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Module 3: Getting started with ESP32 And Wokwi platform:

Introduction

We will go through the steps necessary to set up an ESP32 / ESP8266 development board with the Arduino Cloud IoT. To test it out, we will send random values from the board to the cloud, and set up a switch that can enablethe built-in LED on the board.

ESP32 Simulation

The ESP32 is a popular WiFi and Bluetooth-enabled microcontroller, widely usedfor IoT Projects. Wokwi simulates the ESP32, ESP32-C3, ESP32-S2, ESP32-S3, ESP32-C6 (beta), and ESP32-H2

Getting Started

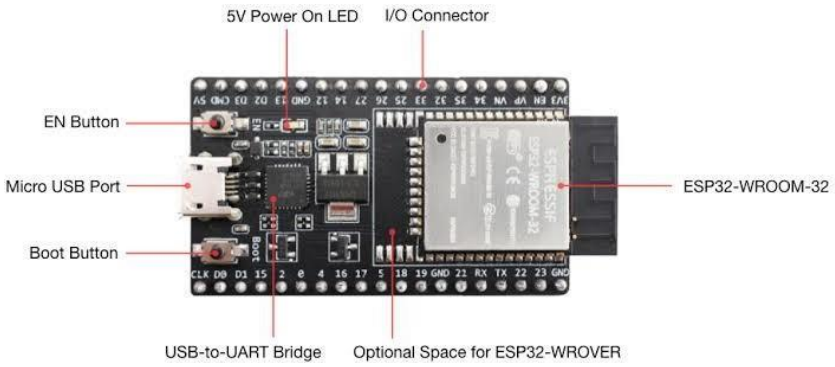
We can use the ESP32 simulator to run different kinds of applications:

ESP32 Arduino Core projects (including ESP-IDF projects)

MicroPython and CircuitPython projects
(examples athttps://wokwi.com/micropython)

Rust projects (see https://wokwi.com/rust)

Custom application firmware files (e.g. applications built using the ESP-IDF)



MicroPython:

Start from the MicroPython ESP32 Project Template, or from the MicroPython ESP32 Blink Example.

Custom Application Firmware:

Open the ESP32 custom application project template, and press “F1” in the code editor. Then choose “Upload Firmware and Start Simulation…”. Choose any .bin, .elf or .uf2 file from your computer and the simulation will start

Simulator Examples

ESP-IDF Examples

The following examples use the ESP-IDF functions. They are compiledusing Arduino ESP32 Core:

- Blink using FreeRTOS API
- Binary LED counter using FreeRTOS tasks
- GPIO button input + interrupts
- WiFi Example

Custom firmware offset:

When loading a custom firmware, you can specify the offset of the firmware in the flash memory. By default, Wokwi will look at the firmware binary and try to figure out the offset automatically, based onthe presence of the bootloader and the type of the chip. If Wokwi can’tfigure out the offset, it will assume that your firmware is an applicationfirmware and load it at offset 0x10000.

Changing the MAC address

You can change the MAC address of the WiFi interface by adding thefollowing attribute to the chip:

Attribute	Description	Default
macAddress	MAC address of the WiFi interface, e.g. “24:0a:c4:12:45:56”	“24:0a:c4:00:01:10”

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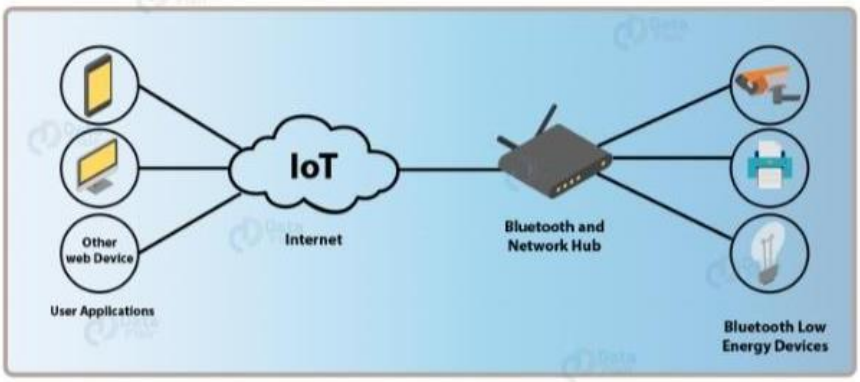
IoT Communication Technology & IoT Protocols:

Several Communication Protocols and Technology used in the internet of Things. Some of the major IoT technology and protocol (IoT Communication Protocols) are Bluetooth, Wifi, Radio Protocols, LTE-A, and WiFi-Direct.These IoT communication protocols cater to and meet the specific functional requirement of an IoT system.There are 6 IoT Communication Technology, let us ook each one of them.

a. Bluetooth:

- An important short-range IoT communications Protocols / Technology. Bluetooth, which has become very important in computing and many consumer product markets. It is expected to be key for wearable products in particular, again connecting to the IoT albeit probably via a smartphone in many cases.



Bluetooth Role In Future IoT

b.Zigbee

- ZigBee is similar to Bluetooth and is majorly used in industrial settings. It has some significant advantages in complex systems offering low-power operation, high security, robustness and high and is well positioned to take advantage of wireless control and sensor networks in IoT applications.

Iot Technology – ZigBee

c.Z-Wave

- Z-Wave is a low-power RF communications IoT technology that primarily design for home automation for products such as lamp controllers and sensors among many other devices.

- A Z-Wave uses a simpler protocol than some others, which can enable faster and simpler development, but the only maker of chips is Sigma Designs compared to multiple sources forother wireless technologies such as ZigBee and others.

Iot Technology – Z-Wave

d. Wi-Fi

- WiFi connectivity is one of the most popular IoT communication protocol, often an obvious choice for many developers, especially given the availability of WiFi within the home environment within LANs.

- Currently, the most common WiFi standard used in homes and many businesses is 802.11n, which offers range of hundreds of megabit per second, which is fine for file transfers but may be too power-consuming for many IoT applications.

e. Cellular

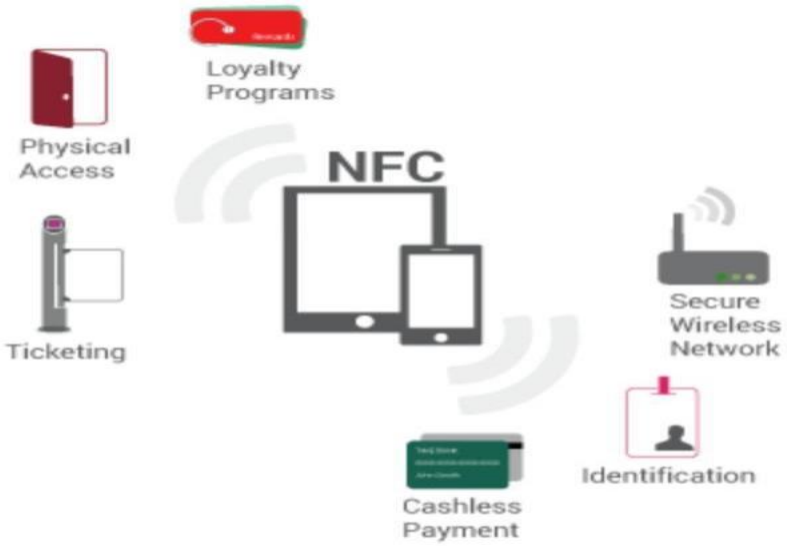
- Any IoT application that requires operation over longer distances can take advantage of GSM/3G/4G cellular communication capabilities. While cellular is clearly capable of sending high quantities of data, especially for 4G, the cost and also power consumption will be too high for many applications.

- But it can be ideal for sensor-based low-bandwidth-data projects that will send very low amounts of data over the Internet.

IoT Communication Protocols – Cellular

f. NFC

- NFC (Near Field Communication) is an IoT technology. It enables simple and safe communicationsbetween electronic devices, and specifically for smartphones, allowing consumers to perform transactions in which one does not have to be physically present.



IoT Communication Protocols – NFC

g. LoRaWAN

- LoRaWAN is one of popular IoT Technology, targets wide-area network (WAN) applications. The LoRaWAN design to provide low-power WANs with features specifically needed to support low-cost mobile secure communication in IoT, smart city, and industrial applications

Iot Technology – LoRaWAN