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Introduction: IoT Connectivity – Part 2

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Z-Wave

Introduction to Z-Wave

- Z-wave is a low power radio communication technology primarily used for home automation and security systems.
- It was designed as a simpler and cheaper alternative to Zigbee for small to medium range connectivity.
- It operates on the unlicensed part of the industrial, scientific and medical (ISM) band: 908.42 MHz in the US & 868.42 MHz in Europe, avoiding any interference with the 2.4Ghz band(Wi-Fi, Bluetooth and others).
- Z-wave uses a Mesh Network Topology to communicate among the devices, supporting up to 232 nodes in a network.

Source: Paul Lamkin. April 26, 2018. Z-Wave explained: What is Z-Wave and why is it important for your smart home

Features of Z-Wave

- A Z-wave network has 2 device categories: **Controller** and **Slave**
- The **Controller** is a central entity which sets up the Z-wave network and manages other slave devices in the network.
- Each logical Z-wave network has 1 Home (Network) ID and multiple unique Node IDs for the devices in the network.
- The Network ID is of length 4 Bytes and Node ID is of length 1 Byte.
- The nodes can communicate only within their home network
- It offers a data rate of up to 100kbps and an average communication range of 30 meters.

Source: Paul Lamkin. April 26, 2018. Z-Wave explained: What is Z-Wave and why is it important for your smart home

Features of Z-Wave (contd.)

- It uses source routed network mesh topology using 1 primary controller.
- Z-wave considers only static devices in the network due to its source routed network topology.
- The devices communicate with one another only when they are in range.
- Messages are routed through different nodes in case of any obstruction due to interior layout and other household appliances.
- These obstructions are called radio dead-spots and can be bypassed using a process called **Healing.**

Source: Paul Lamkin. April 26, 2018. Z-Wave explained: What is Z-Wave and why is it important for your smart home

Application

- Primarily used in Home/Office Automation
- Systems for Smart Energy Management
- System for Smart Security and Surveillance
- Voice control enabled applications
- Appliances automation and control

Source: Applications of Z-wave technology, (March 2018)

ISA 100.11a

Introduction to ISA 100.11a

- ISA 100.11a is a Standard for wireless network technology developed by the International Society of Automation(ISA).
- The primary focus of the technology is the implementation of automation in the industrial environment.
- The protocol stack of ISA 100.11a is in compliance with IoT.
- It is based on the IEEE 802.15.4 protocol along with other wireless networks.

Source: ISA100 Wireless tutorial | What is ISA100 Wireless

Features of ISA 100.11a

- It supports multiple devices working on different protocols to interact in a single network, simultaneously.
- It is an open standard which enables interoperability and communication between different devices.
- It uses the IPv6 based technology and adds the associated benefits such as increased address space and security.
- 128 bits AES encryption security.
- Hence, it offers essential scalability and reliability for industrial network.
- It supports 2 network topologies for operation: 1)Star and 2)Mesh.
- Uses TDMA/CSMA schemes for resource sharing, collision avoidance.

Source: ISA100 Wireless tutorial | What is ISA100 Wireless?

Application

- It is primarily used for automation in large scale complex industries.
- Wireless monitoring of the industrial network and devices.
- Process monitoring and control automation in the industrial environment with large and complex setups.

Bluetooth

Introduction to Bluetooth

- A short range wireless communication technology.
- Its is aimed at replacing the cables with wireless medium to communicate between portable devices.
- It is based on Ad-hoc technology, also known as Ad-hoc Piconets.
- Network can be established between 2 to 8 Bluetooth devices.

Source: Bluetooth Basics (March 31, 2018)

Features of Bluetooth

- It is a low cost wireless communication technology.
- Low power consumption.
- Bluetooth technology uses the unlicensed industrial, scientific and medical (ISM) band at 2.4 to 2.485 GHZ.
- Supports 1Mbps and 3Mbps data rate for version 1.2 and 2.0, respectively.
- The operating range: 1 meter for Class 3 radios, 10 meters for Class 2 radios, and 100 meters for Class 1 radios.

Source: Bluetooth Basics (March 31, 2018)

Application

- Bluetooth is suitable for a network of devices with smaller radius.
  - Connectivity with desktop and laptop peripherals
  - Wireless connectivity between mobile phones and other portable devices.
  - Multimedia transfer between devices
  - Automobiles use Bluetooth for connecting with multimedia and navigation devices.
  - GPS devices are connected with the end user.

Source: Tarun Agarwal. April 11, 2016. How does Bluetooth work?

RFID

Introduction to RFID

- RFID stands for “radio-frequency identification” .
- An RFID system consists of RFID tag, RFID reader and RFID software.
- RFID tag stores digitally encoded data, which is read by a RFID reader.
- RFID tag data can be read outside the line-of-sight, as compared to traditional barcodes and QR codes.

Source: RFID Radio Frequency Identification Technology Tutorial

Features of RFID

- RFID tag consists of an integrated circuit and an antenna, covered with a protective material.
- Tags can be classified as passive or active.
- **Active** tags use their own power supply for operation and data transfer.
- **Passive** tags have to be powered by a reader inductively in order to transmit data.

Source: RFID Radio Frequency Identification Technology Tutorial

Application

- Store product tracking.
- Asset and baggage tracking.
- Supply chain management.
- Livestock tracking and management.
- Automobile tracking.
- Authentication and access control

NFC

Introduction to NFC

- **Near field communication**, or NFC, has been derived from radio-frequency identification (RFID).
- NFC works within close proximity without any physical contact between the devices unlike RFID which has a longer range of communication.
- A NFC device can be any of the two types: 1) Active and 2) Passive.
- An **Active** type of device can both read and transmit data.
- A **Passive** device can only transmit data but cannot read from other NFC devices.

Source: NFC Near Field Communication Tutorial | NFC Tutorial (2016)

Features of NFC

- NFC operates at 13.56 MHz frequency.
- The communication range of NFC devices is less then 10 centimeters.
- Data rate supported are 106, 212 or 424 Kbps (kilobits per second).
- Two communication modes are supported between two devices: Active-Active or Active-Passive mode.

Source: NFC Near Field Communication Tutorial | NFC Tutorial (2016)

Application

- Banking and payments using NFC enabled smartphones, transaction cards.
- Tracking goods.
- Data Communication between smart phones.
- Security and authentication using NFC enabled ID cards.
- Low-power home automation systems.

References

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Thank You!!