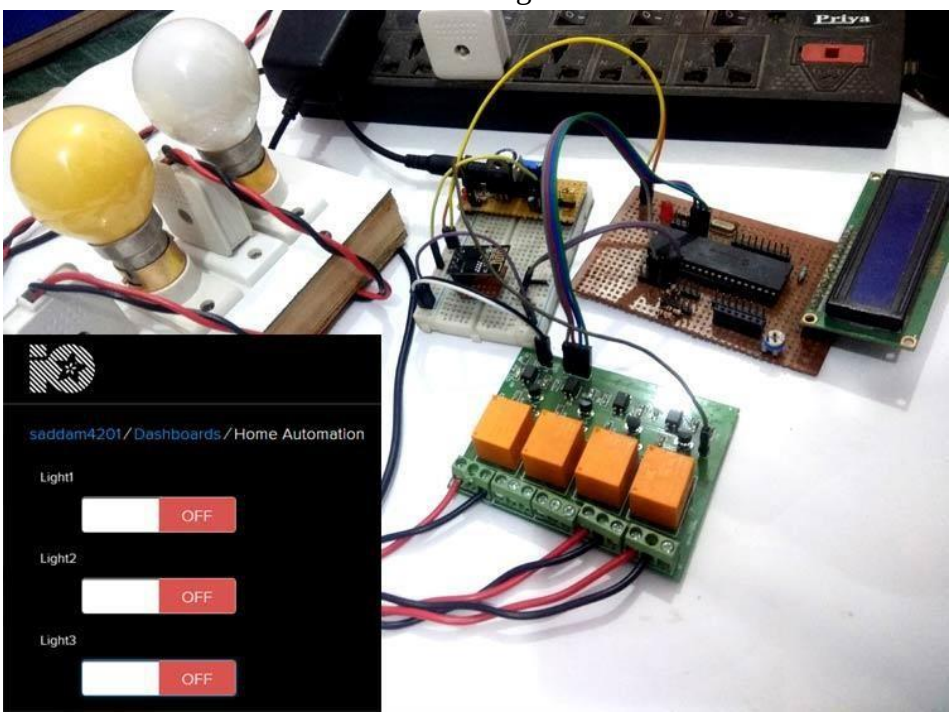
5.4.1 Home Automation

IoT based Web controlled Home Automation using PIC Microcontroller and Adafruit IO



IoT based Web controlled Home Automation using PIC Microcontroller and Adafruit IO

Home Automation has always been inspiring projects for most of us. Toggling an ACload from the comfort of our chairs or bed of any room without reaching for the switch in another room sounds cool doesn't it!!. And now in the era of IoT, thanks to the ESP8266 module which made it easy to control anything from anywhere in the world.

In this IoT based project, we will use Adafuit IO to control Home appliaces from a webpage using ESP8266 and PIC microcontroller. We have connected three AC light as loads and they can be controlled remotely using either your phone or computer. Here ESP8266 is used with PIC microcontroller.

Component RequiredESP8266

PIC microcontroller(PIC16f877A)

12V 5A Electromagnetic Relay Module -112v Power supply (12V/1A or above) -1 LM7805 Voltage Regulator -1

LM317 Regulator -110k ohm

Resistor -11k

Resistor – 3 10k

Pot – 1

1k Pot -1 16x2 LCD

1000uF capacitor -1

10uF capacitor -2

Wires for connection

18.432 MHz Crystal oscillator -1

LED -2

22pF capacitor -2
BreadBoard or PCB (optional)

Circuit Diagram

In Web controlled Home Automation project, we have used PIC microcontroller PIC16F877A for performing all the operations. It will communicate with ESP8266 Wi-Fi module to send and receive data from the Adafruit server and take action accordingly to turn ON/OFF relay or load and displaying the status of loads over LCD. We have used 16x2 LCDdisplay for displaying the status of connected AC appliances.

In this project we have three power supplies:

As we have used a 12v relay module we need 12v so we have used a 12v adaptor to power the relay.

