

WL-WSN

Wireless Sensor and IoT Network Laboratory



FEATURES

- It enables analysis of wireless media propagation, network formation, radio parameter impact, and real-time communication performance.
- The system provides a hands-on experimental environment bridging simulation and real-world deployment.
- "The WL-WSN IoT Trainer Kit provides a complete platform for real-time wireless communication analysis, multi-hop networking, and IoT-based monitoring using industry-relevant protocols and tools."
- Based on IEEE 802.11 (WSN) with ESP32 Wi-Fi-enabled IoT integration
- Study wireless communication and network formation
- Measure RF propagation and reliability
- Analyze network performance
- Build applications using on-board sensors
- The system is powered by the Patented S-WiFi Network Stack, offering hardware-independent architecture, self-organizing network formation, and self-healing communication.
- Network Architecture:
 - 16-bit addressing scheme
 - Two-tier network: Master Device (MD) and Network Processing Devices (NPD)
- Each device includes an OLED display for real-time monitoring.

SPECIFICATIONS

802.11 BASED IOT NODES

- **Consisting of** — (5 x nodes + 1 x Master + Router)

Sensor Nodes

- OLED display 1.3"
- LED indications: Power, Rx/Tx
- Rechargeable battery power for 1 Hrs of operation
- Serial interface for Programming

Processor :

- 32-bit RISC CPU, up to 32MIPs

Sensors

- Integrated Temperature, Pressure and Humidity Sensor
- PWM, Relay, ADC & DIO

SENSOR CONTROL COMMAND

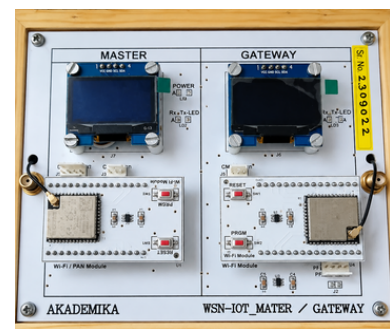
- Set pwm
- Configure DIO
- Set/Get DIO val
- Read sensor and ADC values

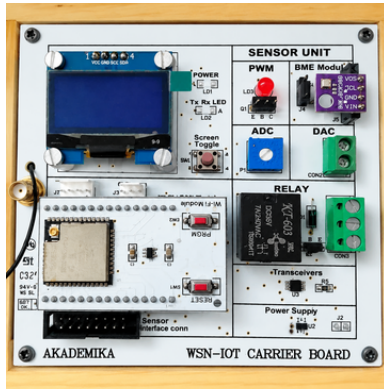
NETWORK CONFIGURATION SETTING

- Facility to emulate and define Network Configuration. The user is able to set the list of devices in the MD and NPD to allow or to block these devices during network formation. This facility allows the user to create user defined network topology as well create multi-hop network within the laboratory space.

NETWORK PARAMETERS AND PROCESSING DISPLAY

- Facility to display Device list with details like Device, Parent, Hops, DevLQI,
- Facility to display Device Parameters like Device, packet Interval, duration, expected Data packets, packet size, Retry, Ack Type, LQI Th,
- Facility to display processed Results like device, data/control transmitted packets, Communication Load %, Dev Efficiency %, Expected NW Efficiency%, NW Efficiency %





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EXPERIMENTAL PARAMETERS

- Packet interval time — 0-999999 mS
- Experiment duration — 1-9999 seconds
- Data size in packet — 0-200 Bytes
- Packet type — Sequential, Random
- ACK for packet — No ACK, Hardware ACK
- Start of experiment — Start on reset, Start after command



GUI APPLICATION SOFTWARE

- Radio/transmission setting: Power, LQI threshold, message transmission Retries
- Experiment settings: Packet interval, Packet size, Acknowledge type, Experiment Duration,
- Change device address and Role
- Reset network
- Ping

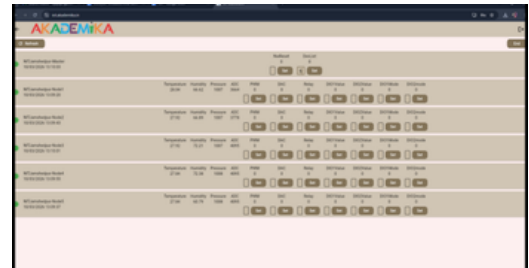
CLOUD SERVICES — STUDENT LEARNING OUTCOME

- The students learn to configure the cloud supporting IoT Services such as MQTT and Visualise and Control the Current / live values of all the sensors and using the interface change the actuators values on the Cloud. The Dashboard shows the saved data in tabular form / graph to be plotted and exported to CSV and pdf file

IOT FEATURES · CLOUD SOFTWARE

- The Dashboard should display and control all the Sensors
- Real-time cloud monitoring
- Remote device control

- Multi-node data aggregation
- Cloud Dashboard Data uploaded to cloud
- Data Logging & Analysis: Real-time network and sensor data can be logged, displayed in tabular form, analyzed graphically, and exported in CSV, PDF, and text formats for reporting, comparison, and further study.
- Control parameters remotely



EXPERIMENTS

- Wireless Network Setup & Analysis
- Packet Delivery Ratio & Routing Overhead
- LQI vs Distance Measurement
- Bandwidth Overhead Analysis
- Hops vs Delay Study
- Throughput vs Packet Size, Throughput vs Packet Interval
- Transmission Rate Analysis
- Indoor vs Outdoor Comparison
- IoT Sensor Monitoring



Sensor ID	Sensor Name	Value
WSN001	WSN001	100
WSN002	WSN002	200
WSN003	WSN003	300
WSN004	WSN004	400
WSN005	WSN005	500
WSN006	WSN006	600
WSN007	WSN007	700
WSN008	WSN008	800
WSN009	WSN009	900
WSN010	WSN010	1000