Wi-SUN Network

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10/30/2025

Agenda

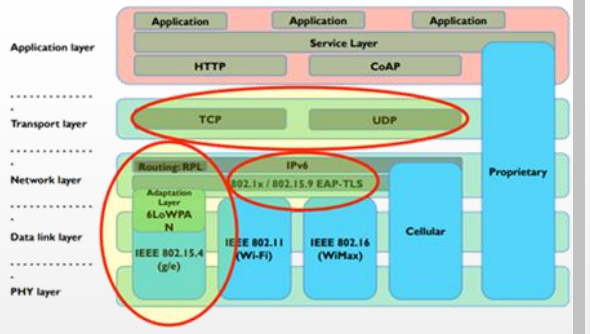
- Wi-SUN Overview
- Wi-SUN Solution Architecture
- Development Planforms
- Real Life applications and deployments
- Q&A

Wi-SUN Overview

Wireless Smart Ubiquitous Networks (Wi-SUN) is a leading IPV6 Sub-GHz mesh technology for smart city and smart utility applications.

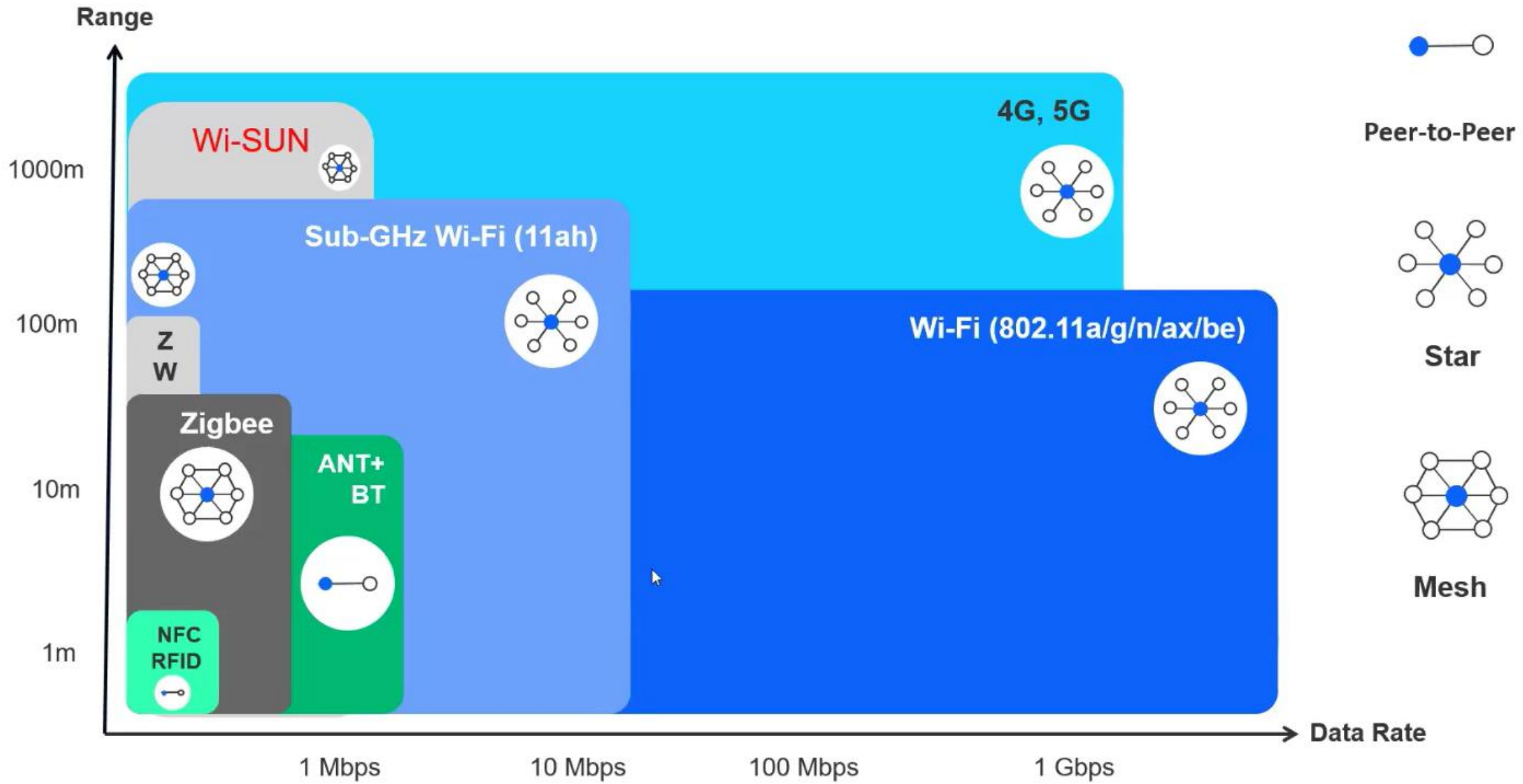
- A move from Proprietary to standards-based solutions
  - Ease of use
  - Flexibility
  - Avoid vendor lock-in
- Wi-SUN specifications bring Smart Ubiquitous Networks to service providers, utilities, municipalities/local government and other enterprises, by enabling interoperable, multi-service and secure wireless mesh networks.
- Wi-SUN can be used for large-scale outdoor IoT wireless communication networks in a wide range of applications.
  - Scalable self-healing mesh
  - High performance long range
  - Interoperable & secure

