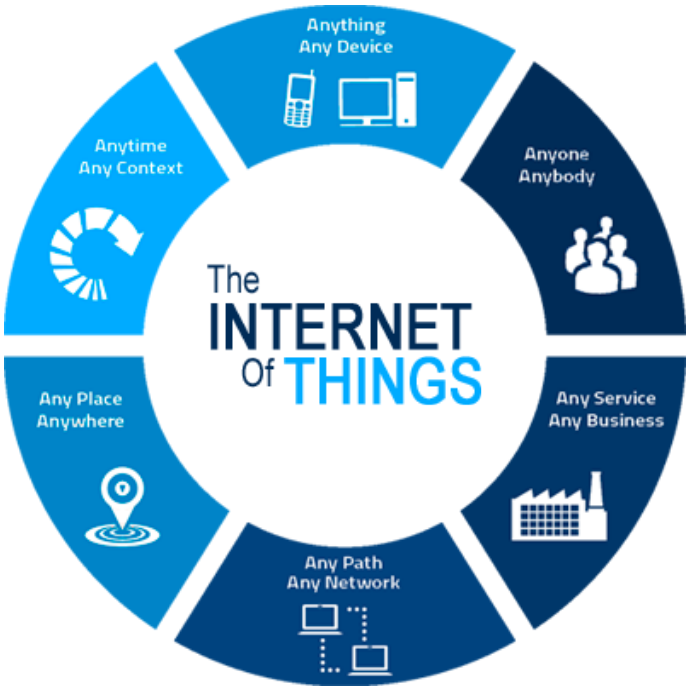
Understanding IOT

What is IOT?

The Internet of Things (IoT) is the inter-networking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to collect and exchange data. In simple words , Internet of Things (IoT) is an ecosystem of connected physical objects that are accessible through the internet. The thing in IoT could be a person with a heart monitor or an automobile with built-in-sensors, i.e. objects that have been assigned an IP address and have the ability to collect and transfer data over a network without manual assistance or intervention. The embedded technology in the objects helps them to interact with internal states or the external environment, which in turn affects the decisions taken.



How does IoT work?

First, there is the underlying technology, the various wireless radios that allow these devices to connect to the Internet and to each other. These include more familiar standards like Wi-Fi, low-energy Bluetooth, NFC and RFID, and some that youve probably havent heard of, like ZigBee, Z-Wave and 6LoWPAN (have your eyes glazed over yet?).Then there are the things themselves, whether theyre motion sensors, door locks or light bulbs. In some cases, there may also be a central hub that allows different devices to connect to one another. Finally, there are cloud services, which enable the collection and analysis of data so people can see whats going on and take action via their mobile apps.

Functioning of IOT

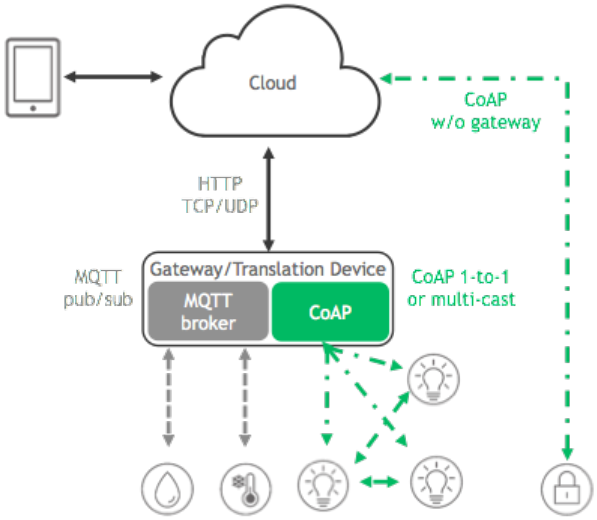


Figure 1: IOT Functioning

Uses of IoT

IoT software addresses its key areas of networking and action through platforms, embedded systems, partner systems, and middleware. Iot is a growing trend with varies applications all around the world. These applications have not only helped in making the job easier but also because of these applications we can transform the future. Many areas that are unaccessable or remote can be monitored using some IoT applications. The various applications of IoT are :

1. **Smart home**
   Smart Home clearly stands out, ranking as highest Internet of Things application on all measured channels. More than 60,000 people currently search for the term Smart Home each month. This is not a surprise. The IoT Analytics company database for Smart Home includes 256 companies and startups. More companies are active in smart home than any other application in the field of IoT. The total amount of funding for Smart Home startups currently exceeds $2.5bn. This list includes prominent startup names such as Nest or AlertMe as well as a number of multinational corporations like Philips, Haier, or Belkin.

