Section 6, Wireless Communication in the Raspberry Pi 4

In this section, we will cover the following topics

● Introduction to Wireless Communication in Raspberry Pi 4

● Remote GPIO Control with Bluetooth

● Introduction to the Cayenne Platform

● IoT Project With Cayenne

Video, Introduction to Wireless Communication in Raspberry Pi 4

In this video, we will cover the various wireless communication standards supported by the raspberry pi 4.

Wireless communication involves the transmission of information over a distance without the help of wires, cables, or any other forms of electrical conductors. Wireless communication is a broad term that incorporates all procedures and forms of connecting and communicating between two or more devices using a wireless signal through wireless communication technologies and devices.

As covered in the hardware overview of the Pi 4, the board comes inbuilt with 2 Wireless interfaces. It supports both WiFi and Bluetooth Wireless communication out of the box. The inclusion of the latest versions of the wireless capabilities of WiFi and Bluetooth to the Raspberry Pi 4 enhances its application possibilities in areas such as robotics, environmental sensing, and remote imaging. Impressively, the Raspberry Pi 4 has a dual band 802.11ac Wi-Fi and throws in Bluetooth 5.0 support, an improvement over the Bluetooth 4 on prior models.

The support for dual-band WiFi means that you can now connect to a faster 5 GHz WiFi Access point. This will significantly reduce the latency for remote access and improve overall networking speed.

Bluetooth connectivity is very important for IoT applications. The obvious advantage of Bluetooth 5.0 is its ability to transfer data at double speed & four times the distance as compared to Bluetooth 4.2. Bluetooth 5.0 also allows us to pair and communicate with multiple devices independently. Bluetooth 5.0 can also replace WiFi implementation for small IoT Edge devices in some applications with Bluetooth Low Energy, due to its longer range & ability to communicate with multiple devices independently.

In addition, other communication standards such as ZigBee and near field communication, also called NFC can be realized by special interfacing modules having serial UART support. So which communication standard should you choose for your next wireless project?

There is no single best solution for all projects; rather, each of the wireless communication standards has different advantages and disadvantages for different applications.

Bluetooth 5 is a popular standard for interfacing to devices, for applications where the data rate is not a critical factor. It has a low cost and low power consumption profile, which makes it particularly suitable for battery-powered Internet of Thing devices. Along with Bluetooth 5, Pi 4 also supports BLE, also called Bluetooth Smart. BLE can establish up to 20 connections simultaneously at half the power consumption of Classic Bluetooth. It supports more simultaneous connections because it transfers small data packets and establishes quick connections. Classic Bluetooth 5.0 on the hand can initiate only 7 simultaneous connections.

WiFi communication is more suitable than Bluetooth for full-scale networking applications in which a high data rate is critical; therefore, it is popular with media rich Internet attached devices and laptop computers. Unfortunately, WiFi has heavy power consumption costs. It can sometimes use as much as 40 times the power consumption of Bluetooth for comparable communication tasks.

The ZigBee communication standard can also be utilized by the Raspberry pi 4, usually by interfacing via a UART device to XBee modules. XBee devices are designed to have a low power profile, and they can communicate over significant distances, forming mesh network arrangements to extend the network range further. Unfortunately, the maximum data rates are quite limited in comparison to Bluetooth and Wi-Fi; however, the low communications latency means that the standard is suitable for real-time control like in industrial automation.

NFC is a short-range radio communication standard that builds on RFID communications, similar to the one we implemented in the last section. It supports a communication range of up to 8 inches and enables very high data rates when the devices are closer than 2 inches. NFC supports communication with unpowered devices using inductive coupling, just like the RFID tag we used earlier, but it can transfer a lot of data, much quicker than any normal RFID tag could. Its very useful in many applications like logistics, medicine, Inventory management, Access control, E wallet payment etc. You can interface your Raspberry Pi 4 with an NFC Reader Module Like the NFC PN532, to start building projects around this protocol. The interfacing will be similar to that of the MFRC522 RFID Reader, as both use SPI bus to interface with the Pi 4.

Summary

In this video, we have covered the following topics

* Various Wireless Communication Standards supported in the Raspberry Pi 4

In the next video, we will learn to do remote GPIO Control over Bluetooth.