Wi-SUN, Wireless Smart Ubiquitous Network

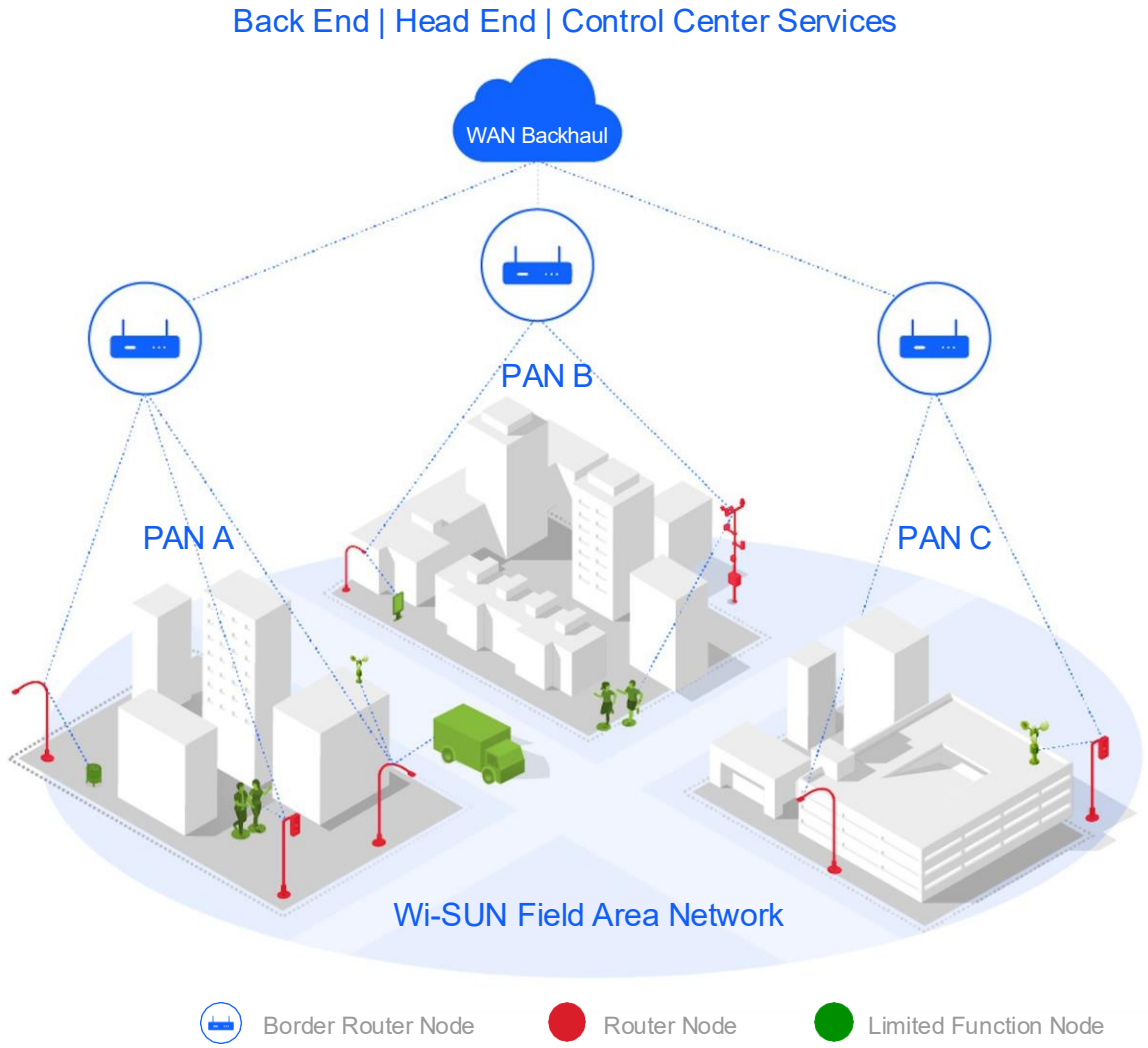
SMART CITY MKT PROBLEM	SOLUTION : WI-SUN ALLIANCE	SOLUTION: WI-SUN	SOLUTION : CERTIFICATION
	Itron, SILICON LABS, TOSHIBA, OMRON, Trilliant, HEXING, RENESAS, NICT, arm, cisco, Landis Gyr+		Wi SUN Certified FAN
▶ Proprietary Protocols ▶ Lack Of Interoperability ▶ Non-IP Based ▶ Limited Security	▶ Global Organization ▶ Silicon Labs Promoter Member ▶ 43 Countries ▶ 240+ Members ▶ ~100 Million Devices	▶ OPEN Standards Based ▶ Interoperable ▶ IPv6/6LoWPAN ▶ Mandatory Security ▶ FSK, OFDM ▶ FAN 1.0 and FAN 1.1	▶ PHY Certification ▶ FAN Profile Certification ▶ 6 Independent Test Houses ▶ ~50 FAN Certified Products

WI-SUN : A GLOBAL STANDARD DELIVERING INTEROPERABLE CONNECTIVITY & SCALABILITY

Rate, Range, and Topology

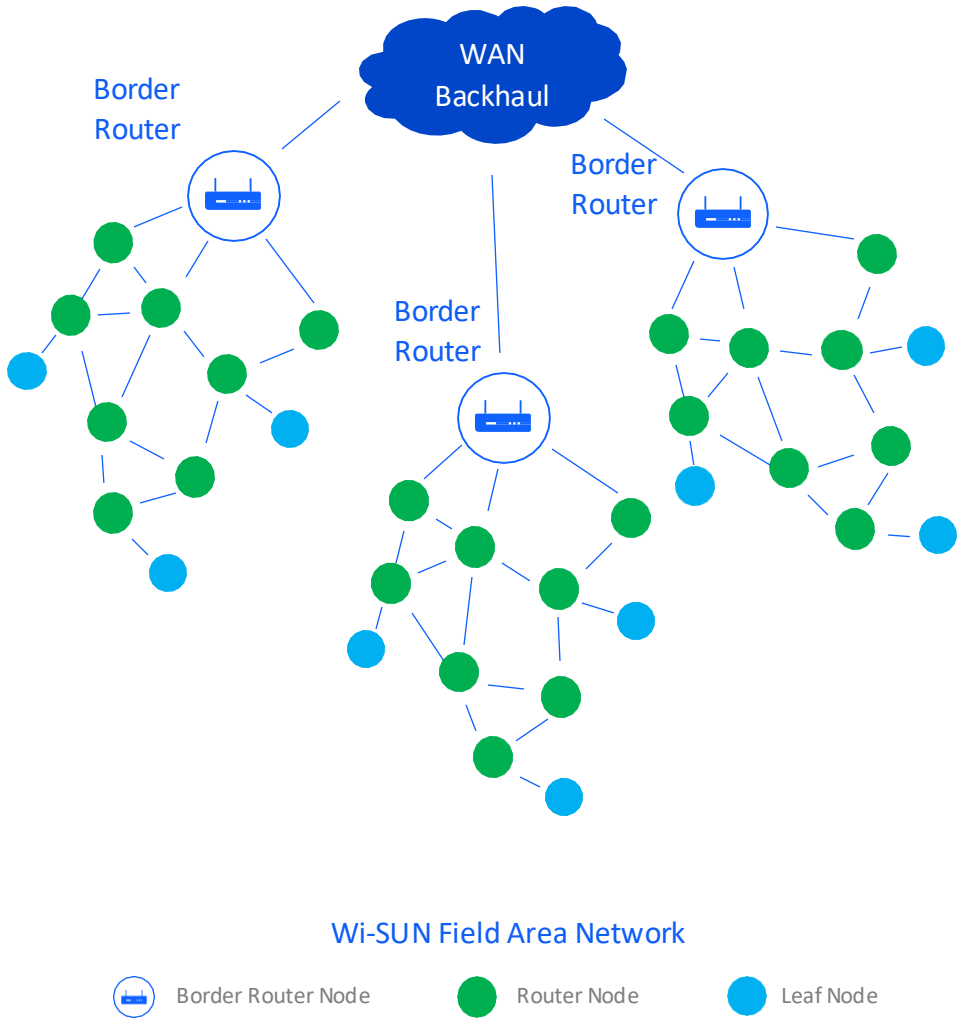


Wi-SUN Solution Architecture



- **Border Router**
  - Provides WAN connectivity
  - Maintains source routing tables
  - Disseminate PAN wide information such as broadcast schedules
- **Router Nodes**
  - Upward and downward packet forwarding within a PAN
  - Services for relaying security and address management protocols
- **LFN(Limited Function Nodes) / Leaf Nodes**
  - Discover and join a PAN
  - Battery powered devices
  - Send/receive IPv6 packets
  - Introduced in FAN 1.1

Wi-SUN Key Words



System Elements:

- Wi-SUN Network
- Border Router
- Router/Node
- Leaf Node
- IPV6/6LoWPAN

Silicon Labs Delivers the Wi-SUN Foundation

Applications & Device Management

Grid intelligence | Distribution automation | Municipal infrastructure | Cloud database management | Enterprise efficiency | … … …

SECURITY

Stack (L2-L4)

Wi SUN **FAN 1.0**

Line powered, FSK modulations

Wi SUN **FAN 1.1**

Battery powered, OFDM modulations

Wi SUN **FAN 2.0**

… … …

SECURITY

Hardware

EFR32xG Series 1

EFR32xG12
1 MB / 256 kB
2.4/sub-GHz

EFR32xG13
512 kB / 64 kB
2.4/sub-GHz

EFR32xG Series 2

EFR32xG25
1 MB / 96 kB
2.4GHz

EFR32xG28
512 kB / 32 kB
2.4GHz

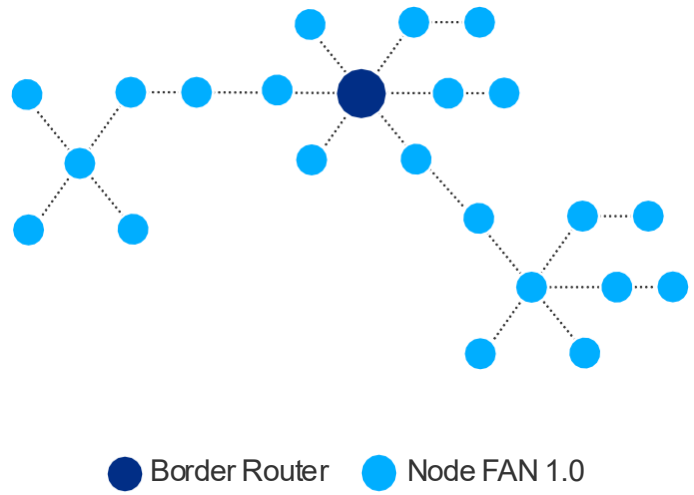
Coming Soon
Sub-GHz

CUSTOMER FOCUSED ON CREATING AND MONETIZING VALUE ON THE APPLICATION LAYER

SILICON LABS

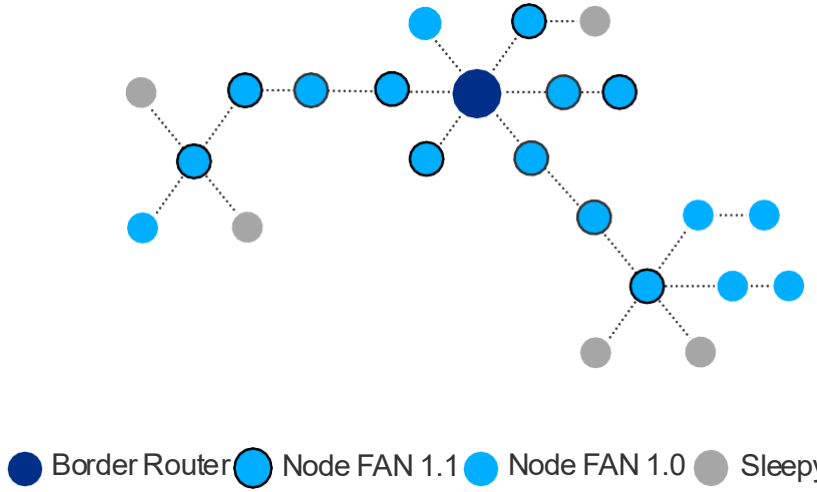
Wi-SUN FAN 1.0 vs FAN 1.1

Wi-SUN FAN 1.0



- Deploy a mesh network with up to several thousands' nodes
- Native IPv6 communication through 6LoWPAN
- Based on FSK PHYs (up to 300 kbps)
- Interoperable
- Secure

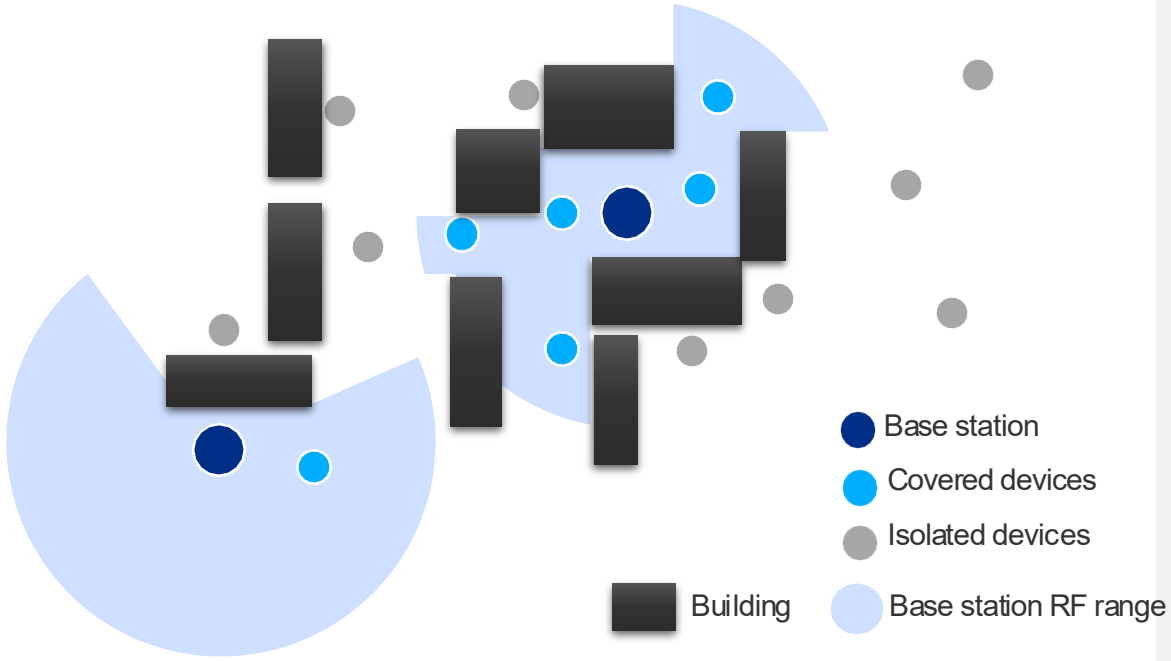
Wi-SUN FAN 1.1



- Enable battery powered devices in the network (water/gas metering, smart city sensing…)
- Expanded global footprint (Japan, Brazil, EU…)
- Introduction of OFDM PHYs (up to 2.4 Mbps) for high performance use cases like distribution automation
- Modulation and data rate negotiation between nodes to make use of the different PHYs for optimum performance

