Internet of Things

About:

When you Google “what is IoT,” many of the answers are unnecessarily technical. Case in point:

“The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.”

– An unnecessarily technical explanation of IoT

The point is that connecting things to the internet yields many amazing benefits. We’ve all seen these benefits with our smartphones, laptops, and tablets, but this is true for everything else too. And yes, we do mean *everything*.

The Internet of Things is actually a pretty simple concept, **it means taking all the physical places and things in the world and connecting them to the internet**.

When something is connected to the internet, that means that it can send information or receive information, or both. This ability to send and/or receive information makes things “smart."

Let’s use smartphones again as an example. Right now you can listen to just about any song in the world, but it’s not because your phone actually has every song in the world

stored on it. It’s because every song in the world is stored somewhere else, but your phone can send information (asking for that song) and then receive information (streaming that song on your phone).

To be smart, a thing doesn't need to have super storage or a supercomputer inside of it - it just needs access to it. All a thing has to do is *connect* to super storage or to a super computer. In the Internet of Things, all the things that are being connected to the internet can be put into three categories:

1. Things that collect information and then send it.
2. Things that receive information and then act on it.
3. Things that do both.

And all three of these have enormous benefits that compound on each other.

There are many applications across the sectors and domains and IoT has created a buzz in the tech world. The idea is to start with basics and gradually understand the IoT related concepts by conducting hands-on projects/ tasks.

Pre-Requisites:

Good to know before starting Level 1:

- Fair understanding of what an Arduino board and a Raspberry pi do, and their applications
- Basic knowledge of different kind of sensors and actuators
- Circuit design

- Comfortable with using the Arduino IDE
- Blinking an LED using Arduino
- Adding the ESP library to the Arduino IDE

https://www.instructables.com/Your-First-Experiments/

https://www.instructables.com/InputOutput/

https://www.instructables.com/Skills-Infusion/

Topics Involved:

- Basic Electronics
- Circuit Design
- Arduino
- Raspberry Pi
- ESP32
- STM32 bluepill

Syllabus:

Level 1:

This level is meant for introducing you to the domain. You will be learning the basics of how to set everything up and get started, the prerequisites if any etc.

You will be performing the following experiments:

- Gather Your (Internet Of) Things

We'll be programming an ESP8266 wifi board using the Arduino software and programming language. How about being notified when a door is opened, your water heater leaks, or there's movement at the bird feeder? OR build a real-time weather monitor, YouTube subscriber counter, or other data-driven project? Combine the coding skills from these two and build an interactive device that both listens and speaks to the internet.

https://www.instructables.com/Gather-Your-Internet-Of-Things/

- Trigger an email

We will build a basic project that triggers an internet action when a physical switch is activated. The code will detect the switch and send a message to a feed on the cloud data site Adafruit IO. Another cloud services site, IFTTT, will monitor this feed and send an email when activity is detected.

https://www.instructables.com/Circuit-Triggers-Internet-Action/

- Simple Arduino Digital clock without RTC

It's a simple digital clock controlled by Arduino without using any RTC module (Real Time

Clock). Every time we switch on this clock we have to set it to the present time, just like the analog clocks found in homes. https://create.arduino.cc/projecthub/Annlee_Fores/simple-arduino-digital-clock-without-rtc-7d4303

Giftduino - The perfect Arduino Gift Box

This is a simple project to build a gift box. https://create.arduino.cc/projecthub/circuito-io-team/giftduino-the-perfect-arduino-gift-box-670837

Gesture Controlled Robot

This is a Gesture Controlled Robot using Arduino and PAJ7620 Gesture Sensor. The project will explain what PAJ7620 Sensor is, detect various hand gestures and how to control a robot using this sensor. https://create.arduino.cc/projecthub/jithinsanal1610/simple-gesture-controlled-robot-using-arduino-843cf6

Setting up a Raspberry Pi

Just the beginning of a whole lot of new things here. Go ahead and https://www.raspberrypi.com/documentation/computers/getting-started.html

Music Box with a Raspberry Pi

In this project, you will build a button-controlled “music box” that plays different sounds when different buttons are pressed.

https://projects.raspberrypi.org/en/projects/gpio-music-box

Using the camera module

Learn how to use a camera module with a Raspberry pi.