We needed 5v for powering the PIC microcontroller, LCD and some of the relay module circuit. So we have used a 7805 voltage regulator connected with a 12v supply. This voltage regulator provides 5v output.

A 3.3v power supply is used for powering the ESP8266 as it works on 3.3v. This supply is made by using LM317 voltage regulator which can be configurable to 3.3v by using some voltage divider circuitry with this. Learn more about creating a LM317 based variable power supply.

Setup Adafruit IO for IoT Home Automation

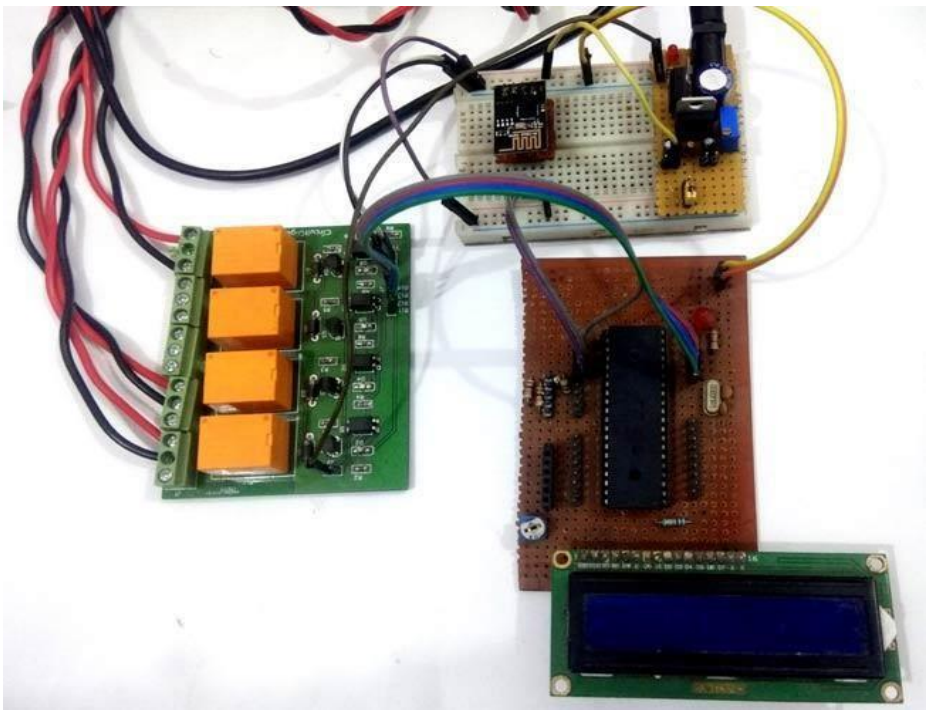
In this project, we are going to control some home AC appliance via a web page crated using Adafruit IO. Adafruit IO is a simple to use internet service that easily enables IoT devices to GET and POST data. Additionally, it can be used to create GUI interfaces for viewing data, controlling devices, and triggers for alerts/warnings.

