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Understanding Wireless Sensor Network

Scientech 2311W V2.0

Wireless Sensor Network (WSN) research has enabled large scale monitoring using small Sensors with radio links. The technological advance in wireless communications and microelectronics has enabled the development of small, low-cost Sensor Nodes. Wireless Sensor Networks are developed to organize and control these Sensor Nodes, which have sensing, data processing, communication and control capabilities. Information collected from these Sensor Nodes is routed to a sink Node via wireless communication approach. The research in the Wireless Sensor Network has focused primarily on the networks issues such as routing, data dissemination and aggregation of co-related data for downstream data delivery. The combination of small size, low cost and wireless networking functionality makes Wireless Sensor Network (WSN) technology exceptionally scalable.

Scientech 2311W v2.0 Wireless Sensor Network will help users to design their own WSN network and also help them to understand the overall concept & its applications.

Scope of Learning

- Understand the concept of Wireless Sensor Network.
- Learn different network topologies like
  - Point to Point
  - Star
  - Mesh
- Study Sensors and their circuit diagram.
- Interface analog / digital signaling of Sensors.
- Learn Graphical analysis of analog / digital Sensors.
- Routing algorithm
- Learn to configure End Device and Router.
- Study End Device parameters like
  - Sleep period
  - Sensor scan time
  - PAN ID
  - Baud Rate
- Interfacing using Arduino, Python, and C programing etc.

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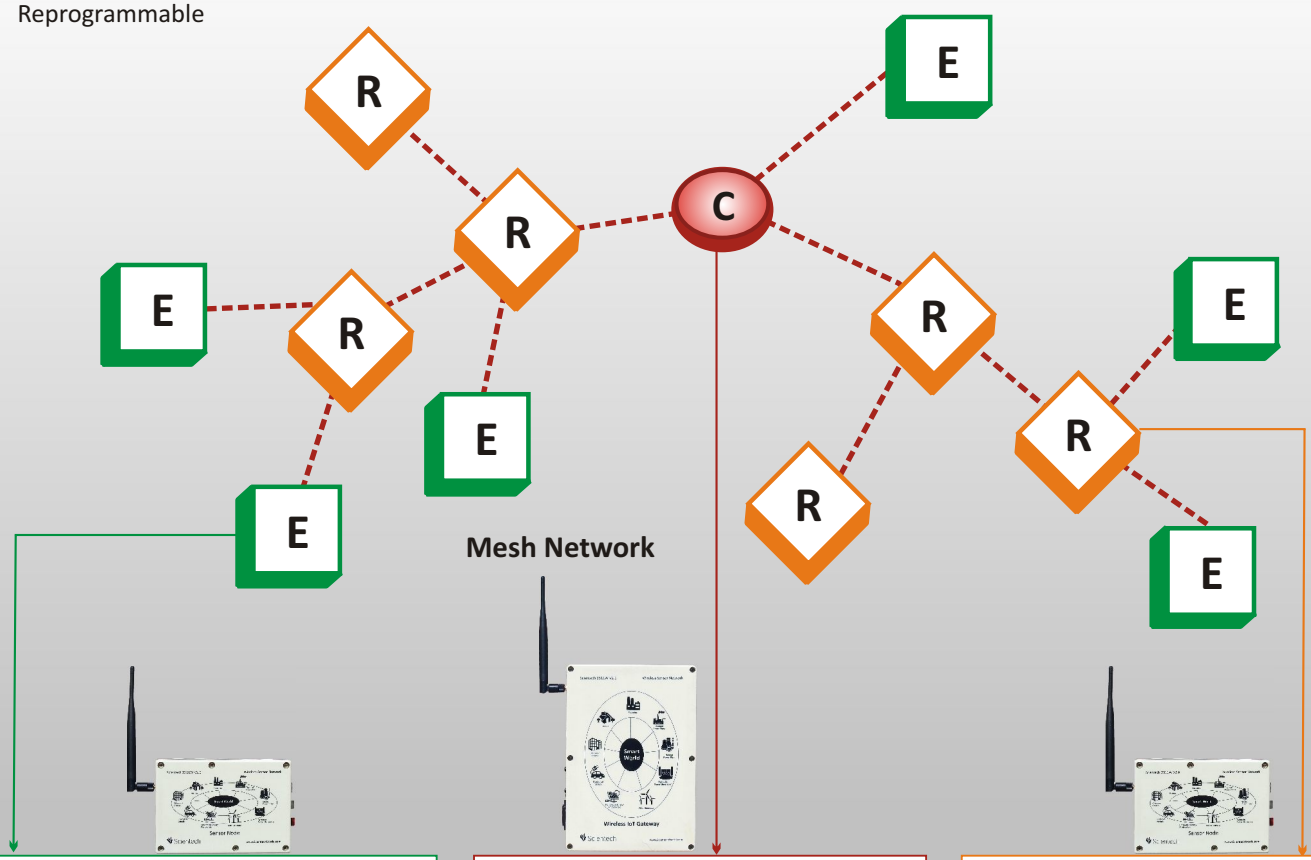
Device Features