https://www.instructables.com/Build-a-Photo-Booth/

Simple and Intuitive Web Interface for Raspberry Pi

The Raspberry Pi is an amazing 35 dollars mini-computer. It allows us to do everything we could do with a regular Linux computer (Connecting to the internet, watching videos, launching applications) and also to interact with the world surrounding it, just like an Arduino. It is a mix between a computer and a microcontroller. In this project we are going to learn how to control LEDs with the Raspberry Pi. Firstly directly from the Raspberry Pi itself, then from any device like the Smartphone or the tablet.

https://www.instructables.com/Simple-and-intuitive-web-interface-for-your-Raspbe/

Build a twitter bot with a Raspberry Pi

A great way to build an audience of people interested in the same topic on twitter is by building a twitter bot. Go ahead and try it yourself! https://www.makeuseof.com/tag/photo-tweeting-twitter-bot-raspberry-pi-nodejs/

Communicate with an android app

Exactly like the title says, this will be about establishing communication between your raspberry pi and an android application, using JSON. https://www.instructables.com/Raspberry-Pi-Android-App-communication/

.

Level 2:

ESP32-CAM Face Recognition Door Lock System

Security is the major concern for anyone nowadays, whether it's data security or security of their own home. With the advancement of technology and the increasing use of IoT, digital door locks have become very common these days. Digital lock doesn't require any physical key but it uses RFID, fingerprint, Face ID, pin, passwords, etc. to control the door lock. Here we build a Face ID controlled Digital Door lock system using ESP32-CAM. -

https://circuitdigest.com/microcontroller-projects/esp32-cam-face-recognition-door-lock-system

Iot Based Air Quality Index Monitoring System

In this project, we are going to build an ESP32 Air Quality Monitoring System using Nova PM SDS011 sensor, MQ-7 sensor, and DHT11 sensor. The air hanging over us thickens with smoke and gaseous emissions from burning fields, industrial factories, and vehicular traffic, blocking out the sun and making it hard to breathe. Experts say that the high levels of air pollution and COVID-19 pandemic can be a dangerous mix that can have serious consequences. The necessity for real-time monitoring of Air Quality is very glaring. This can be done by the help of this project. https://circuitdigest.com/microcontroller-proejcts/iot-based-air-quality-index-monitoring-system-measure-pm25-pm10-co-using-esp32

Set up your Raspberry Pi server

Set up and configure a Linux server on a raspberry pi. https://www.instructables.com/Ultimate-Pi-Based-Home-Server/

Home automation using Raspberry Pi

Explore the possibility of controlling AC appliances with the click of buttons on a webpage using internet

https://circuitdigest.com/microcontroller-projects/iot-raspberry-pi-home-automation

Level 3:

You now have the skills required to work on an IoT project of your own. Feel free to use any/all of the skills and equipment you have learnt in the last 2 levels.

Assessment:

Level 1:

After completing this level, upload a photograph/video of the functioning circuit or model and show it to your domain co-ordinator.

You are required to provide a detailed report consisting of:

1. Project specifications
2. Challenges faced
3. Documentation (circuits,photographs etc.)
4. Material used
5. What you have learnt

After successfully completing both the report, you'll be allowed to move on to level 2.

Level 2:

After completing this level, upload a photograph/video of the functioning circuit or model and show it to your domain co-ordinator.

You are required to provide a detailed report consisting of:

1. Project specifications
2. Challenges faced
3. Documentation (circuits,photographs etc.)
4. Material used
5. What you have learnt

A date will be fixed on which you give a brief seminar on your report. After successfully completing both the report and seminar, you'll be allowed to move on to level 2.

Level 3:

Level 3 assessment will be on a case-by-case basis. Contact your coordinator for more details.

References:

https://www.leverege.com/iot-ebook/what-is-iot

https://create.arduino.cc/projecthub/alankrantas/tinygo-on-arduino-uno-an-introduction-6130f6

Useful Links:

1. https://www.balena.io/docs/learn/develop/integrations/bluemix/
2. https://www.ibm.com/cloud/internet-of-things
3. https://developer.ibm.com/learningpaths/iot-getting-started-iot-development/
4. https://magpi.raspberrypi.org/

Courses:

1. https://www.coursera.org/specializations/iot
2. https://online.stanford.edu/courses/xee100-introduction-internet-things
3. https://www.coursera.org/specializations/internet-of-things

4. https://www.edx.org/micromasters/curtinx-internet-of-things-iot
5.

Notes