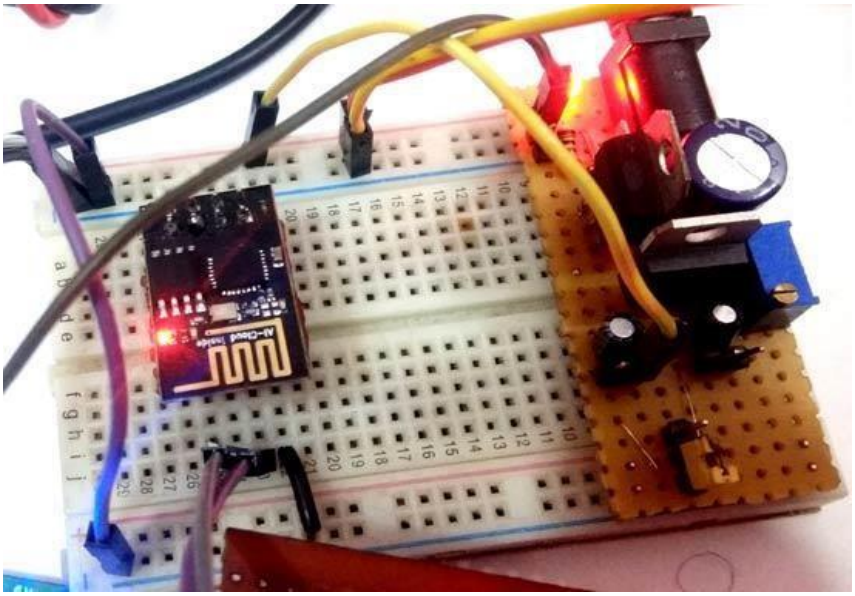
MQTT Protocol

This IoT based Home Automation Project uses MQTT protocol for exchanging data between server and client. This protocol is very fast compared to the TCP/IP protocol. And the working concept is also different from the TCP/IP protocol. This protocol has three maincomponents.

Publish ,Broker ,Subscriber

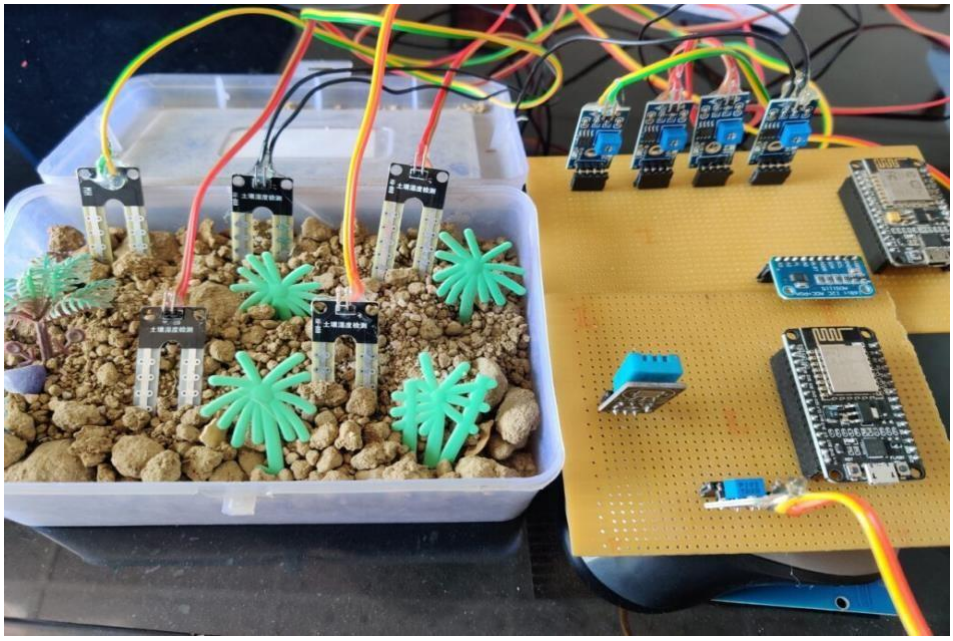
According to MQTT.org (official website), “MQTT stands for MQ Telemetry Transport. It is a publish/subscribe, extremely simple and lightweight messaging protocol, designed for constrained devices and low-bandwidth, high-latency or unreliable networks. The design principles are to minimize network bandwidth and device resource requirements whilst also attempting to ensure reliability and some degree of assurance of delivery. These principles also turn out to make the protocol ideal of the emerging “machine-to-machine” (M2M) or “Internet of Things” world of connected devices, and for mobile applications where bandwidth and battery power are at a premium.”





