INTRODUCTION TO **IOT**

A hands-on session by
ELECTRONICS CLUB, CFI

What is Internet of Things?

- A network of devices such as vehicles, and home appliances that contain electronics, software, sensors, actuators, and connectivity which allows these things to connect, interact and exchange data.
- IoT transforms everyday physical objects that surround us into an ecosystem of information.
- We aim at automating everything that can be automated.

How does IoT work?

Sensors ---> Connectivity ---> Data Processing ---> User Interface

- ➔ An IoT system consists of sensors/devices which “talk” to the cloud through some kind of connectivity. Once the data gets to the cloud, software processes it and then might decide to perform an action, such as sending an alert or automatically adjusting the sensors/devices without the need for the user.
- ➔ But if the user input *is* needed or if the user simply wants to check in on the system, a user interface allows them to do so. Any adjustments or actions that the user makes are then sent in the opposite direction through the system: from the user interface, to the cloud, and back to the sensors/devices to make some kind of change.

Where do we apply IoT?

- **Consumer needs :**

  Smart home, Elder care

- **Commercial applications :**

  Medical and healthcare, Transportation, Office automation

- **Industrial requirements :**

  Manufacturing, Agriculture

- **Infrastructure spaces :**

  Energy management, Environmental monitoring, Living Labs

What next?

From “If” to “How”:

- ➔ Whether or not businesses employ IoT applications will no longer be in question since they will be fully ingrained into IT landscapes and digital strategies. Instead, the focus will be on how businesses are leveraging connectivity to increase efficiencies.

From “Technology” to “Business Outcome”:

- ➔ IoT will be considered an intrinsic feature of business, indistinguishable from other standard processes. For example, IoT applications will be considered essential to the operations of modern warehouse systems, company car fleets and more.

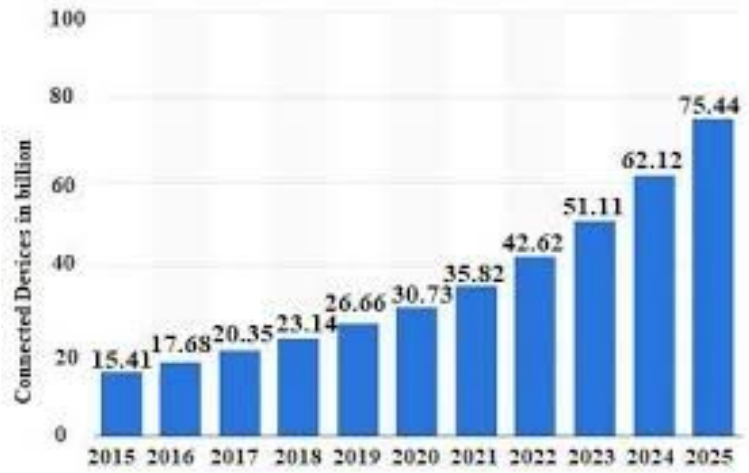
What next?

- ➔ Business-led approaches to procuring and managing IoT will dominate in order to drive measurable results. Further, IoT and other IT components such as cloud, mobile and analytics will be purchased together as part of a fully-integrated solution. From “Caution” to “Action”: Cybersecurity will continue to be critical. As IoT becomes part of the fabric of overall IT security practices, businesses will take an active approach in protecting this crucial asset.

From “Optimize” to “Engage”:

- ➔ As businesses build IoT into their products and services, certain sectors will take a natural lead when it comes to revolutionizing how they engage customers. The automotive industry, through the connected car, and healthcare, through mHealth, will be among the sectors leading the way.

What is future of Internet of Things?



- Bain predicts the combined markets for IoT to be valued at $520 billion by 2021, double the value in 2017.
- Data center and analytics will be the fastest growing IoT segment with a CAGR of 50% from 2017 to 2021.

Things You'll Learn

ESP32 -

Wifi module and the main processing unit used in our project. It is a a dual core microcontroller which has many other features such as bluetooth, built-in antenna switches, power amplifier etc.

IFTTT (If This Then That) -

A free web-based service which is used to create applets which are triggered by changes which occur in other commonly used web services.