2. **Wearables**
   Wearables remains a hot topic too. As consumers await the release of Apples new smart watch in April 2015, there are plenty of other wearable innovations to be excited about: like the Sony Smart B Trainer, the Myo gesture control, or LookSee bracelet. Of all the IoT startups, wearables maker Jawbone is probably the one with the biggest funding to date. It stands at more than half a billion dollars!

3. **Smart City**
   Smart city spans a wide variety of use cases, from traffic management to water distribution, to waste management, urban security and environmental monitoring. Its popularity is fueled by the fact that many Smart City solutions promise to alleviate real pains of people living in cities these days. IoT solutions in the area of Smart City solve traffic congestion problems, reduce noise and pollution and help make cities safer.

4. **Smart grids**
   Smart grids is a special one. A future smart grid promises to use information about the behaviors of electricity suppliers and consumers in an automated fashion to improve the efficiency, reliability, and economics of electricity. 41,000 monthly Google searches highlights the concepts popularity. However, the lack of tweets (Just 100 per month) shows that people dont have much to say about it.

5. **Real-Time Analytics**
   These applications take data or input from various devices and convert it into viable actions or clear patterns for human analysis. They analyze

information based on various settings and designs in order to perform automation-related tasks or provide the data required by industry.

6. **Data Collection**
   This software manages sensing, measurements, light data filtering, light data security, and aggregation of data. It uses certain protocols to aid sensors in connecting with real-time, machine-to-machine networks. Then it collects data from multiple devices and distributes it in accordance with settings. It also works in reverse by distributing data over devices. The system eventually transmits all collected data to a central server.

Protocols used in IoT

IoT primarily exploits standard protocols and networking technologies. However, the major enabling technologies and protocols of IoT are RFID, NFC, low-energy Bluetooth, low-energy wireless, low-energy radio protocols, LTE-A, and WiFi-Direct. These technologies support the specific networking functionality needed in an IoT system in contrast to a standard uniform network of common systems.

1. NFC and RFID
   RFID (radio-frequency identification) and NFC (near-field communication) provide simple, lowenergy, and versatile options for identity and access tokens, connection bootstrapping, and payments.

   (a) RFID technology employs 2-way radio transmitter-receivers to identify and track tags associated with objects.

   (b) NFC consists of communication protocols for electronic devices, typically a mobile device and a standard device.

2. Low-Energy Bluetooth
   This technology supports the low-power, long-use need of IoT function while exploiting a standard technology with native support across systems.

3. Low-Energy Wireless
   This technology replaces the most power hungry aspect of an IoT system. Though sensors and other elements can power down over long periods, communication links (i.e., wireless) must remain in listening mode. Low-energy wireless not only reduces consumption, but also extends the life of the device through less use.

4. Zigbee
   ZigBee, like Bluetooth, has a large installed base of operation, although perhaps traditionally more in industrial settings. ZigBee PRO and ZigBee Remote Control (RF4CE), among other available ZigBee profiles, are based on the IEEE802.15.4 protocol, which is an industry-standard wireless networking technology operating at 2.4GHz targeting applications that require relatively infrequent data exchanges at low data-rates over a restricted area and within a 100m range such as in a home or building.

5. Z-Wave
   Z-Wave is a low-power RF communications technology that is primarily designed for home automation for products such as lamp controllers and sensors among many others. Optimized for reliable and low-latency communication of small data packets with data rates up to 100kbit/s, it operates in the sub-1GHz band and is impervious to interference from WiFi and other wireless technologies in the 2.4-GHz range such as Bluetooth or ZigBee. It supports full mesh networks without the need for a coordinator node and is very scalable, enabling control of up to 232 devices.

IOT Platform Providers

1. AMAZON WEB SERVICES IOT PLATFORM
   AWS IoT is a managed cloud platform that lets connected devices easily and securely interact with cloud applications and other devices. AWS IoT can support billions of devices and trillions of messages, and can process and route those messages to AWS endpoints and to other devices reliably and securely Main features of AWS IoT platform are:

   (a) Software Development Kit for devices

   (b) Device Shadows

   (c) Secure Device Gateway

   (d) Rules engine for inbound message evaluation

   (e) Registry for recognizing devices

   (f) Software Development Kit for devices

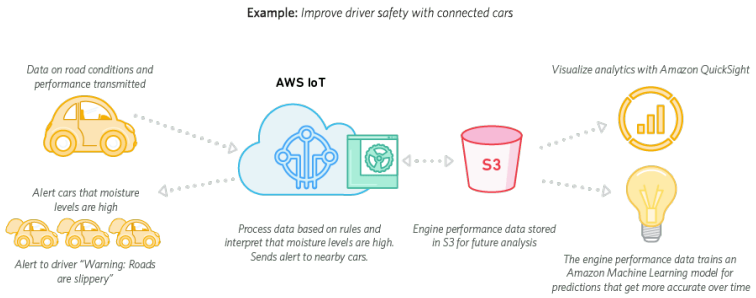


Figure 2: AWS IOT

2. Microsoft Azure IoT
   The Azure internet of things (IoT) services offer a broad range of capabilities. These enterprise grade services enable you to:

   (a) Collect data from devices

   (b) Analyze data streams in-motion

   (c) Store and query large data sets

   (d) Visualize both real-time and historical data

   (e) Integrate with back-office systems

   (f) Manage your devices

3. Kaa
   Making in the list as solely open source IoT platform Kaa is a middleware. It is developed to speed up the process of IoT solutions deployment. It can be used as cloud enablement software for connected devices, customizable middleware, transport-agnostic link or as a feature rich platform for IoT applications. Its features include:

   (a) 100% free open-source
   (b) Helps in reducing marketing time
   (c) Minimizes the development cost
   (d) Customizable for business applications
   (e) Can handle millions of devices
   (f) Easy and direct hardware integration

Hardwares Used for IOT

The hardware utilized in IoT systems includes devices for a remote dashboard, devices for control, servers, a routing or bridge device, and sensors. They mainly include :-

1. IoT Sensors
2. Wearable Electronics
3. Standard Devices
   (a) Desktop
   (b) Tables
   (c) Mobile Phones

Raspberry Pi and IOT

So what is the use of Raspberry Pi in IOT? The answer is quite simple, Raspberry Pi is one of the key learning platforms for IoT. The RasPi is a popular platform because it offers a complete Linux server in a tiny platform for a very low cost.

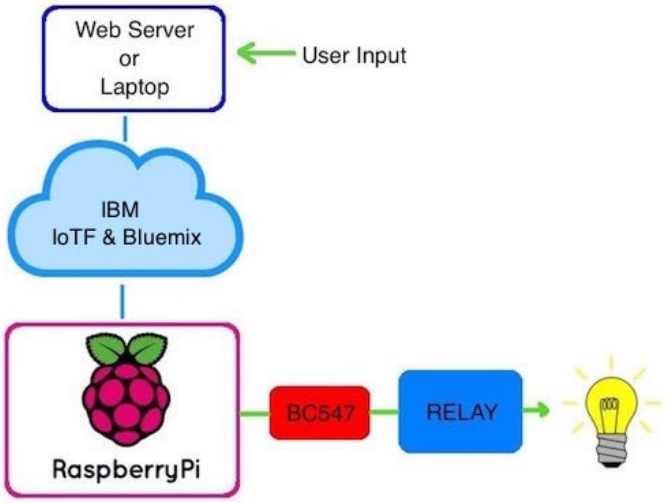


Figure 3: Pi In IOT

Code to control GPIO

We create a simple working model of IOT controling the GPIO of the raspberry pi.
We follow the following steps to control the GPIO.

1. Install OpenHAB 2 on you raspberry pi.
   - **What is opneHaB?**
     The open Home Automation Bus (openHAB, pronounced pnhb) is an open source, technology agnostic home automation platform which runs as the center of your smart home!
   - **How to install it?**
     Download the openhab image from Openhab Website
     and user Etcher or any other similar software to flash it on your raspberry sd card.
2. Connect the openhabian pi via ssh using default username and password as openhabian—openhabian
3. Enter into configuration mode and enable samba fileshare share.
4. Connect to the samba server using smb://[Your Pi Ip]
5. Make changes in the default.items file and default.sitemaps file
   - **default.item file configuration**

```
Switch Led_1 "LED SET 1"
{
gpio="pin:4 activelow:no "
}
Switch Led_2 "LED SET 2"
{
gpio="pin:16 activelow:no "
}
```

   - **default.sitemaps file configuration**

```
sitemap default label="My home automation" {
Frame label="Green Led"
{
    Switch item=Led_1
}
Frame label="White Led Set"
{
    Switch item=Led_2
}
```

6. Take your Raspberri pi and Connect it with circuit on the bread board in the following manner. You should use pin 4 and pin 16 as well as two ground pins on the Raspeberry pi. Connect the PI to the router.

