ROBOTICS NOTES

Internet of Things (IoT)

Internet of Things

1. Smart Farming
2. Security
3. Transportation
4. Nature
5. Smart City
6. Healthcare
7. Education
8. Smart Living
9. Marine
10. Engagement
11. Industrial IoT
12. Difable
13. Fintech & E-commerce
14. Sport

Development Board

1. Arduino
2. Arduino 101
3. Bluino
4. ESP8266
5. ESP32
6. Particle.io (Proton, Electron)
7. Espruino
8. MXChip IoT
9. Raspberry Pi
10. Etc.

LoRa

- Wireless modulation technology.
- Physical (PHY) layer for long range communications.
- Operates in the license-free ISM bands all around the world.
- 433, 868, 915 Mhz
- Regulated (power, duty cycle, band width) E.g: EU; 0.1% or 1% per sub-band duty-cycle limitation (per hour).

Sensitivity: -142 dBm
Link Budget (EU): 156 dB

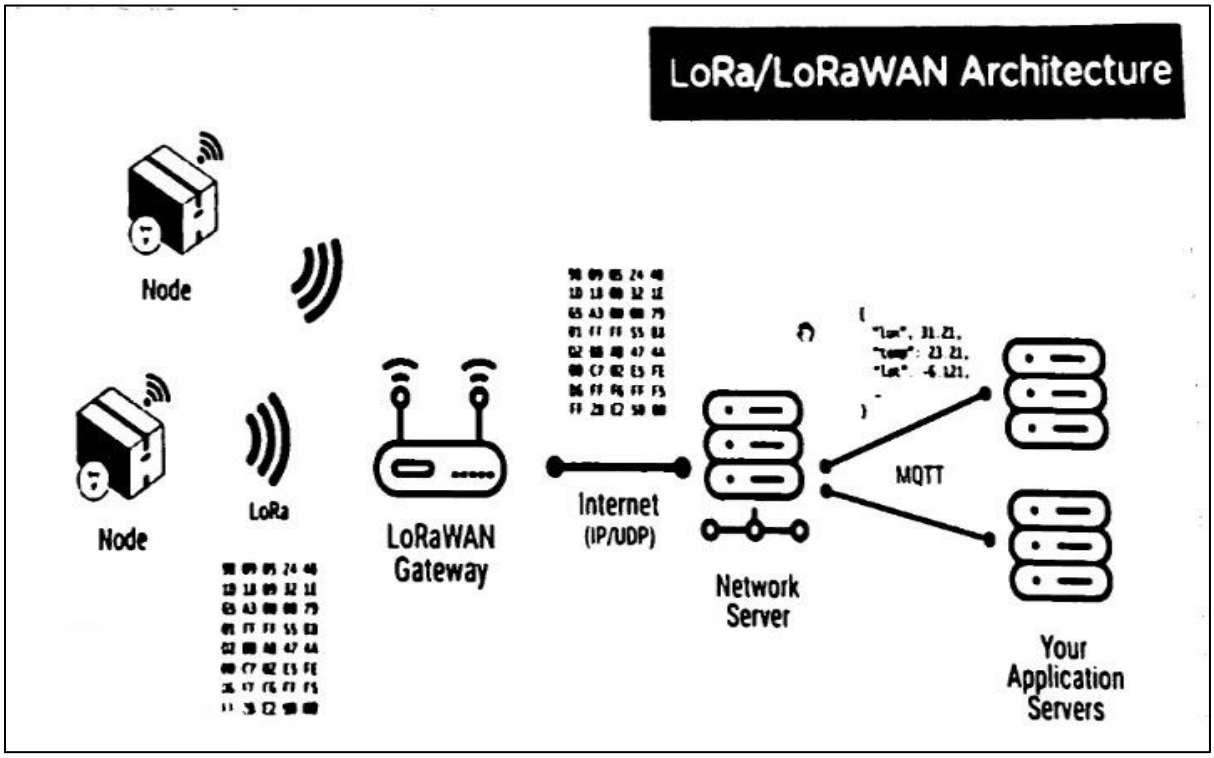
ISM Regulation

Countries	Frequency based receiver	Max. Output power
EU	868 MHz	14 dBm
USA	915 MHz	20 dBm
KOREA	900 MHz	14 dBm
JAPAN	920 MHz	
MALAYSIA	919 to 923 MHz	20 dBm
PHILIPPINES	868 MHz	
VIETNAM	920 to 925 MHz	
INDIA	865 to 867 MHz	
SINGAPORE	922 MHz	
THAILAND	920 to 925 MHz	
INDONESIA	922 MHz	
ANZ	915 to 928 MHz	
TAIWAN	920 to 925 MHz	
CHINA	470 to 510 MHz	17 dBm

What is LoRaWAN?

- Communications protocol & architecture utilizing the LoRa physical layer.
- Data rates are from 300bps to 5.5kbps. Has 2 high-speed channels at 11kbps and 50kbps (using FJK modulation
- Secure bi-directional communication.

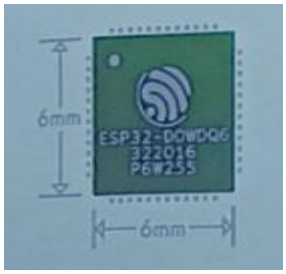
LoRa/LoRaWAN Architecture



ESP8266 vs ESP32

Specifications	ESP8266	ESP32
MCU	**Xtensa Single-Core 32-bitL106**	**Xtensa Dual-Core 32-bit LX6 600 DMIPS**
802.11 b/g/n Wi-Fi	**Yes, HT20**	**Yes, HT40**
Bluetooth	**N/A**	**Bluetooth 4.2 and below**
Typical Frequency	**80MHz**	**160Mhz**
SRAM	**160kBytes**	**512kBytes**
Flash	**SPI Flash up to 16Mbytes**	**SPI**
GPIO	**17**	**36**
Hardware/Software PWM	**None/ 8 Channels**	**1/ 16 Channels**
SPI/I2C/I2S/UART	**2/1/2/2**	**4/2/2/2**
ADC	**10-bit**	**12-bit**
CAN	**N/A**	**1**
Ethernet MAC Interface	**N/A**	**1**
Touch Sensor	**N/A**	**Yes**

ESP32 Specs



- CPU: Tensilica Xtensa 32-bit LX6, up to 240 MHz, DMIPS, DUAL cores
- 3.3 V operating voltage
- Internal Memory: 530Kb RAM, 448Kb ROM, 8KB RTC slow & fast RAM
- External Flash: 512KB to (4 x 16) MiB
- WiFi (802.11): b/g/n/e/I
- Bluetooth v4.2 BR/EDR & BLE
- Peripherals: GPIOs, PWM, ADC, DAC, I2s

ESP32 Boards

1. Espressif DevKit
2. ESP32 Things
3. ESP320
4. ESP32 N1
5. FiPy
6. **Di kitaon*
7. **Di kotaon*
8. **Di kitaon*

???

1. Huzzah
2. Hornbill
3. ARS01119B
4. AnalogLamb ESP32
5. Node32S
6. FireBeetle
7. D-duino-32

Programming Languages

1. C
2. C++
3. Python
4. ASM (Assembly Language)
5. JavaScript

Development Platforms

1. Arduino
2. MicroPython
3. ESP-IDF
4. Mongoose OS
5. Espruino

Development Tools/IDE

1. Visual Studio
2. Eclipse
3. VS Code
4. PlatformIO
5. Espruino
6. Sublime