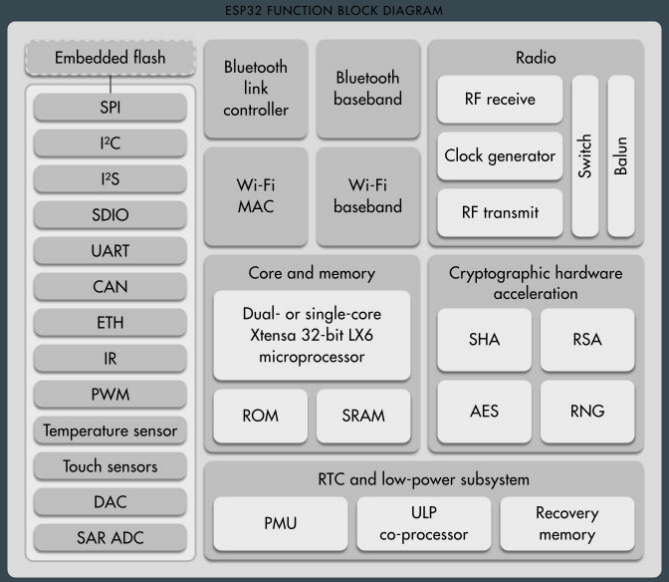
Integrating ESP32 module and IFTTT -

Using the Adafruit web service along with Google Assistant in IFTTT to create a trigger through a voice command and turn on the LED on the ESP32 with the help of the Adafruit IO.

NodeMCU - ESP32

- NodeMCU is an open source IoT platform.It includes firmware which runs on the ESP8266, ESP32 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

Features of ESP32 :



Microcontroller unit - MCU & Microprocessing unit - MPU :

Microcontroller	Microprocessor
Microcontroller is a small computer present on a Integrated Circuit.	Microprocessor is the Central Processing unit of the System.
A typical microcontroller includes a processor, memory and input/output (I/O) peripherals on a single chip.	External RAM , ROM is required , along with External I/O peripherals.
Low Power Consumption	High Power Consumption
Low Processing Power	High Processing Power
Single-Purpose	General-purpose
Present in Microwave oven , Washing machines etc..	Present in Edge Computing devices such as Phones etc..

So If Microprocessors feel more powerful ,why should we even care about Microcontrollers ?

Let us demystify the question by understanding how our phones work :

Most of our Phones have a ARM (Advanced RISC Machine) Processor as the central processor and they also have different microcontrollers for different actions such as display control , speaker control , touch control etc.. where the microprocessor sends commands to the microcontrollers through various buses present and gets back information to process it and communicate back with the microcontrollers.

So , most of the Projects are usually a mix of microcontrollers and microprocessors working together.

But OnePlus brags about Snapdragon 8xx or something , what the hell is that then ?

Arduino IDE

And Yes , it does have Dark Theme in it :)

- Arduino IDE is an open source software that is mainly used for writing and compiling the code into the Arduino Module.
- It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process.
- It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment..
- The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board.
- This environment supports both C and C++ languages.

Basic Arduino Programming

Parts of the environment :