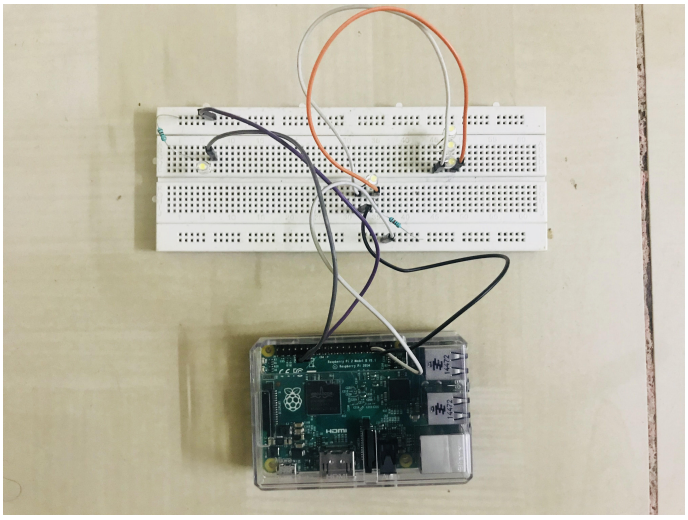


Figure 4: Setting up breadboard

7. Go to your browser and enter the following link [Your Pi Ip address]:PortNumber
In this case the link is 192.168.0.65:8080
Once you have entered the link the Openhab Page appears.

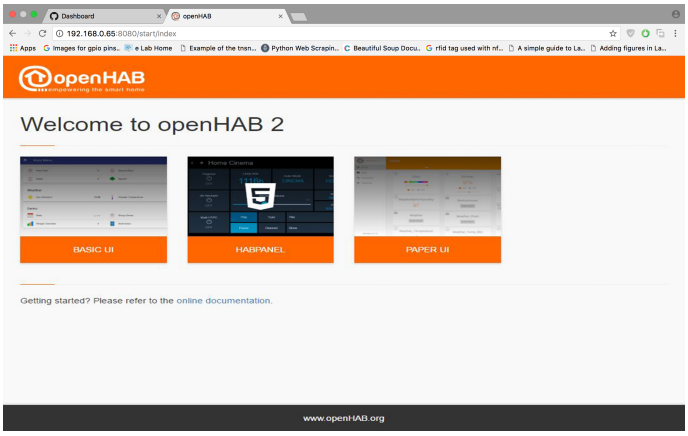


Figure 5: Openhab Page

8. Click on Paper UI to access the Triggers of the items in sitemap. Now you can control your led from any device

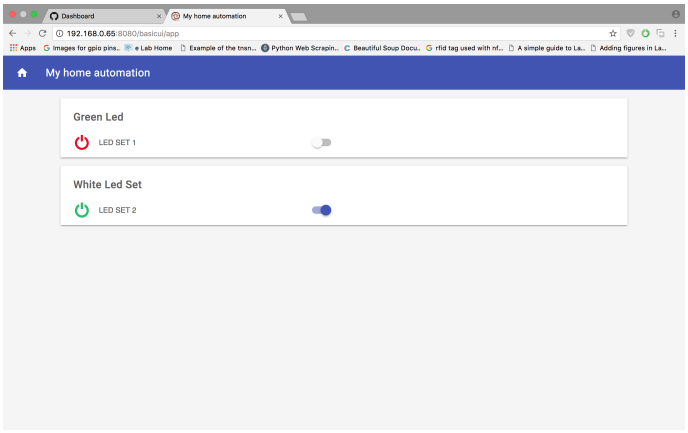


Figure 6: Paper UI

9. After turning the switch on the led will lighup on this device. Now you can add as much things you can and extend it further.

Learning Outcomes

Basics of IOT

- Helped me in learning what Iot is.
- Helped me in undestanding the various protocols,IoT platforms,Iot Communication protocols
- Taught me how IOT applications work.
- Helped me get familiar with Raspberry Pi.
- Simple IOT project to control Led using Raspberry Pi.

Industial Training

- Provided me with the opportunity to test my interest in an IT career.
- Helped me develop skills in the application of theory to practical work situations.
- Helped me develop understanding of the functioning and organisation of a business organization and interact with other professional and non-professional groups.
- Apply methods such as design and problem solving, develop technical, interpersonal and communication skills, both oral and written.
- Helped me build spirit of teamwork, sharing ideas and self-confidence.
- Helped me build good communication skills and learn proper behavior of corporate life.