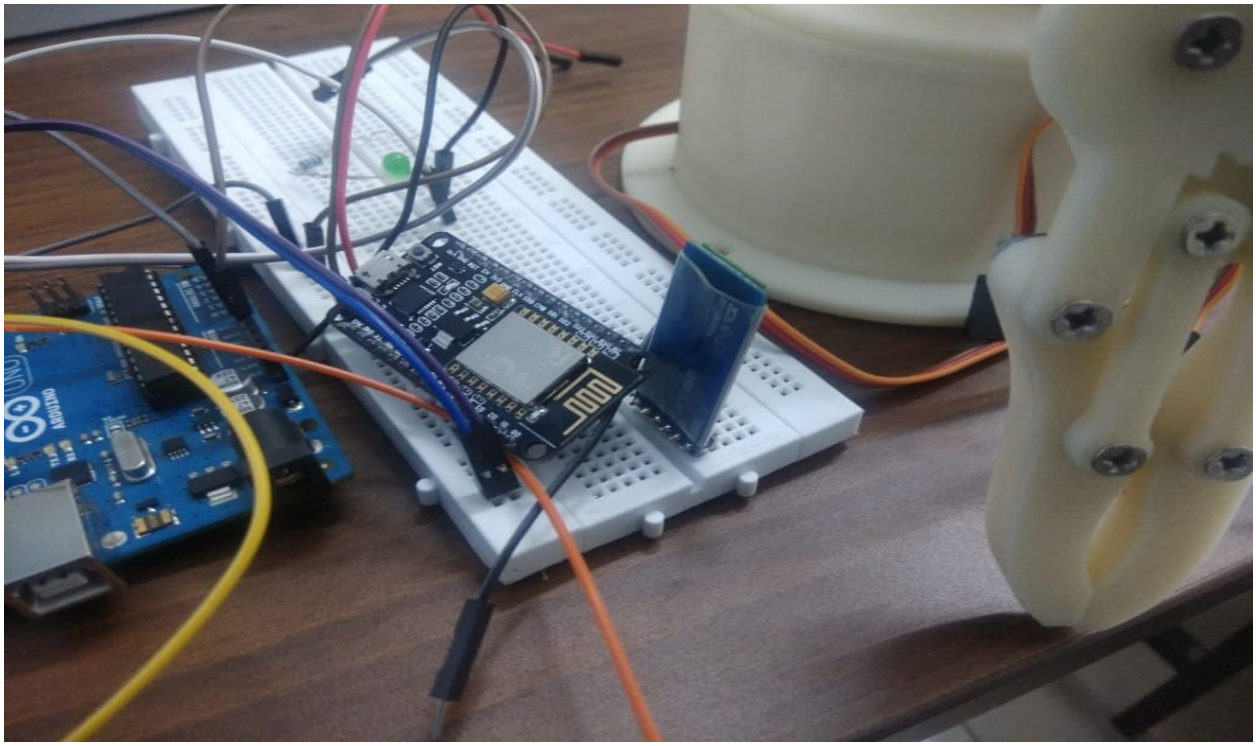
Tinkering Lab GE107

# IOT BASED ROBOT CONTROLLABLE BY AI VOICE ASSISTANT



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## Introduction

Internet of Things (IoT) had a recent breakthrough in the Tech Era. Many of these are already visible around in the form of smart devices such as Smart Bulbs, Fans, Mirrors etc. It has a varied application in day to day life and can help us automate a variety of tasks which are normally performed manually. We tend to perform one such automation as a demonstration of how much more powerful it can make the already existing technologies. We tend to control a mechanical robotic arm using a Voice Assistant. Here we use Google Assistant but in general, any voice assistant can be used which has API provided in IFTTT applets like Google Assistant and Alexa. IFTTT has a large collection of such APIs.