Save - ctrl/cmd+S

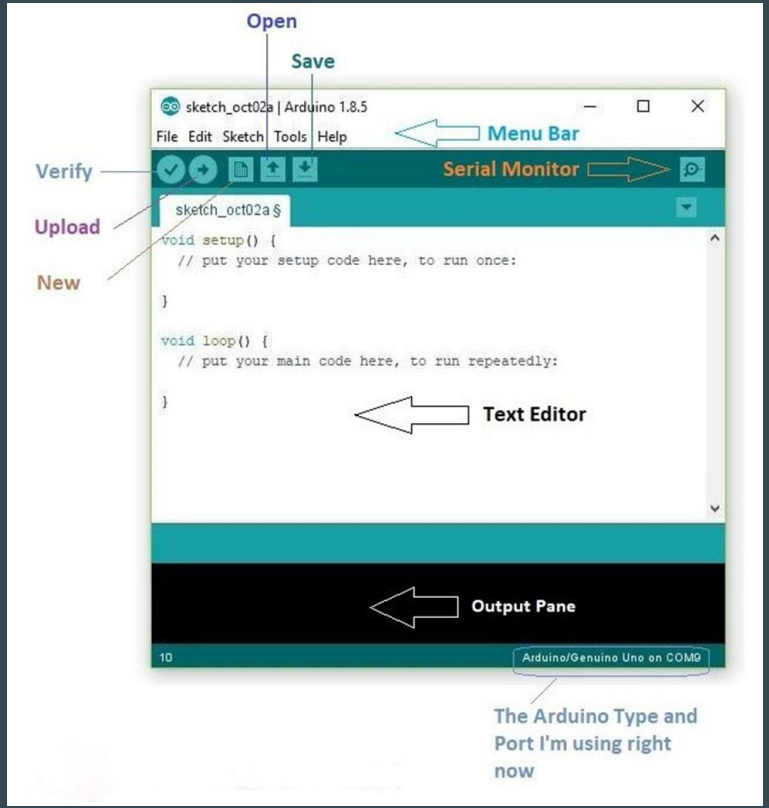
Verify - ctrl/cmd+R

Upload - ctrl/cmd+U

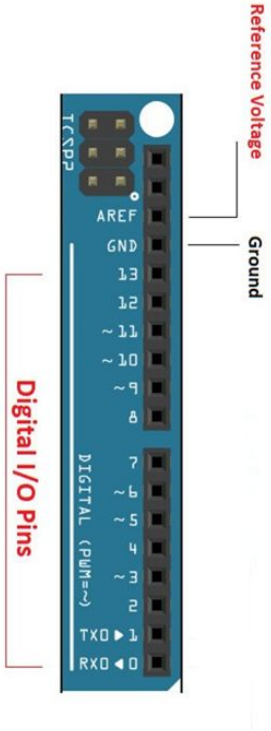
Text editor

Output pane

Board and port used



WORKING WITH PINS




```
int led = 12;
int button = 1;

void setup() {
  pinMode(led, OUTPUT);     // e.g. speakers, leds, motors
  pinMode(button, INPUT);   // e.g. buttons, IR sensors, microphones, accelerometers

}




void loop() {
  digitalWrite(led, LOW);
  delay(1000);
  digitalWrite(led, HIGH);
  delay(1000);

}
```

pins in arduino

example code

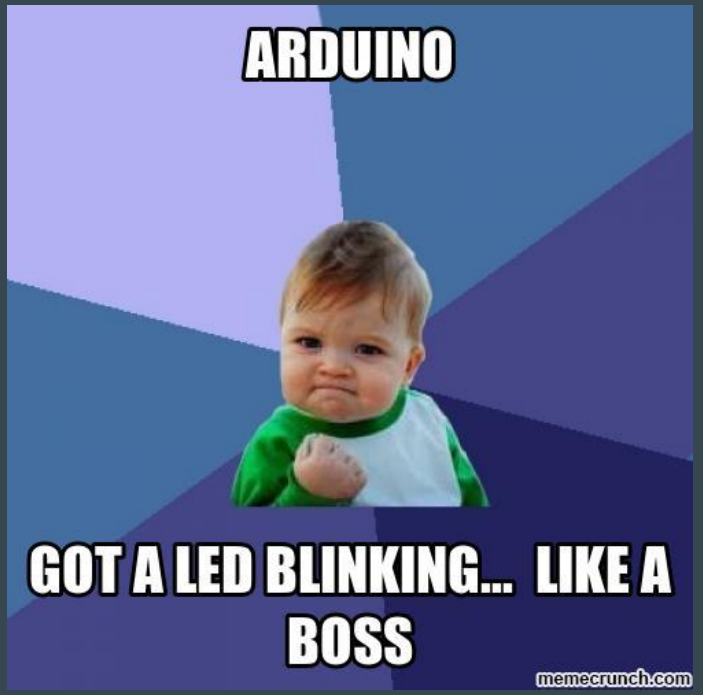
Code Explanation :

```
void setup(){

// One Time Setup and Pin Initialisations

}

void loop(){

// Loops forever

}
```

Code Explanation : Continued

```
int led = 2;  // Define the Pin number
void setup(){
pinMode(led, OUTPUT ) ; // Set the Mode the Pin is going to function
}
void loop(){
digitalWrite(2 , HIGH);  // Set the Value of the Pin to HIGH  ( 3.3V)
delay(200) ;   // wait for 200 milliseconds
digitalWrite(2 , LOW); // Set the Value of Pin to LOW ( 0 V )
delay(200); // wait for 200 milliseconds ( Question : what happens if i delete this line ? )
}
```

Congrats for writing your first Arduino Code :



Next Projects :

