KBR

Raspberry PI, Arduino and Node MCU

↳ Raspberry Pi → is a mini-computer with more processing power and memory, acting as a general purpose computer. It is used for complex tasks.

→ It is a fully fledged computer and it is small as credit card and inexpensive.

→ It is a small single board computer (SBC)

→ It is developed by Raspberry Pi foundation in association with Broadcom company in UK. during 2012.

→ $35 computer board has changed the world.

→ Since its first release in 2012, company has sold more than 20 million units of Raspberry Pi boards.

→ Eben upton Founder, Raspberry Pi

→ Eben upton, a british engineer who developed the board to address the concerns about the decline of computing skills in the UK and to make computer science more accessible.

→ The primary goal was to create a low-cost, small powerful computer which is used to teach and learning computer science.

NOTE:

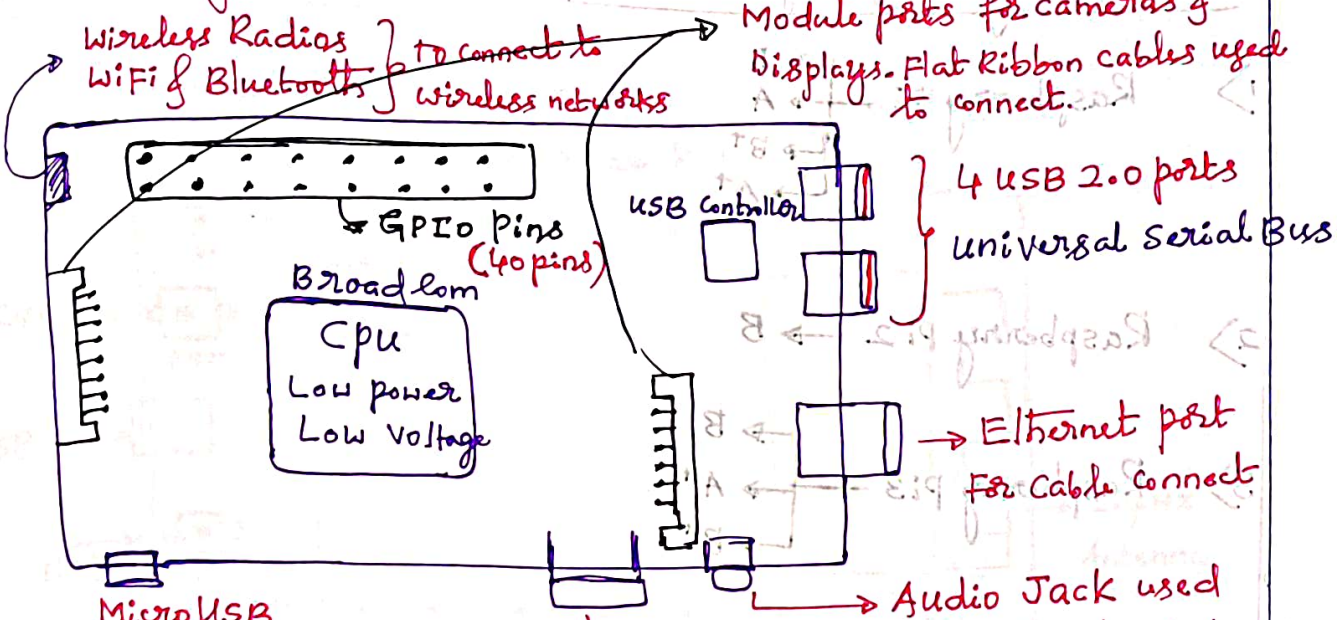
Raspberry pi = small, low cost general purpose computer
Arduino = small, low cost microcontroller board
NodeMCU = Wi-Fi enabled microcontroller board

* The ESP32 and NodeMCU, both commonly used in in IoT projects. but they differ in their core components and capabilities.

↳ ESP 32 → Microcontroller chip with built-in WiFi and Bluetooth. provides high processing power, memory and peripherals.

↳ NodeMCU → only WiFi feature and it is simpler and used for basic projects.

* Raspberry Pi



[High Definition multimedia Interface]

This port can be used with external display such as PC monitor/TV display.

NOTE: MicroSD slot.: Raspberry Pi uses removable storage in the form of SD/MicroSD cards to run the operating systems.

SD → Secure digital card

↳ CPU = Low power low voltage CPU + GPU (Graphics processing unit)

+ Volatile RAM (1 GB) [Few MB – Few GB]

↳ Memory unit = RAM + MicroSD card Storage.

↳ MicroSD card ranges from 8 GB to 32 GB.