## Technology Stack

- **Google Assistant -** The Google Assistant is an artificial intelligence-powered virtual assistant developed by Google that is primarily available on mobile and smart home devices. Unlike the company's previous virtual assistant, Google Now, Google Assistant can engage in two-way conversations. It can recognize your words better than any devices and respond quickly and correctly to your commands. Users primarily interact with the Google Assistant through natural voice, though keyboard input is also supported.
- **IFTTT applets -** If This Then That, also known as IFTTT, is a free web-based service to create chains of simple conditional statements, called applets. An applet is triggered by changes that occur within other web services such as Gmail, Facebook, Telegram, Instagram, or Pinterest. For example, an applet may send an email message if the user tweets using a hashtag, or copy a photo on Facebook to a user's archive if someone tags a user in a photo. In addition to the web-based application, the service runs on iOS and Android.

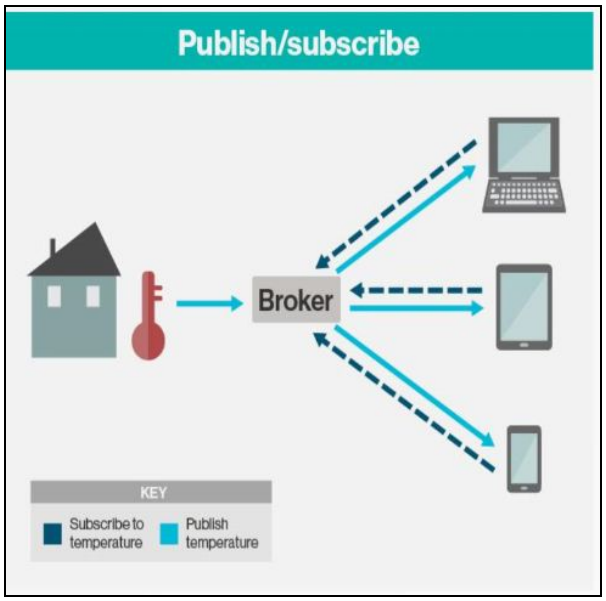



Figure 1: Working of MQTT in simple terms. The system basically comprises of one broker and multiple clients. In this case, clients are devices like smartphones, sensors and other home appliances. They all communicate with the server which is known as the broker.

- **AdafruitMQTT from Adafruit.io -** MQTT(Message Query Telemetry Transport ) is a client-server publish/subscribe messaging transfer protocol. This protocol is

widely used in the field of IoT Communication between Machine to Machine. It has many features such as easy implementation, Low Bandwidth requirement, lightWeight and simple messaging protocol. Above features make it ideal for using it to collect data from sensors and provide it to Microcontrollers for further processing. We have used Adafruit MQTT for this which provides us feeds for serving the data from Google Assistant trigger of IFTTT to the feed which is then transferred to Microcontroller.

- **NodeMCU(ESP8266) -** NodeMCU is an open-source IoT platform.It includes firmware which runs on the ESP8266 WiFI SoC from Espressif system and hardware which is based on the ESP-12E module. The term NodeMCU refers to the firmware rather than development kits. The firmware uses the Lua Scripting Language. We connected it to WiFi and provided it with the AdafruitMQTT unique key through which it was able to establish a communication with the AdafruitIO feeds and was able to receive Stream data from Server and transfer it to the Arduino Microcontroller for further processing.

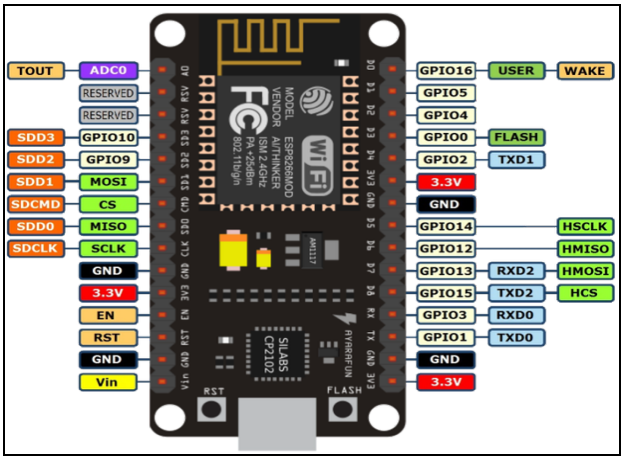



Figure 2: Pin Diagram of NodeMCU(ESP8266)

- **AutoConnect -** It an Arduino library united with ESP8266WebServer class of ESP8266 or WebServer class of ESP32. Easily implementing the Web interface constituting the WLAN for ESP8266/ESP32 WiFi connection. With this library to make a sketch easily which connects from ESP8266/ESP32 to the access point at runtime by the web interface without hard-coded SSID and password.