Bluetooth LED Control - Install RoboRemo App from PlayStore

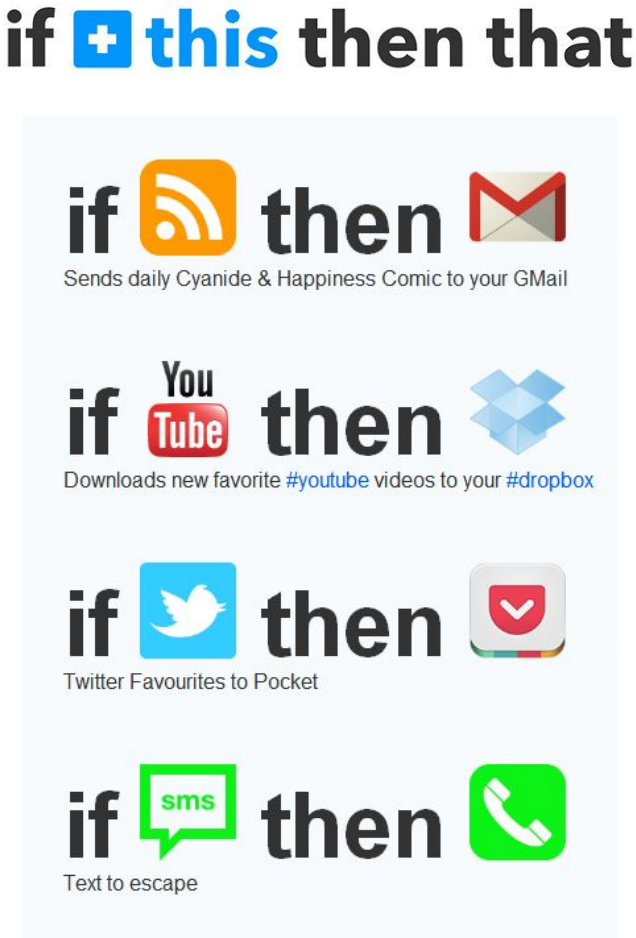
WiFi based LED Control

Capacitive Touch Based LED Control

Instagram Followers Count from ESP32

Voice Activated LED Control - IFTTT & Google Assistant

Voice Activated LED Control - Google Assistant

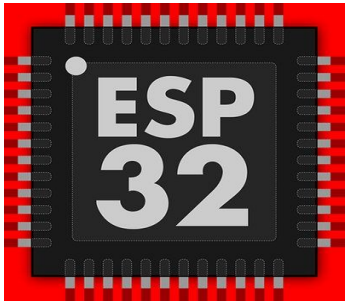


- If This Then That, also known as IFTTT, is a free web-based service to create chains of simple conditional statements, called applets.
- This is a very self-intuitive platform to create applets.
- An applet is triggered by changes that occur within other web services such as Gmail, Facebook, Telegram, Instagram, or Pinterest.