* Raspberry pi family and Model

1) Raspberry pi → B, A, B+, A+

2) Raspberry pi 2 → B

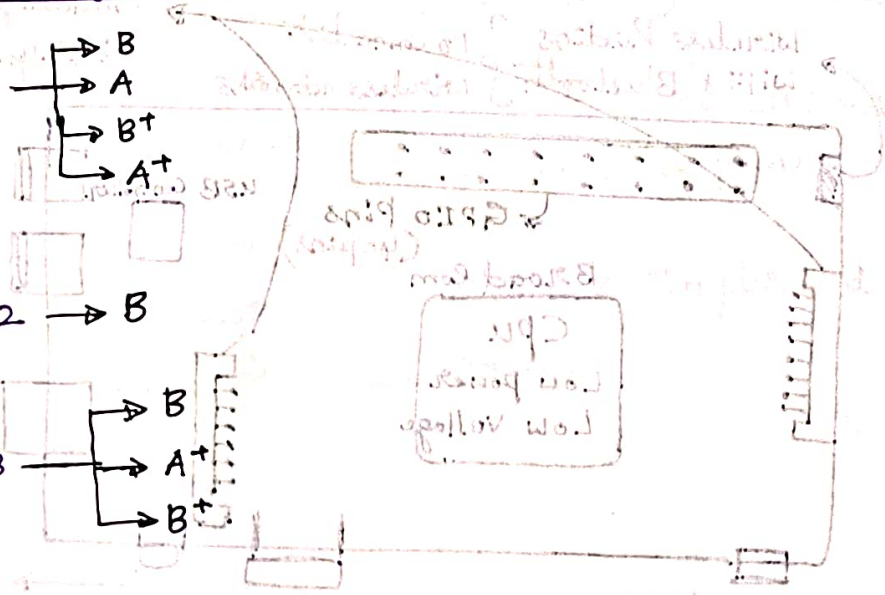
3) Raspberry pi 3 → B, A+, B+

4) Raspberry pi 4 → B

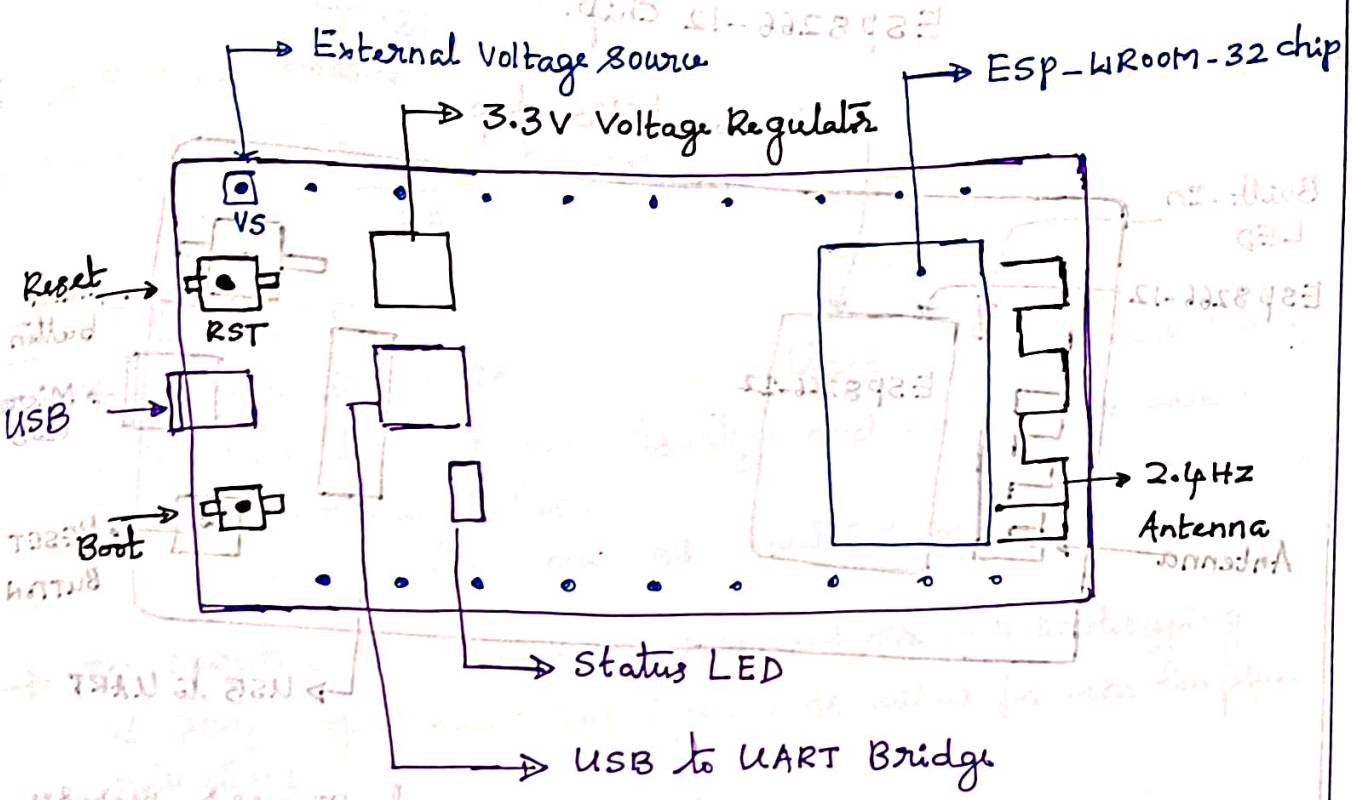
5) Raspberry pi pico

6) Raspberry pi 5 → B

7) Raspberry pi 0



* ESP 32 Board:

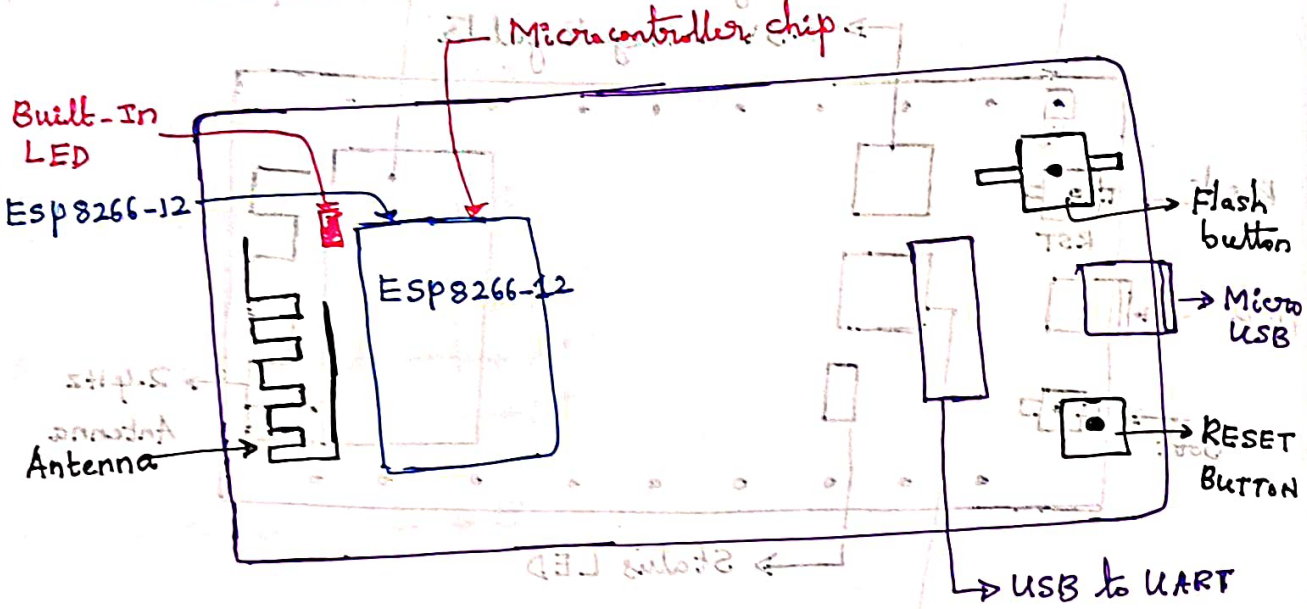


↳ ESP-WROOM-32 chip contains the following:

→ versatile, low-cost module from Espressif systems
→ Dual-core Xtensa LX6 processor (32-bit)
→ provides built-in WiFi and Bluetooth.
→ Low power consumption feature.
→ Includes variety of peripherals like GPIOs, UART, SPI, I2C etc.
→ Widely used in IoT due to its affordability, ease of use and versatility.

ESP-WROOM-32 MC chip contains the Tensilica Xtensa Dual-core 32-bit LX6 processor.

* NodeMCU : Is a development board built around the Esp8266-12 chip.



↳ Esp8266-12 : This chip consists of processor, memory, WI-FI and other peripherals.

↳ processor: is Tensilica Xtensa 32-bit LX106 RISC processor.

RISC

Esp8266 µc chip contains the Tensilica L106 32-bit processor

* Conclusion :

↳ Esp-WROOM-32 µc chip (Esp32 µc) is advanced microcontroller chip with built-in WiFi and Bluetooth.