- Wireless Network using ZigBee protocol.
- Easy to configure.
- ISM band 2.4 GHz operation
- Data collection from End Device & rely to coordinator using Router.
- Six analog input and 4 digital input/ output connector on each Node.
- Status indicators like Data Transmission battery charging.
- Possible network combinations - point to point, star, mesh.
- Battery charging via USB cable.
- Node configuration connector.
- Easy to install.
- Reconfigurable
- Protocol design
- Reprogrammable

Software Features

- Live data table and simultaneous graph plotting of all six Sensors of particular Node.
- Live monitoring and graph plotting of battery voltages of all connected Nodes.
- Data logging facility over MySQL database.
- Data search facility with resolution option, viz data/minute, data/hour or data/day.
- Apply formula to Sensor data to plot desired parameter
- Modem configuration feature so that user can configure Node parameters like baud rate, sleep time, PAN ID, destination address etc.



End Devices:

- Low-power / battery-powered device.
- Sufficient functionality to talk to their parents (either the coordinator or a router)
- End devices must always interact with their parent to receive or transmit data.
- Intended to sleep periodically and therefore have no routing capacity.
- Several end devices can operate in one PAN ID.

Coordinators:

- One coordinator in each network and it is the device that establishes the network.
- Able to store information about the network, including security keys.
- The coordinator is responsible for establishing the operating channel and PAN ID for an entire network.
- Once established, the coordinator can form a network by allowing routers and end devices to join to it.

Routers:

- It acts as a intermediate Nodes, relaying data from other devices (End Device).
- It creats/maintains network information and uses this information to determine the best route for a data packet.
- A router must join a network before it can allow routers and end devices to join to it.
- A router can participate in routing packets and is intended to be a mains-powered Node.

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Technical Specifications

Scientech 2311W Wireless IoT Gateway

Processor	: 64bit ARMv7 Quad Core Processor 1.2GHz
Connectivity	: 802.11 b/g/n Wireless LAN Bluetooth 4.1, zigbee, USB & Ethernet
RAM	: 1GB
Memory	: 32GB
OS	: Linux
Ethernet	: 10/100 BaseT Ethernet socket
Video Output	: HDMI
USB	: 1 no.
Analog Input	: 6 nos.
Zigbee Frequency	: 2.4GHz
Power	: 220VAC

Scientech 2311W Sensor node

Analog Inputs	: 6 nos.
Digital Outputs	: 4 nos.
I2C channel	: 1 no.
Communication	: Zigbee 2.4 GHz
PC Interface	: USB
Charging	: USB and Solar Panel
Battery	: 3.7V/4400mAH
Solar Panel	: 6W (optional)
ADC Resolution	: 10 Bit
ADC reference voltage	: 3.3V
Supply for Battery Charging	: +5V via USB
Sleep mode time (default)	: 5000ms
Wake up time (default)	: 20ms
Indoor/Urban Range	: up to 60m
Outdoor RF line-of-sight range	: up to 800m
Frequency	: ISM 2.4 GHz
Antenna	: RF Antenna 2.4GHz
Network Topologies	: Point to Point, Star, Mesh network