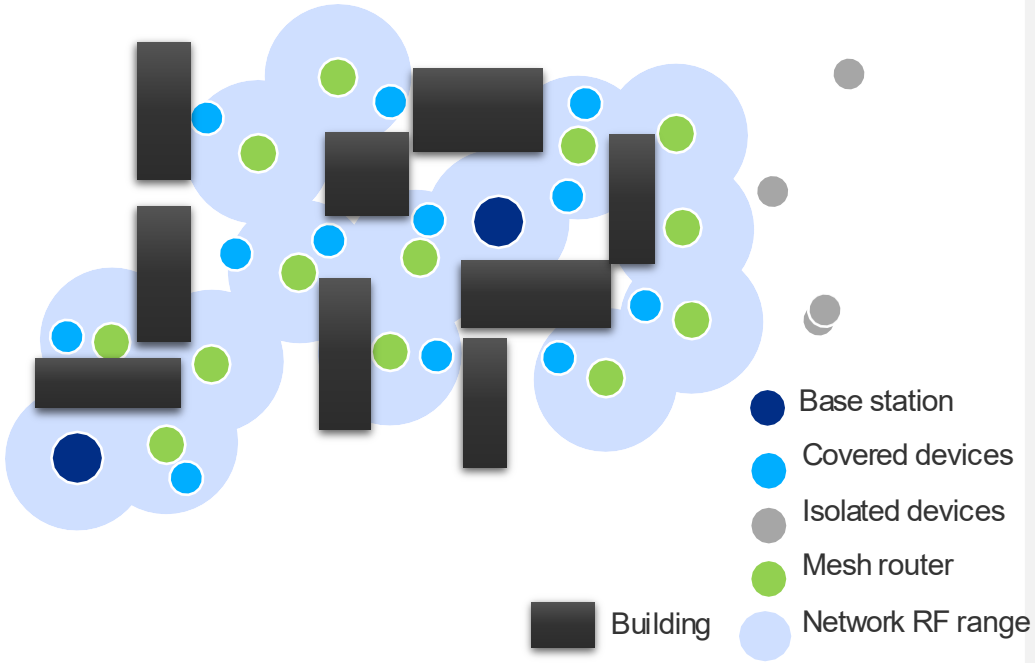
Long Range vs Mesh IoT Protocols

Long-range IoT Protocol



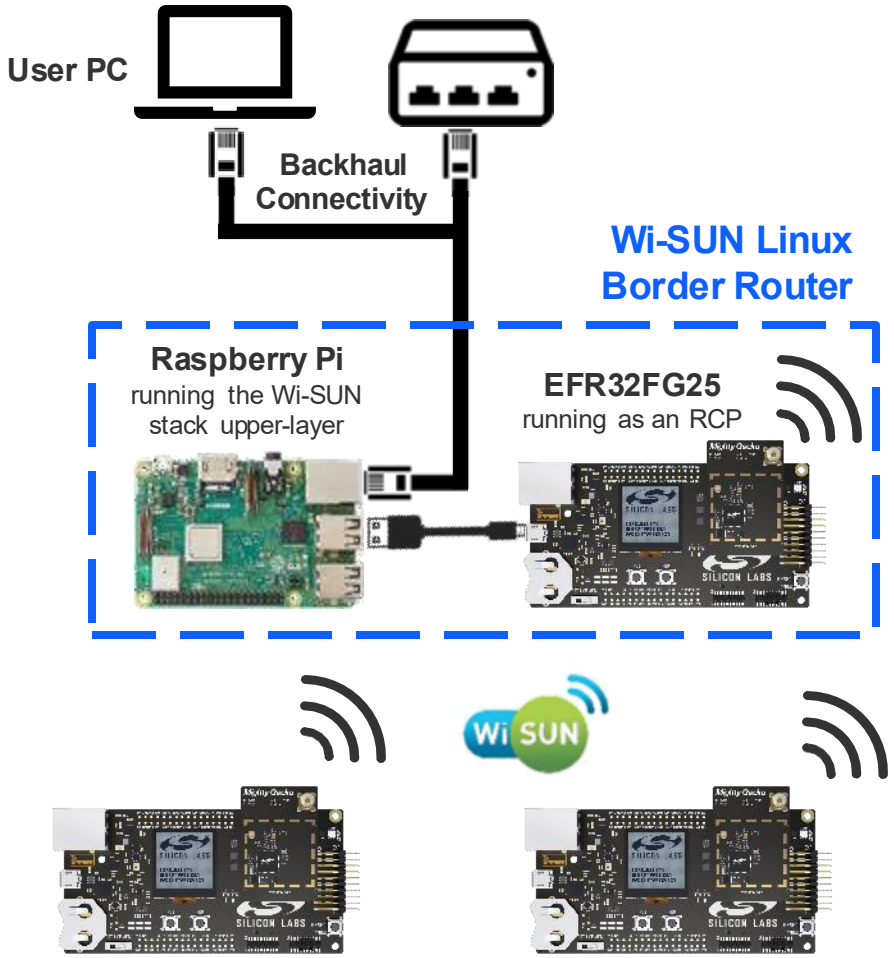
- Star topology includes expensive base stations
- In an urban environment or RF challenging layout, deploying enough base stations to cover the entirety of an area is tedious.

Mesh Network Protocol



- Mesh topology is more flexible
- Mesh routers can be deployed on grid powered devices (electric meters, streetlights…)
- Having a complete RF coverage of such an area becomes possible

Wi-SUN Border Router Reference - HW Solution



- **Host API**
  - Based on Spinel & extended to Wi-SUN needs.
- **Border Router Configuration & Visualization**
  - Web GUI for configuration & network visualization
- **Wi-SUN Network Layer**
  - Provided as source code
  - Implemented in C
  - Easily portable to any Linux distribution
- **Wi-SUN Link Layer**
  - Wi-SUN RCP Binary (PHY/MAC)
- **Documentation**
  - Readme, configuration guidelines, application note
- **Delivery Mechanism**
  - PHY/MAC (RCP) library via Studio
  - Via GitHub
    - Docker Image
    - Source code for the Network Layer (wsbrd)