↳ NodeMCU board is often associated with Esp8266 µc

* NOTE

1) NodeMCU (ESP8266) board
   - uc
2) ESP32 board
3) NodeMCU (ESP32) board
   - uc

* cloud offerings:

→ ThingSpeak is an IoT analytics platform, a cloud based service, which allows to aggregate, visualize and analyze live data streams from the devices.

→ cloud offerings also known as cloud services.

→ Its operated by MathWorks and is used for both prototyping and proof-of-concept IoT systems as well as for more complex applications.

→ Thingspeak is the open data platform for IOT

→ The device or application can communicate with ThingSpeak using a RESTful API.

→ The data can be private or public

→ Thingspeak to analyze and to act on the data.

→ Thingspeak provides an online text editor to perform data analysis and visualization using MATLAB.

→ ThingSpeak is used for diverse applications ranging from weather data collection and analysis to Synchronizing the color of lights across the world.

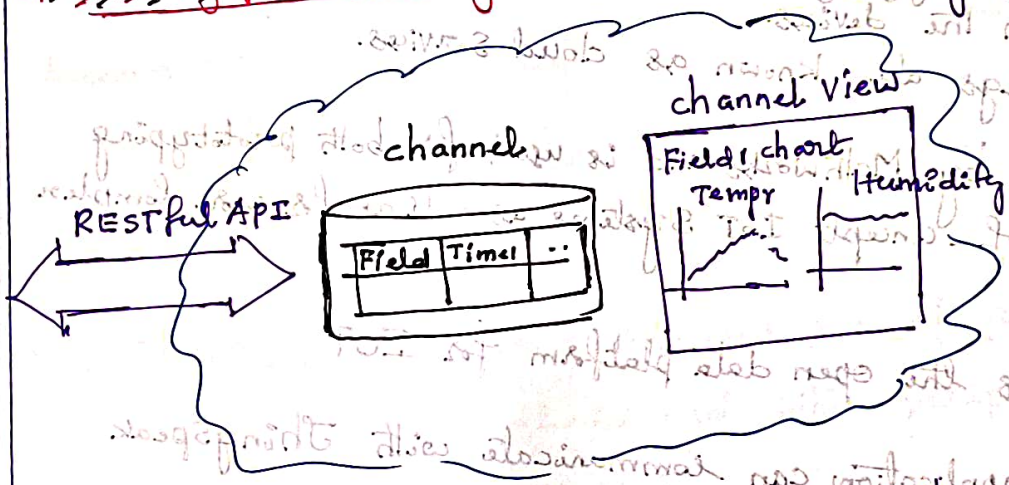
→ Thingspeak provides the time series database. It provides the users with free time-series data storage in channels. Each channel includes data fields.

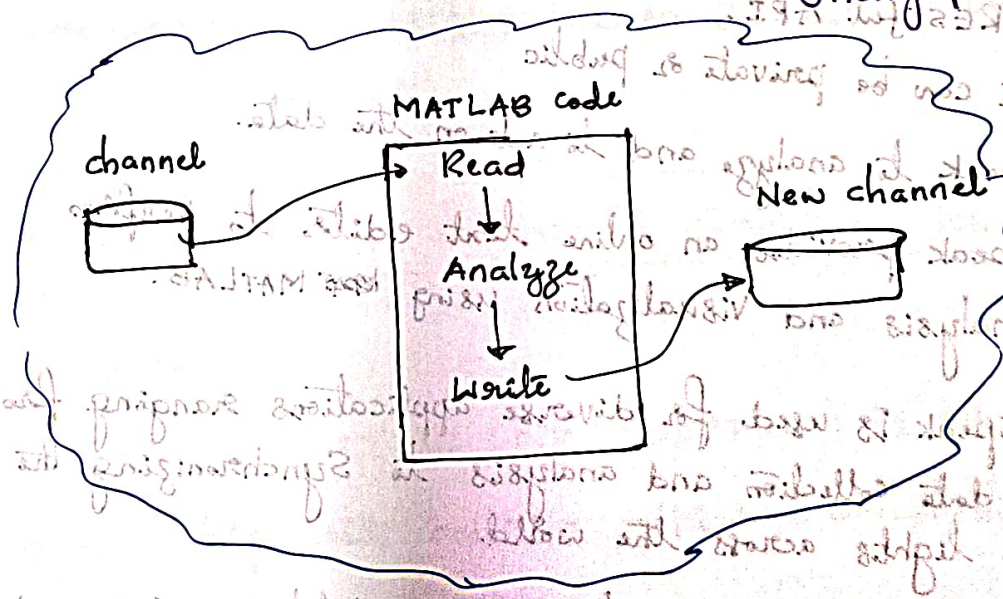
NOTE: Thingspeak and xively are distinct IoT platforms, though they share some similarities.