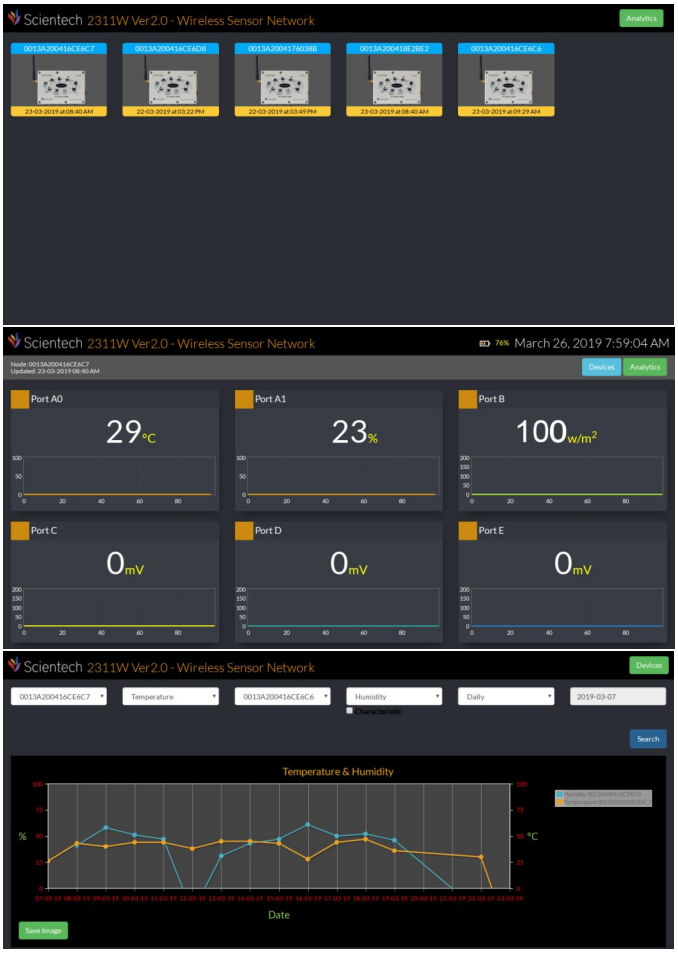
Dimensions in mm

Scientech 2311W Sensor Node	: W 180 x D 125 x H 55 (approximately)
2311W Wireless IoT Gateway	: W 185 x D 265 x H 95

Included Accessories

USB to DIN Connector Cable	: 2 nos.
Scientech 2311W (Wireless IoT Gateway)	: 1 no.
Scientech 2311W Sensor Node	: 5 nos.
HDMI to VGA Converter	: 1 no.
Wireless keyboard	: 1 no.
Wireless mouse	: 1 no.
Mains Cord	: 1 no.

Analysis windows



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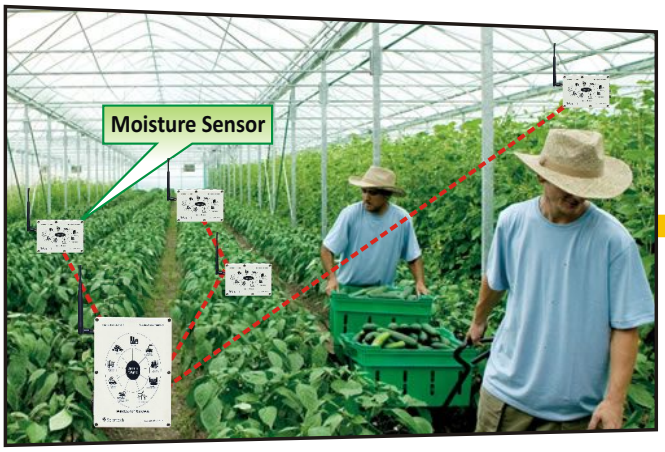
Application Areas:

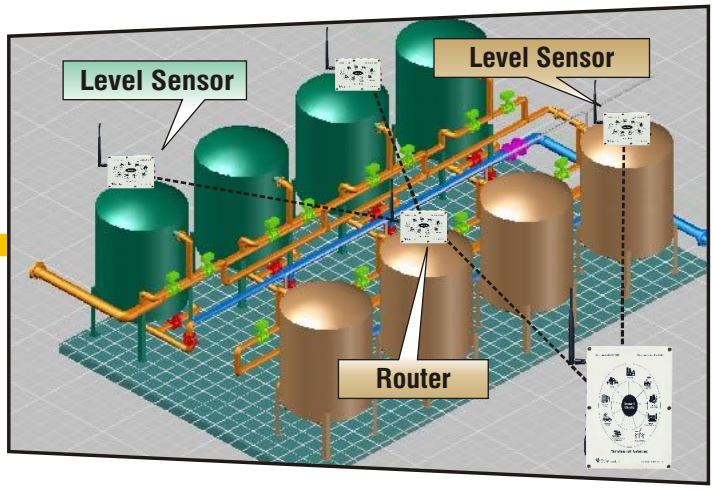
- Agriculture monitoring
- Building automation
- Weather monitoring
- Water management
- Animal monitoring
- Land Slide monitoring
- Vehicle monitoring
- Forest monitoring
- Machine monitoring



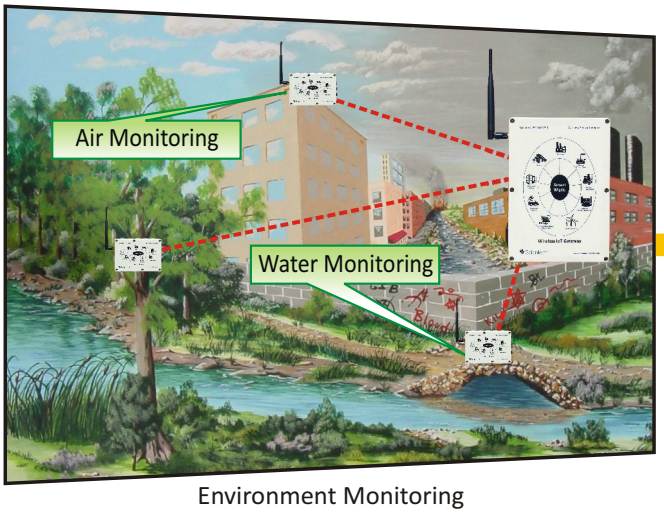
Agriculture Monitoring

Precision agriculture is on of the most promising application domains where Wireless Sensor Networks can deliver a feasible or even optimal solution to monitor moisture, humidity, temperature etc. In precision agriculture, more number of the parameters are to be controlled. They are increasing day by day because of the development in agriculture technology. In this situation, the Wireless Sensor Network with additional hardware and software is an efficient solution.

Wireless Sensor Network technology has demonstrated a great potential for industrial applications, specifically in monitoring data such as pressure, humidity, temperature, flow, level, viscosity, density and vibration. Measurements can be collected through sensing units and transferred wirelessly to a main system for operation and management. Adopting WSNs for process monitoring provides great advantages over traditional wired system.



Industrial Monitoring



Environment Monitoring

Environmental degradation has become one of the biggest concerns for almost every country. Water and air quality are essential to maintain the equilibrium between human development and a healthy environment. The solution proposed for this is an environmental monitoring system based on a Wireless Sensor Network. Wireless Sensor Networks are widely used in monitoring pollutions like air, water etc. It can be deployed in several cities to monitor the concentration of dangerous gases for citizens.

Subject to change - Version 2.0

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