Wi-SUN: Frequency Bands and Operating Modes

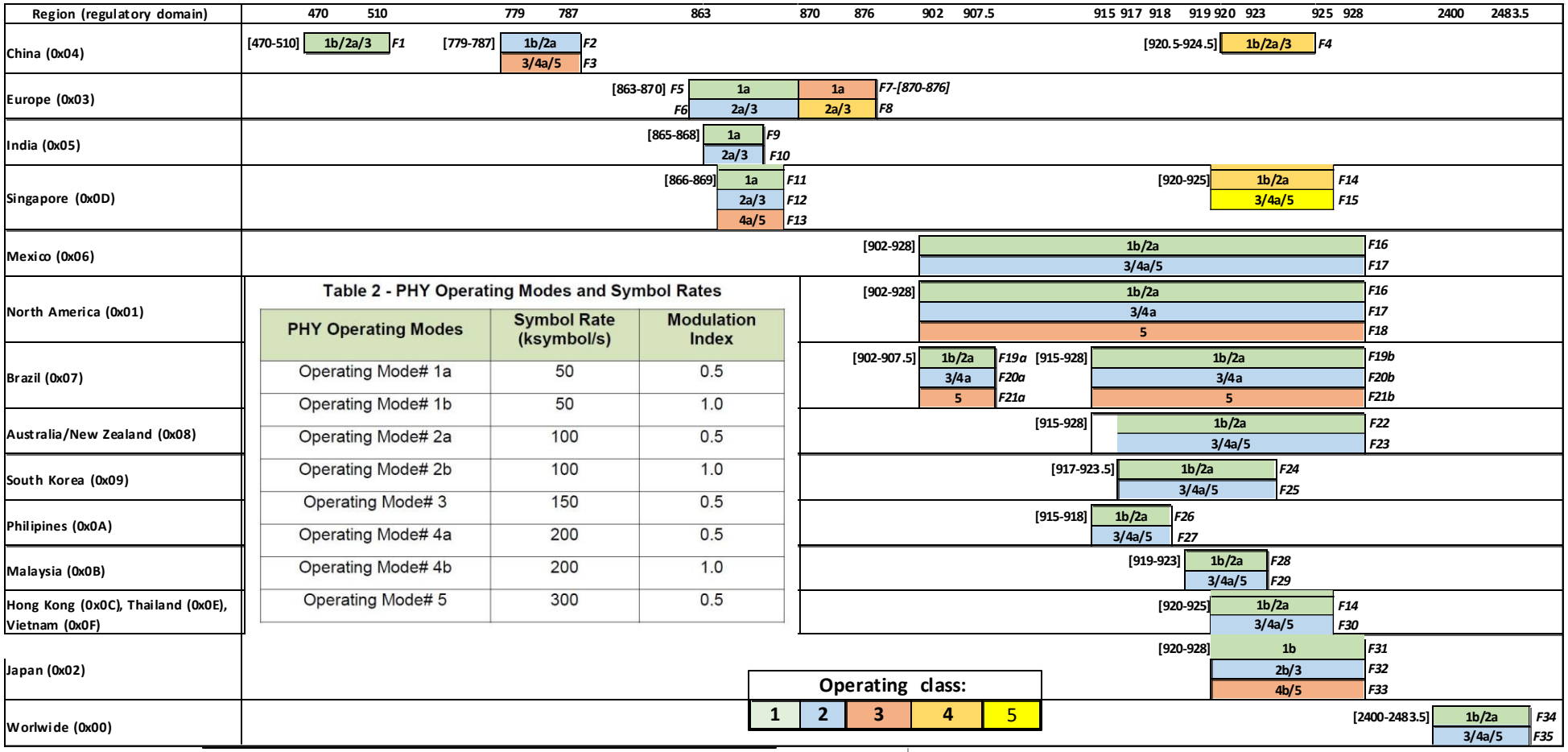
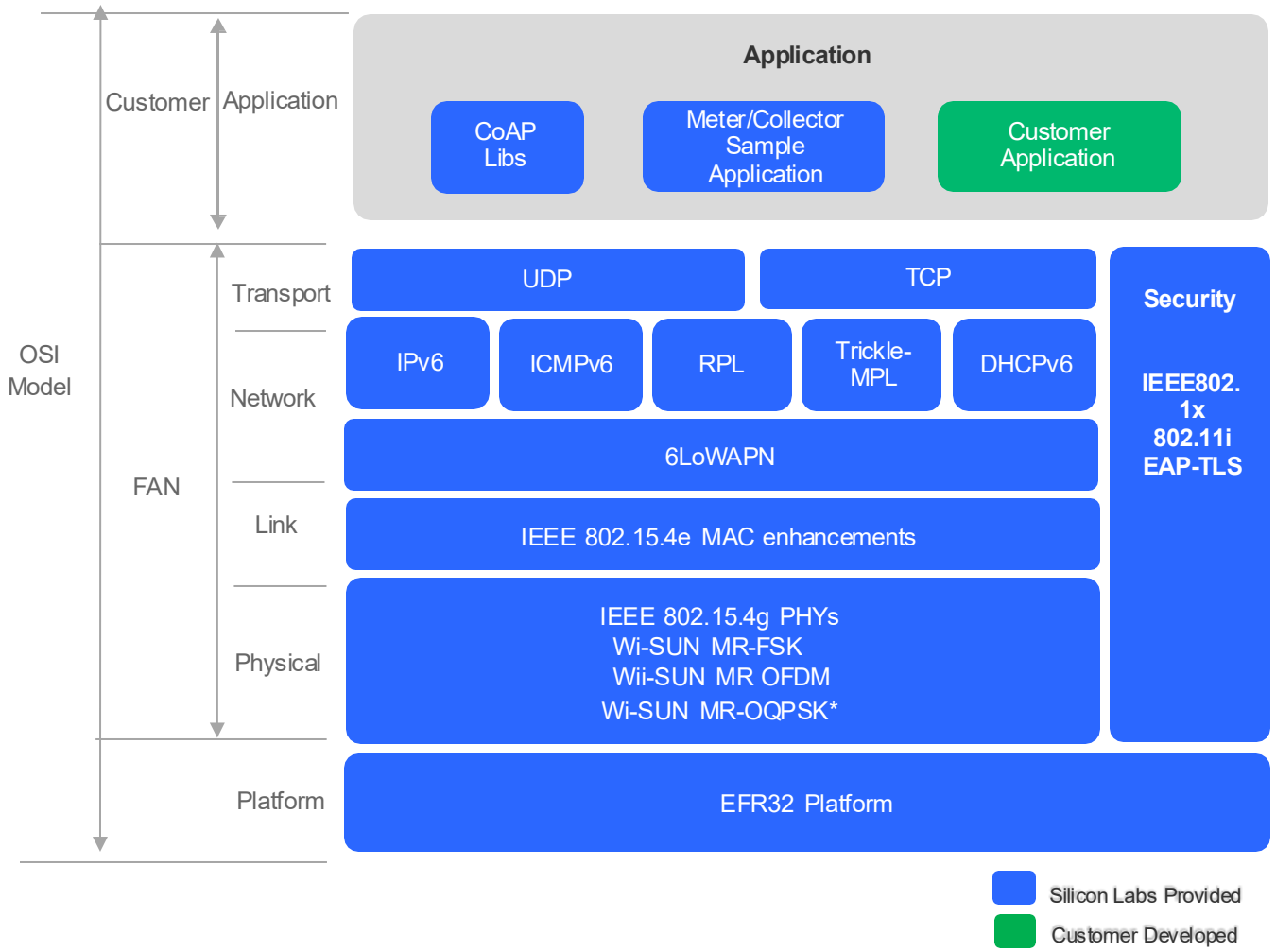


Table 2 - PHY Operating Modes and Symbol Rates

PHY Operating Modes	Symbol Rate (ksymbol/s)	Modulation Index
Operating Mode# 1a	50	0.5
Operating Mode# 1b	50	1.0
Operating Mode# 2a	100	0.5
Operating Mode# 2b	100	1.0
Operating Mode# 3	150	0.5
Operating Mode# 4a	200	0.5
Operating Mode# 4b	200	1.0
Operating Mode# 5	300	0.5