→ Thingspeak is an open-source platform from MathWorks primarily used for DIY projects

→ Xively is a commercial PaaS (platform as a service) for IoT applications.

* ~~Thingspeak Deployment~~ :





* ThingSpeak Deployment :

→ Deployment involves connecting devices to ThingSpeak to send and receive data, visualize it, analyze it.

→ The process starts with by configuring the devices (like Raspberry Pi, ESP32, NodeMCU) to communicate with ThingSpeak using HTTP or MQTT protocols.

→ Setting up a channel

→ obtain the API keys (Write API key & Read API key)

→ configure the device to send data to the channel.

↳ Detailed Steps :

1. To setup a Thingspeak channel.
   - → Log in to user Thingspeak account and create a new channel.
   - → Need to provide a channel name and description
   - → Need to configure the channel as private or public

2. Device configuration:
   - → API keys: obtaining the "user" Write API key and Read API key from the Thingspeak Account.
   - → configure the device (Ex: ESP32, Raspberry Pi) to:
     - Access the Internet
     - using suitable protocol (HTTP/MQTT) for sending data.
     - Specify the Thingspeak channel ID and write API key in the configuration.

NOTE: MQTT → "Message Queuing Telemetry Transport"

3. Send data to Thingspeak

- Data format
- HTTP/MQTT: use the configured API key and channel ID to send data to Thingspeak by using HTTP & MQTT.

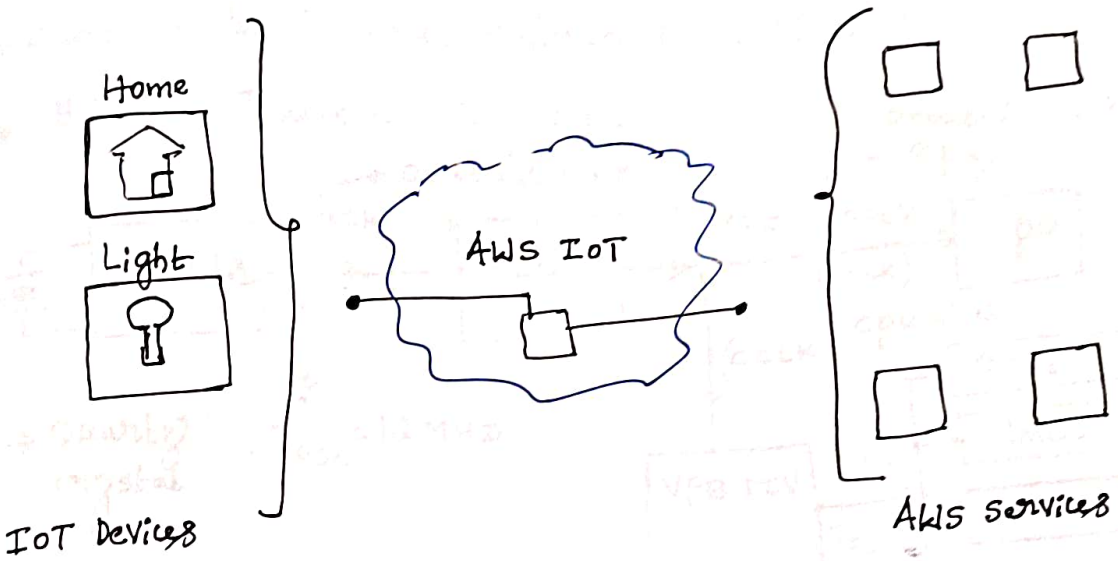
4. Visualize and Analyze data:

→ Thingspeak Interface: Thingspeak provides a web interface to visualize the data in real-time.

→ Data import/Export: We can import or export the data from the channel.

→ Integration with MATLAB: Thingspeak is integrated with MATLAB for advanced data analysis and visualization.

* Features of AWS (Amazon Web Services) IoT :



→ AWS IoT which connects the IoT devices to AWS services which provides the solutions.

→ Key features: Secure device management, Analytics and visualization of device data.

ThingSpeak Vs AWS IoT

ThingSpeak	AWS IoT
→ cloud-based platform for data logging, visualization and basic data analysis.	→ For Video analytics, device management, high sophisticated data processing and high level data analytics capabilities.
→ user friendly, simplicity and ease of use for projects involving Arduino or Raspberry pi	→ It's designed for large scale enterprises.