IF

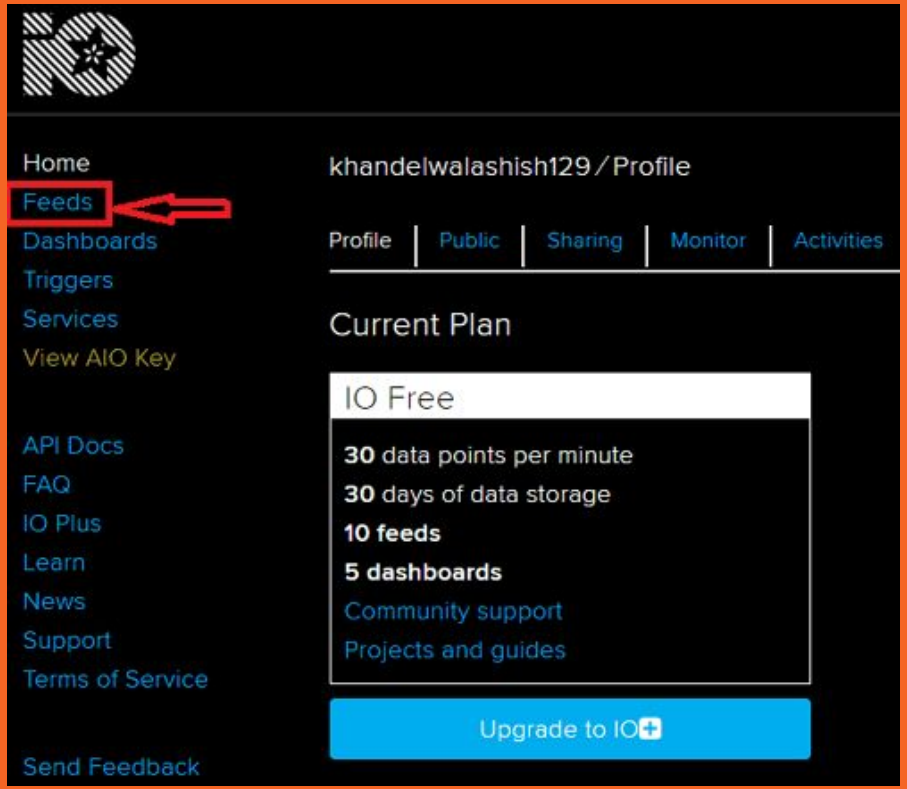
Google Assistant

THEN



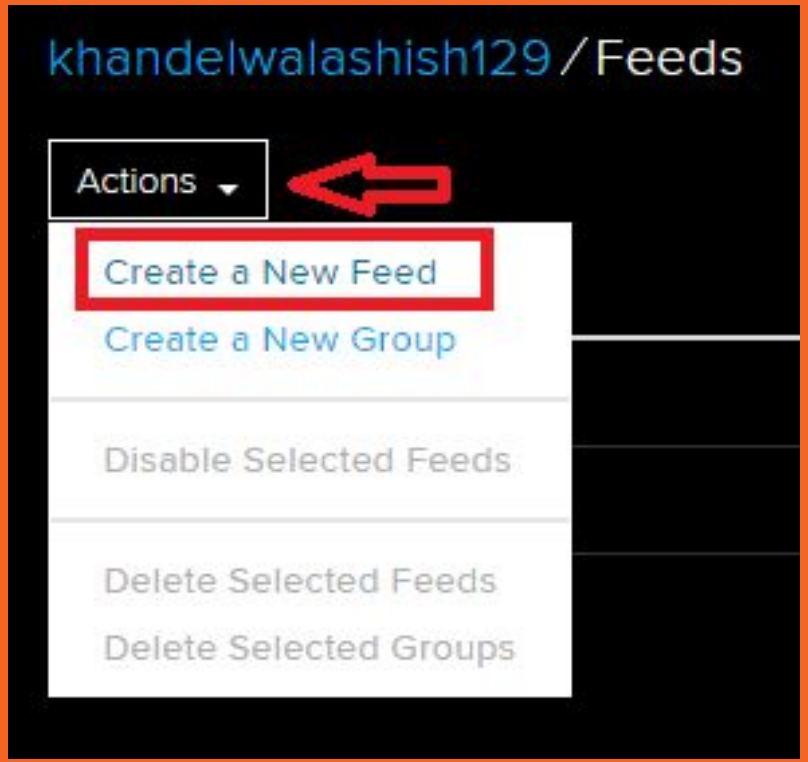
- You will have to select a web service for the trigger and the action and the rest is taken care by IFTTT.
- You can try out various combinations from the services available in it.
- In our project, the web service which acts the trigger is Google Assistant and the action will be done by the Adafruit Web Service.

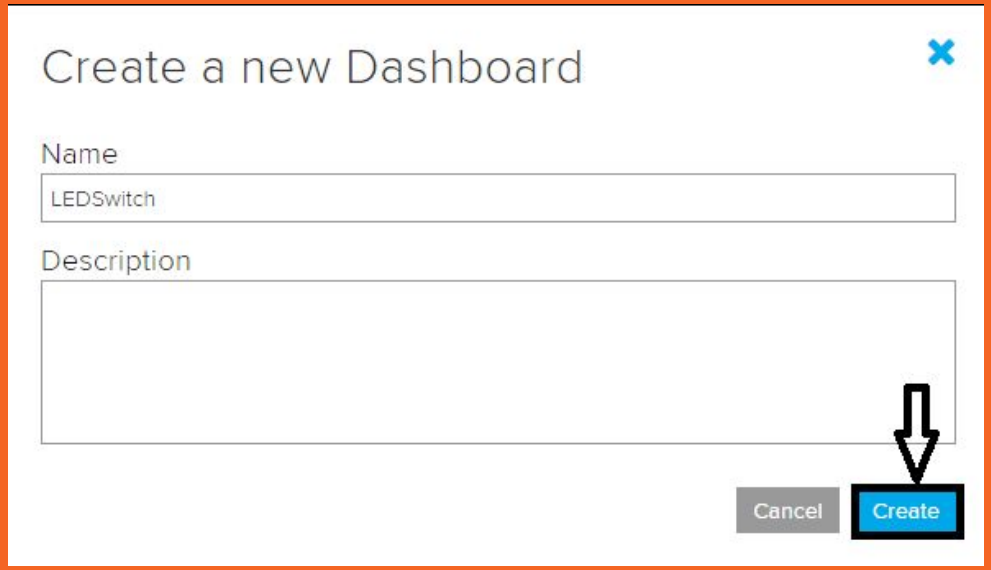
Setting up Adafruit IO Account for IOT controlled LED



- Visit https://io.adafruit.com and create an account.
- After creating your Account you will be taken to your home screen. Click on **“Feeds”** from the left hand menu.