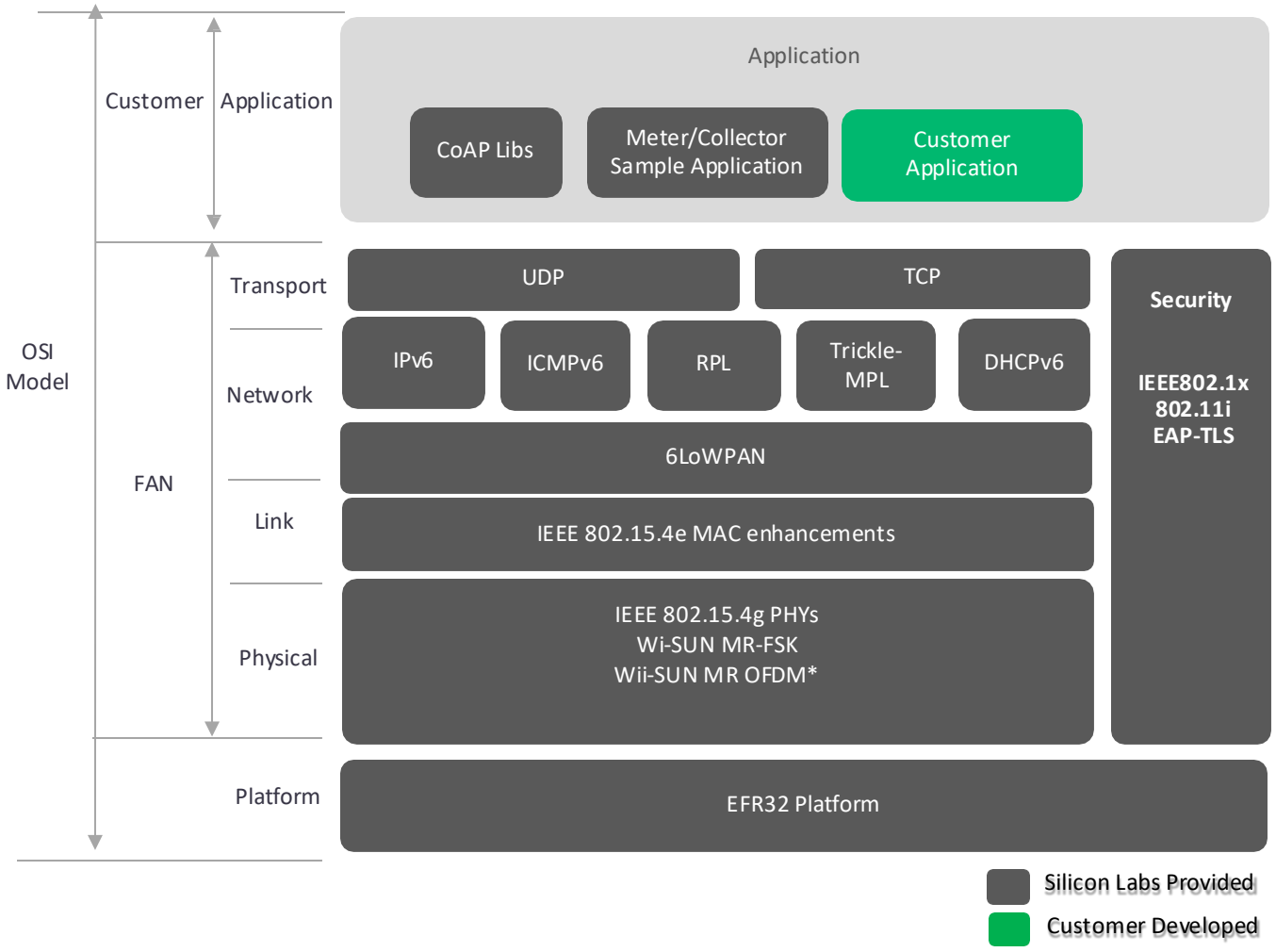
Regulatory domain, operating class and operating mode are provided by the stack, together with network name . The Operating Class (OC) field is an 8-bit unsigned integer which is used to achieve the desired data rate and channel plan within the Regulatory Domain