- **Arduino Uno -** It is an open-source prototyping platform which helps us to Model IoT Devices. It receives the signal from ESP8266 NodeMCU and processes it to take

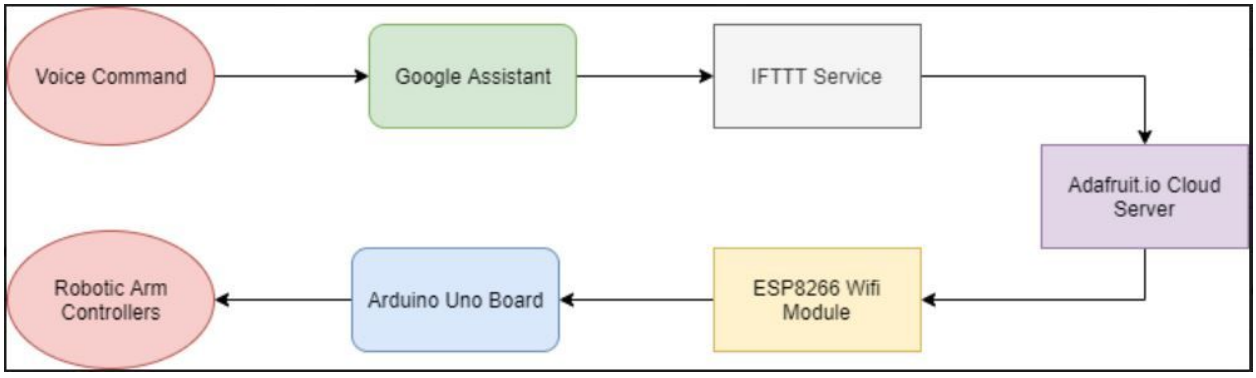
certain actions which in our case is controlling the servo motors and set them at a particular angle.

- **Servo -** It is tiny and lightweight with high output power. This servo can rotate approximately 180 degrees (90 in each direction) and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servos. It comes with 3 horns (arms) and hardware. We have connected it to a 3d printed model which is manufactured using CAD(Computer-Aided Design )Modeling.

## Hardware Communications and Overall Control

First of all, we need to set up a Google account to use adafruit.io and IFTTT. Both are configured using the same account so that we can use it on our Android Phones. We have set up feeds on the Adafruit IO and corresponding triggers on the IFTTT applets. Once the Adafruit is configured we can get all the keys and feed names so that we can use it on the code of ESP8266. Once all the coding is done we connect the NodeMCU to Arduino UNO Board. The Arduino is connected to Servo Motors. The Arduino is programmed using the Arduino IDE. The codebase is available on GitHub but not made public yet. We will open-source it once the Semester is over to avoid plagiarism. Communication is detailed in the following mechanism:

We say a voice command to the google assistant on the phone. It does the Natural Language Understanding (NLU) part automatically and takes an action based on the IFTTT applets. It writes the input received to the Adafruit Feed which is read by the NodeMCU using MQTT. From the Node, the Command is passed to the Arduino UNO and where it takes action on Servo Motors which corresponds to the movement of the robotic arm.



## Further Scope and Implementations

As we Have automated the robotic arm using the google assistant we can use it to automate various routines of our life. like we can automate the rooftop water tank filling. in that case, triggers could be set up to start the motors at a particular time and stop it once the tank is full. all this can be implemented using the wifi module and Arduino.

We can also automate door locks which would open only when the owners issue a command using his mobile to open the lock.

Other than that normal household lights and fans can be automated using nodeMCU chip which is very easy and cost-effective

## References


[1] IoT Based Robot with Wireless and Voice Recognition Mode https://www.researchgate.net/publication/321289206_IoT_Based_Robot_with_Wireless_and_Voice_Recognition_Mode

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[5] https://www.ifttt.com/applets

[6] https://github.com/Hieromon/AutoConnect


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