5.4.2 Smart Agriculture

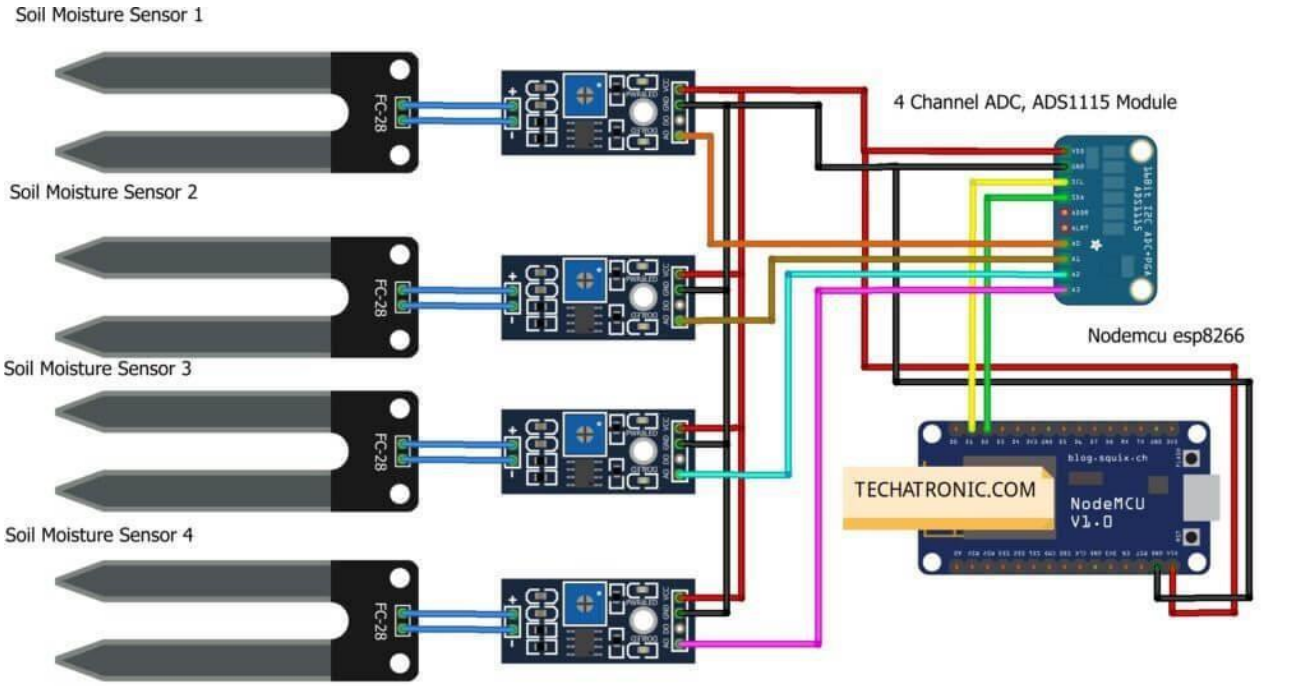
This is smart farming using IoT in this project we will use the server to store the sensor data this is similar to our recent smart agriculture using IoT project.



What is Smart farming using IoT?
Smart farming project is in trend nowadays. everyone wants their farm and land to be smart because it is attractive and techy and also it reduces the manpower they needed to make the system work.

Here, you need a circuit diagram, code, and thingspeak instruction. so we are going to give you all the things below. follow all the steps and make your circuit as we have given.

Here we are going to use two nodemcu.
because we have here 5 analog sensors and 1 DHT.
so we will use 4 soil moisture sensors with the Nodemcu 1 and dht11 and 1 soil moisture sensor with the second node MCU.
and there we need two codes for these two nodemcu.
So, make this project carefully. upload first code with the first nodemcu as we have given below.



Components Required:-

- NodeMcu-2
- General-purpose PCB
- 4 channel ADC multiplexer
- 5 soil moisture sensor
- DHT11
- Breadboard
- Jumper wires

Connection Diagram

Nodemcu esp8266	4 Channel ADC
VV, Vin	VCC
G, GND	GND
D1 Pin	SCL Pin
D2 Pin	SDA Pin

Soil 1 Sensor	Soil 2 Sensor	Soil 3 Sensor	Soil 4 Sensor	4 Channel ADC
VCC	VCC	VCC	VCC	VCC
GND	GND	GND	GND	GND

A0				A0
	A0			A1
		A0		A2
			A0	A3

After making all the connections You need to upload the Code.