Wi-SUN Stack Architecture

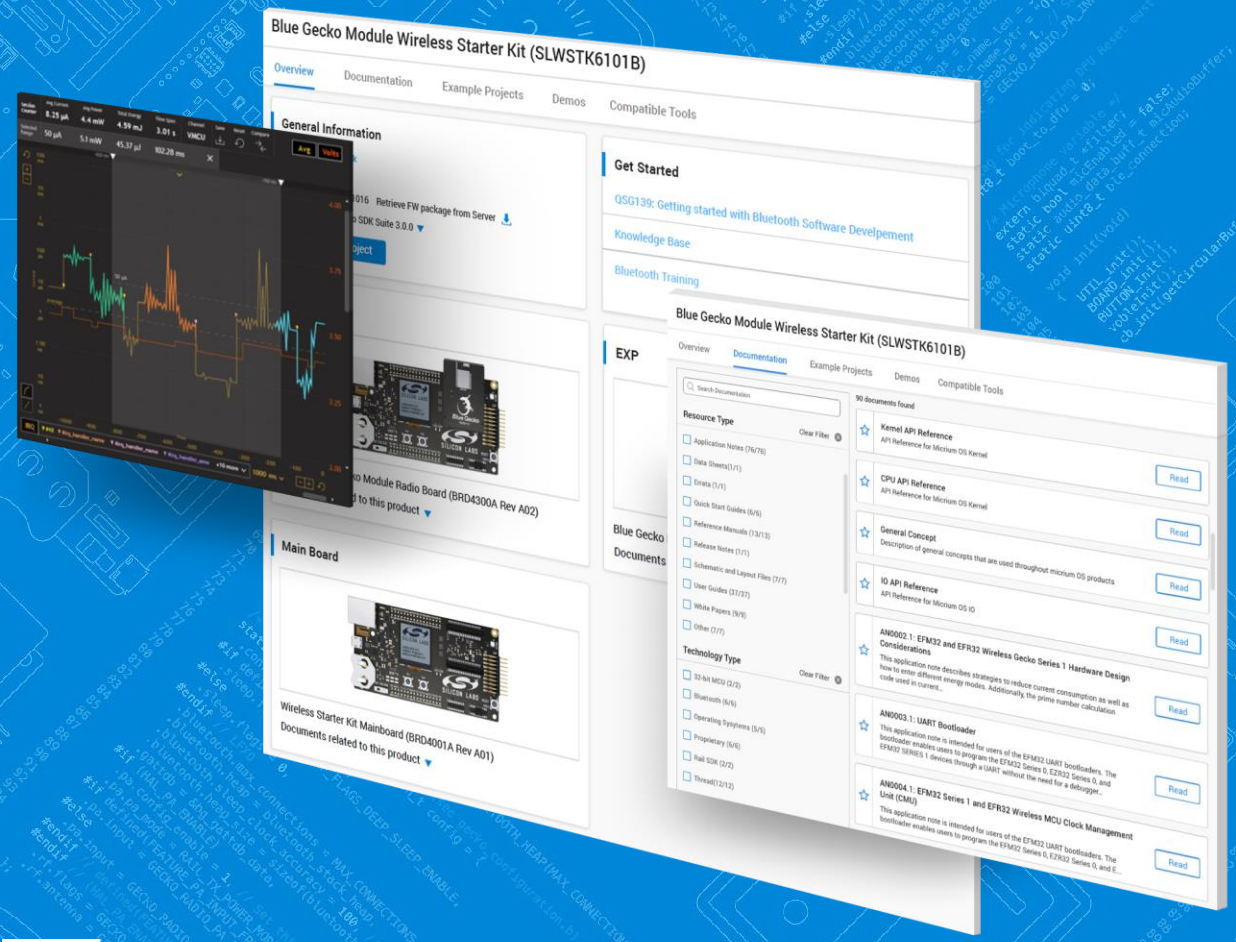


- Protocol Suite (IPv6)
  - UDP and TCP
  - 6LoWPAN Adaptation + Header Compression
  - DHCPv6 for IP address management
  - Routing using RPL & Trickle
  - ICMPv6
  - Unicast and Multicast forwarding
- Security (802.1x)
  - EAP-TLS/PKI Authentication
  - 802.11i Key Management
  - AEC-CCM 128b Encryption
- MAC (802.15.4e)
  - Frequency Hopping
  - CSMA-CA
- PHY (802.15.4g)
  - FSK – Multiple data rates & region support
  - OFDM – Multiple data rates & region support
  - *MR-OQPSK – Future consideration

Stack and Sample Apps



- **Wi-SUN Sample Apps**
  - SoC CLI
  - SoC CoAP Collector
  - SoC CoAP Meter
  - SoC Collector
  - SoC Empty
  - SoC Meter
  - SoC Ping
  - SoC TCP Client
  - SoC TCP Server
  - SoC UDP Client
  - SoC UDP Server
- **PHY (802.15.4g)**
  - FSK (xG12) modulations, data rates, and regions
  - *OFDM Support Coming Soon

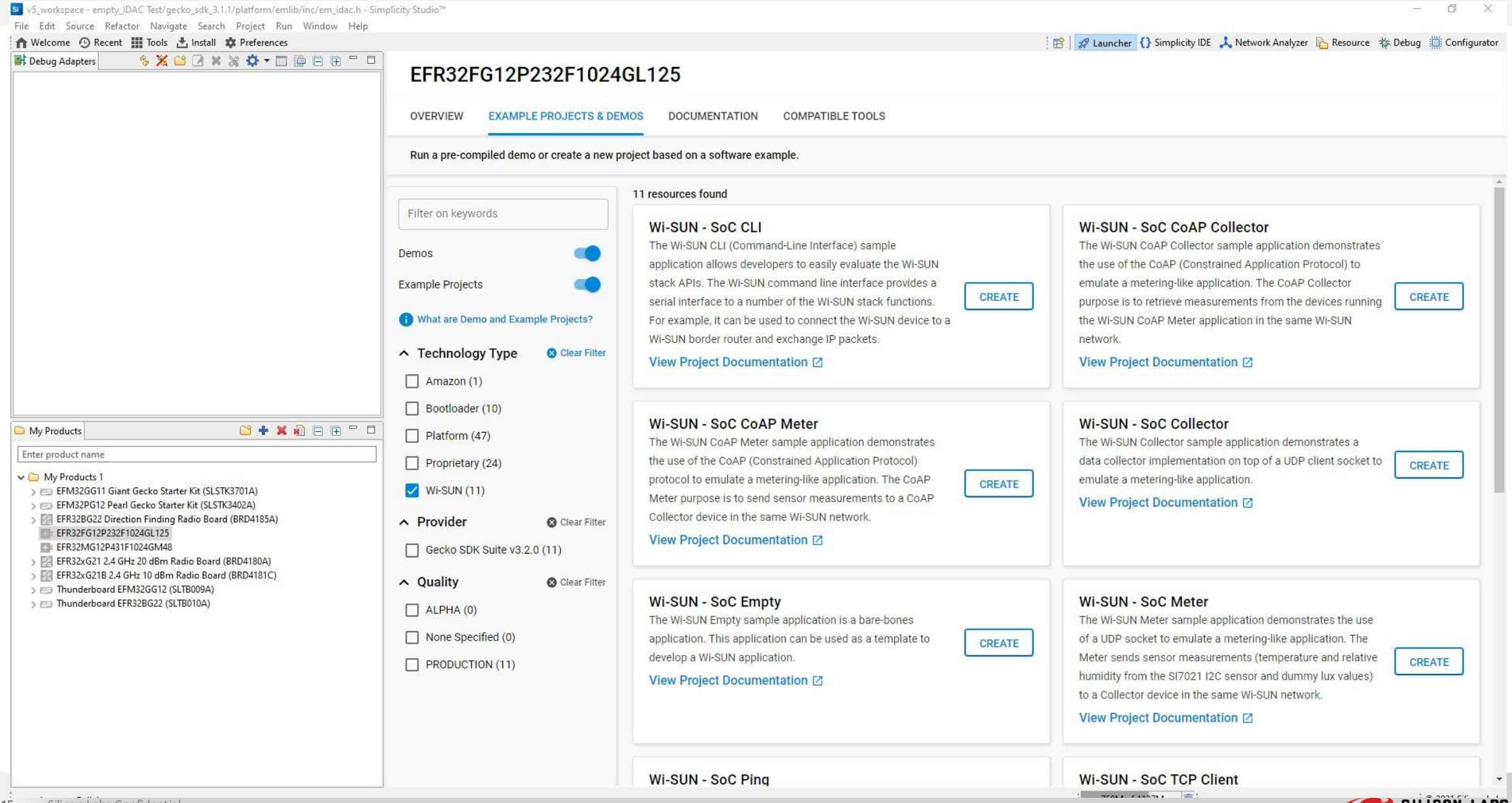


14 Silicon 28.086 Simplicity Studio 5

Simplified Developer Experience

- **Simplicity Studio 5**
  - **Interface**
    - Fresh, new & simplified
    - Intuitive out-of-the-box experience
    - Fast access to developer resources
    - Linux, Mac & Windows
  - **Tools**
    - Configuration utilities
    - Compiler
    - Error & validation
    - IDE & command line support
    - Graphical hardware configurator
    - Energy Profiler – visual energy analysis
    - Network Analyzer – packet capture & decode

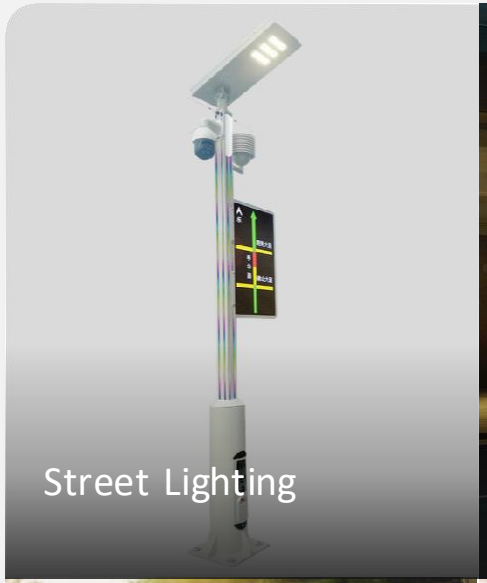
Simplicity Studio 5 – Wi-SUN Application Examples