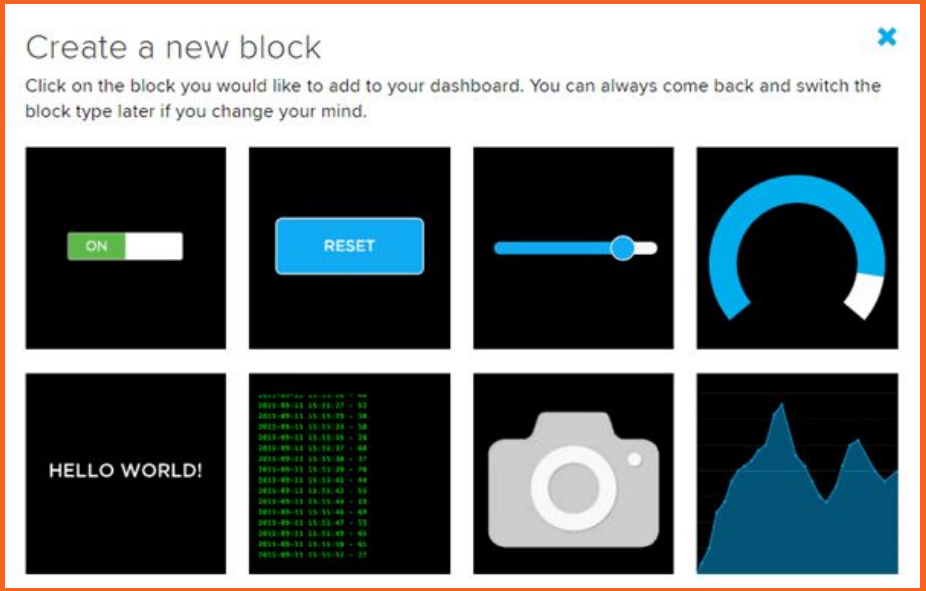
- Now click on Actions and then create a New feed. Then it will ask you to name your feed. Name it as LED_Control.

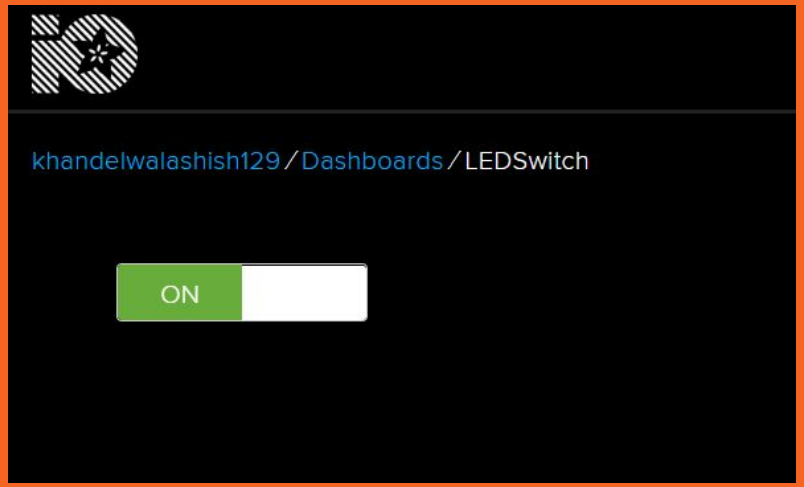


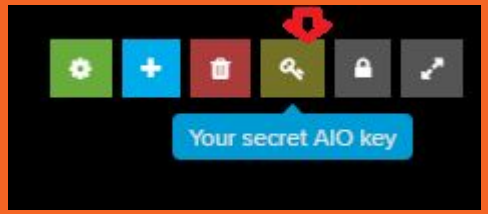


- Now go to “Dashboards” from the left hand menu. Click on Actions and then click on create a new dashboard, give it name as you want; I am giving “LEDSwitch” and then click on Create and your dashboard will now created.

- Now open your new dashboard by simply clicking on it and you should be taken to a mostly blank page. Clicking on blue + button will let you add new UI components to the dashboard.
- For this project I just need a button, so select first option, it will ask you to select the feed, so select the one you just made and keep the defaults for the rest of the settings.