Connect all the Soil moisture sensor Vcc to the Nodemcu Vin

Connect Multiplexer Vcc to the Nodemcu Vin

Connect all the Soil moisture sensor Gnd to the Nodemcuo Gnd
Connect Multiplexer Gnd to the Nodemcu Gnd
Soil moisture sensor Output connects to the Multiplexer as given in the above image

Smart agriculture is mostly used to denote the application of IoT solutions in agriculture. So what is smart agriculture using IoT? By using IoT sensors to collect environmental and machine metrics, farmers can make informed decisions, and improve just about every aspect of their work – from livestock to crop farming.
The adoption of IoT solutions for agriculture is constantly growing. COVID-19 has had a positive impact on IoT in the agriculture market share. Disruptions in the supply chain, and the shortage of qualified workers, has propelled its CAGR to 9,9%. In fact, as per recent reports, the smart framing market share is set to reach $6.2 billion by 2021.

There are many types of IoT sensors for agriculture as well as IoT applications in agriculture in general.

Monitoring of climate conditions
Probably the most popular smart agriculture gadgets are weather stations, combining various smart farming sensors. Located across the field, they collect various data from the environment and send it to the cloud.

Greenhouse automation
The use of IoT sensors enables them to get accurate real-time information on greenhouse conditions such as lighting, temperature, soil condition, and humidity.
In addition to sourcing environmental data, weather stations can automatically adjust the conditions to match the given parameters. Specifically, greenhouse automation systems use a similar principle.

Crop management
Just like weather stations, they should be placed in the field to collect data specific to crop farming; from temperature and precipitation to leaf water potential and overall crop health. You can monitor your crop growth and any anomalies to effectively prevent any diseases or infestations that can harm your yield.

Cattle monitoring and management
Just like crop monitoring, there are IoT agriculture sensors that can be attached to the animals on a farm monitoring their health and log performance. Livestock tracking and monitoring help collect data on stock health, well-being, and physical location.
For example, such sensors can identify sick animals so that farmers can separate them from the herd and avoid contamination.

Precision farming
Also known as precision agriculture, precision farming is all about efficiency and making accurate data-driven decisions. It's also one of the most widespread and effective applications of IoT in agriculture.
By using IoT sensors, farmers can collect a vast array of metrics on every facet of the field microclimate and ecosystem: lighting, temperature, soil condition, humidity, CO_2 levels, and pest infections. This data enables farmers to estimate optimal amounts of water, fertilizers, and pesticides that their crops need, reduce expenses, and raise better and healthier crops.

Agricultural drones
Perhaps one of the most promising agritech advancements is the use of agricultural drones in smart farming. Also known as UAVs (unmanned aerial vehicles), drones are better equipped than airplanes and satellites to collect agricultural data.

Predictive analytics for smart farming
Precision agriculture and predictive data analytics go hand in hand. While IoT and smart sensor technology are a goldmine for highly relevant real-time data, the use of data analytics helps farmers make sense of it and come up with important predictions: crop harvesting time, the risks of diseases and infestations, yield volume, etc.
Data analytics tools help make farming, which is inherently highly dependent on weather conditions, more manageable, and predictable.

End-to-end farm management systems
A more complex approach to IoT products in agriculture can be represented by the so-called farm productivity management systems. They usually include a number of agriculture IoT devices and sensors, installed on the premises as well as a powerful dashboard with analytical capabilities and in-built accounting/reporting features.
This offers remote farm monitoring capabilities and allows you to streamline most of the business operations.
In addition to the listed IoT agriculture use cases, some prominent opportunities include vehicle tracking (or even automation), storage management, logistics, etc.