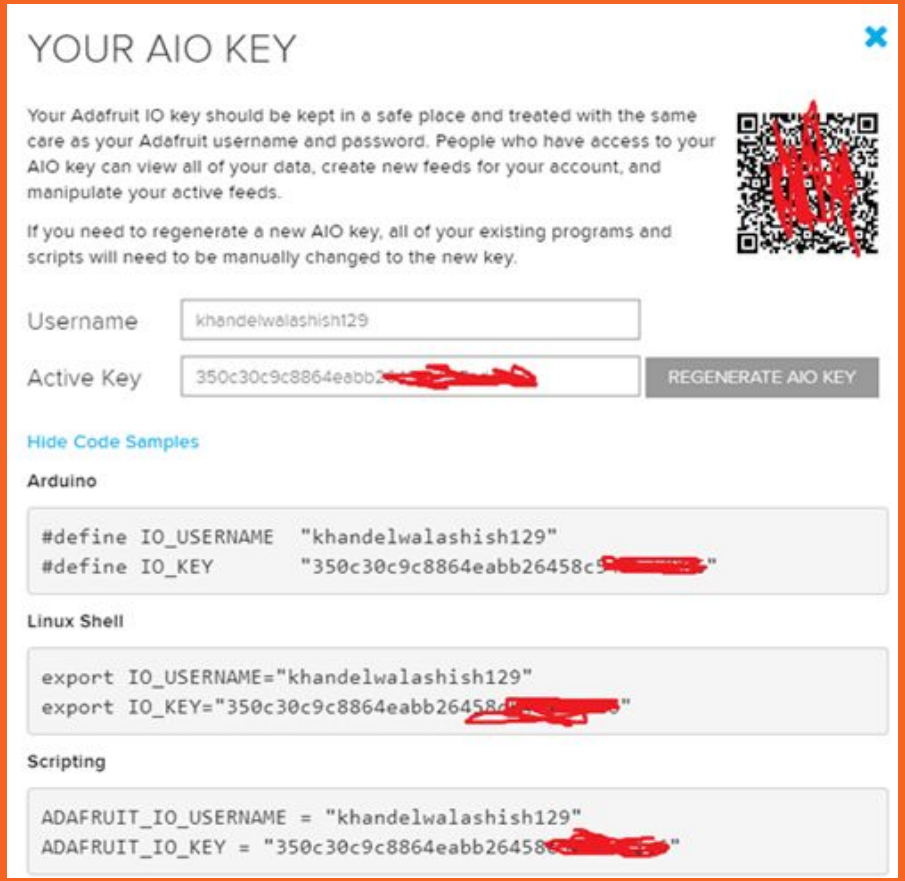






- After selecting your dashboard window will look like this:
- During programming you will required your unique AIO key so for this click on key button at right hand corner of your window.

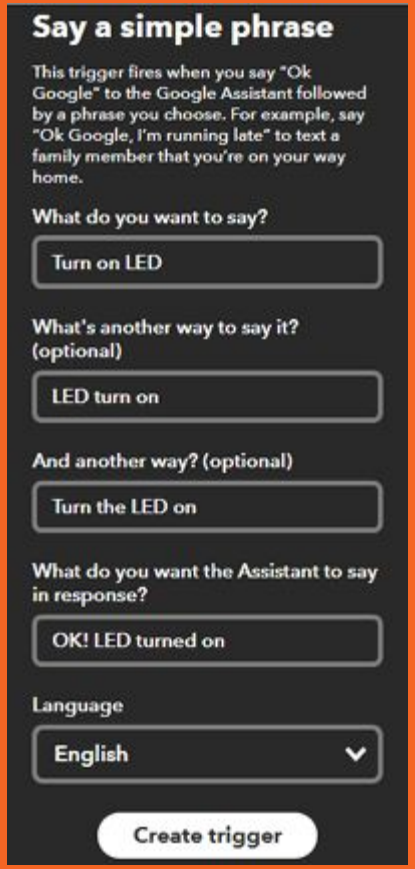
- After clicking on key button your Active key for this project is generated, don't share this key with anyone this must be confidential.

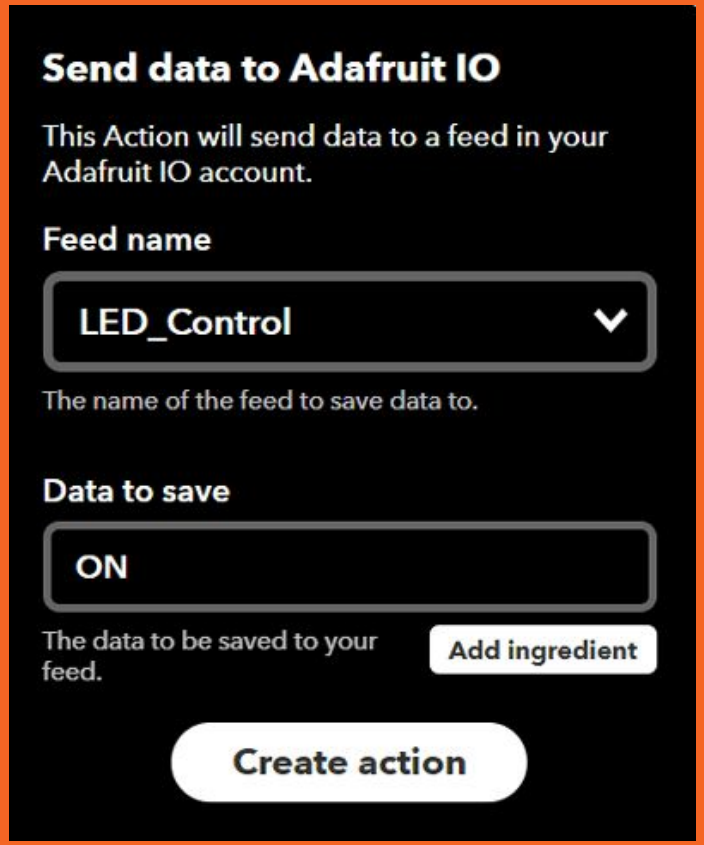


Connecting to Google Assistant through IFTTT

- Go to www.IFTTT.com website and create a new account if you are not having already. You can sign up using your Google account also.
- After creating an account click on your username at right hand corner of the window and click on “New Applet” button.
- After clicking on New applet you will find a window which ask you ‘If this then that’. The term IF THIS THEN THAT means if something happens on the “This” then we have do something on “that”.

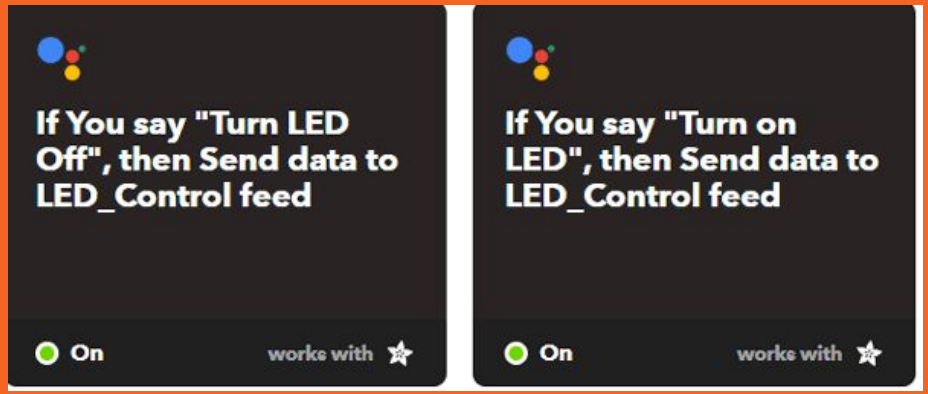
- Click on + blue button and search for “Google Assistant”, and then select “Say a simple phrase” from the menu of specific triggers. This will ask you some details, fill according to you and create trigger.

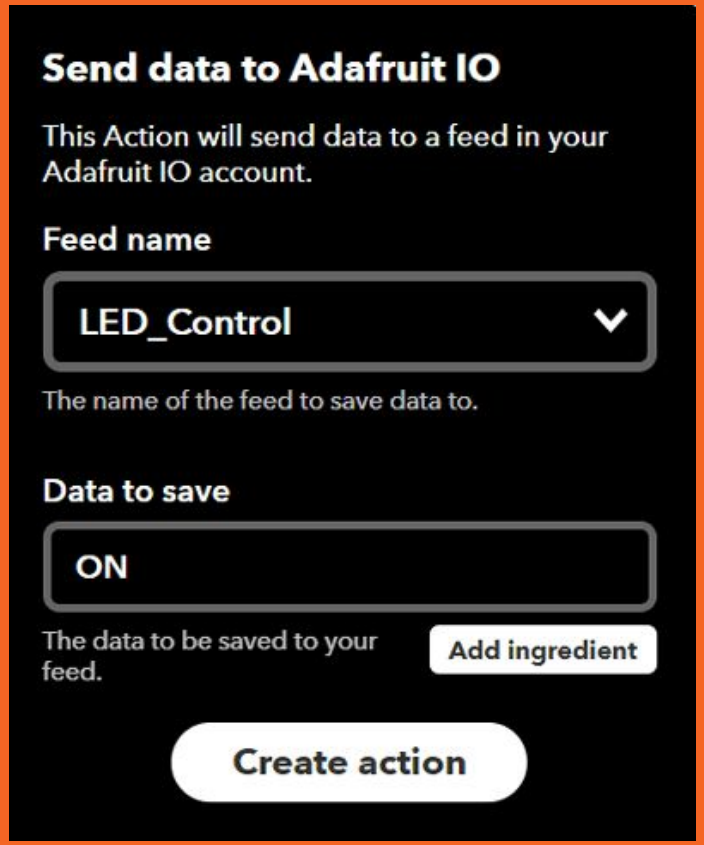




- Now you have to give Action so click on + button of “That”, and search for Adafruit and click on “Send data to Adafruit IO”
- Now it will ask you to select the Feed name so select the feed that you made earlier for this project and in Data to save we will send ON for this applet and click on Create action.

- Once you have created this applet, you have to create another applet for turning the LED “OFF”. You have to follow the same steps to create another applet.
- After creating both the applets go to “My Applets” and you can see both the applets here.





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What Next ??