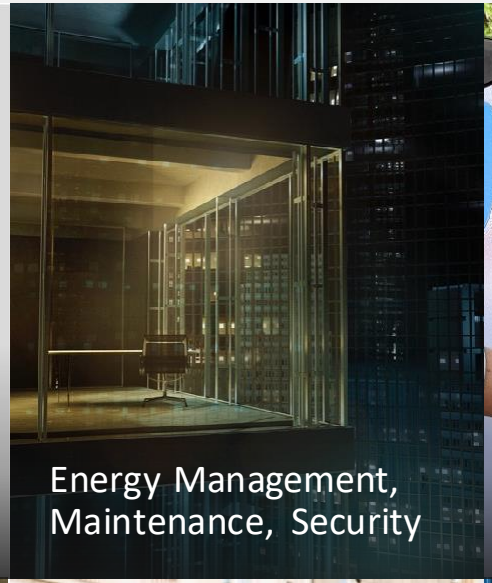


Key Design considerations for Large scale outdoor networks

- Long Wireless Range and robust connectivity
- High transmit data rate and Latency
- Self forming and Self healing
- Battery Life of Remote Sensors
- Interoperability
- OTA

Wi-SUN Field Area Network Applications

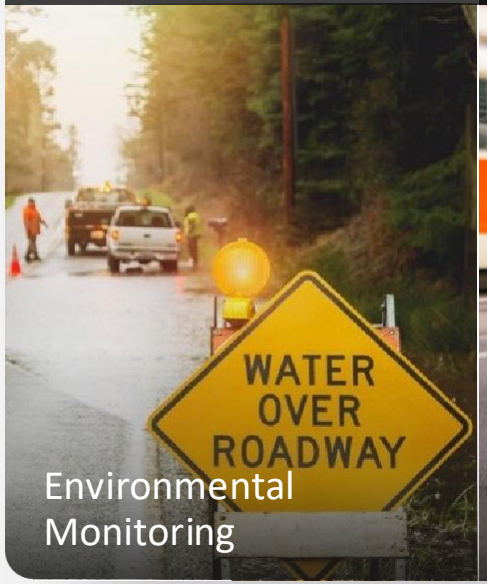

Street Lighting


Energy Management, Maintenance, Security


Traffic Control/Lights, Parking Meters

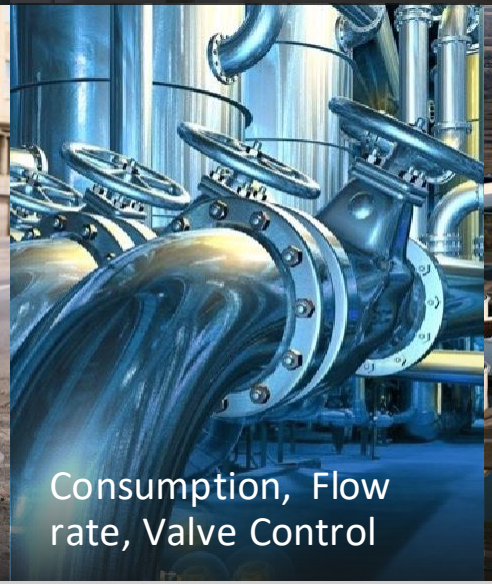

Oil/Gas Production


Utility Meters

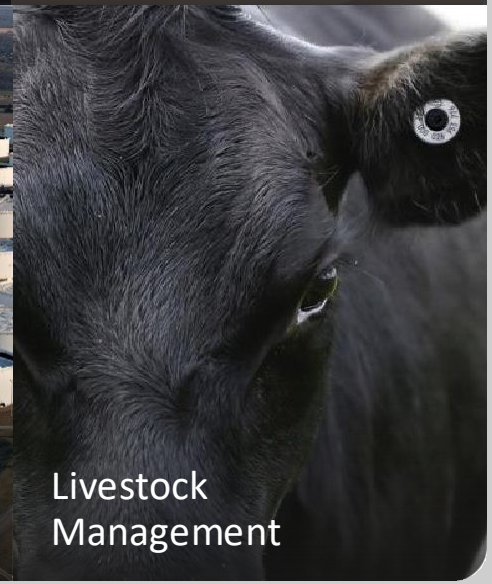


Environmental Monitoring

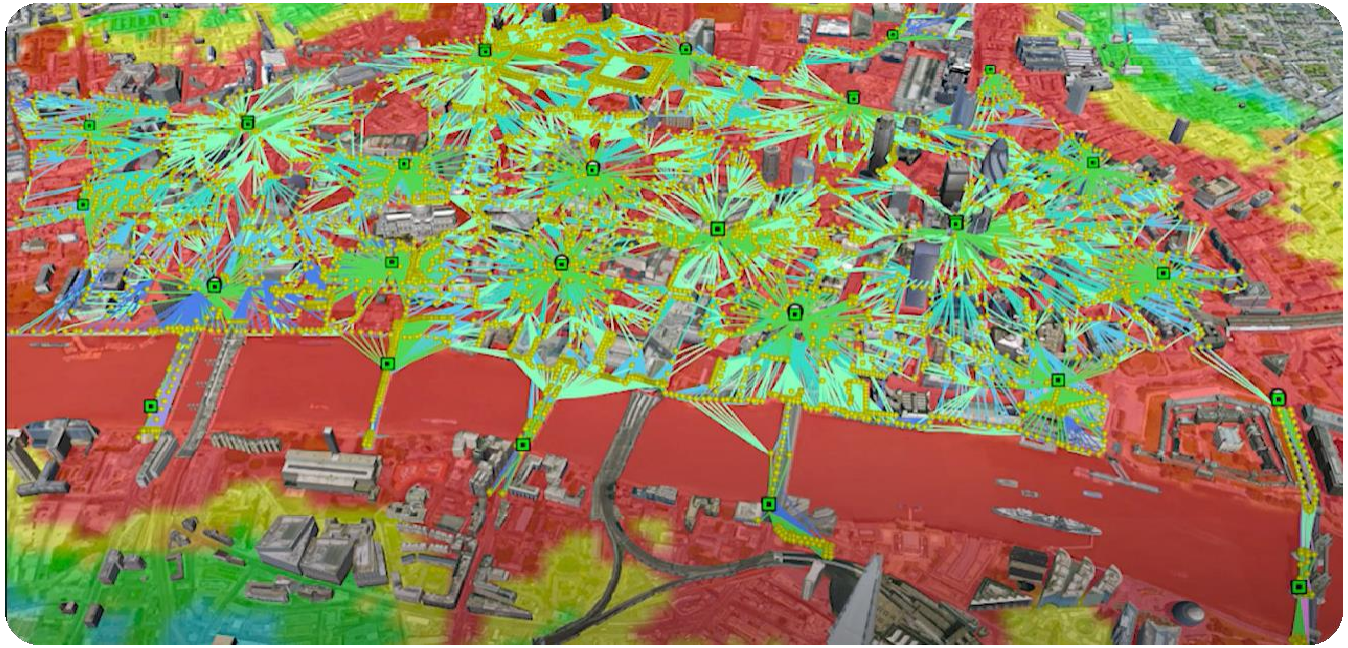

Waste Management

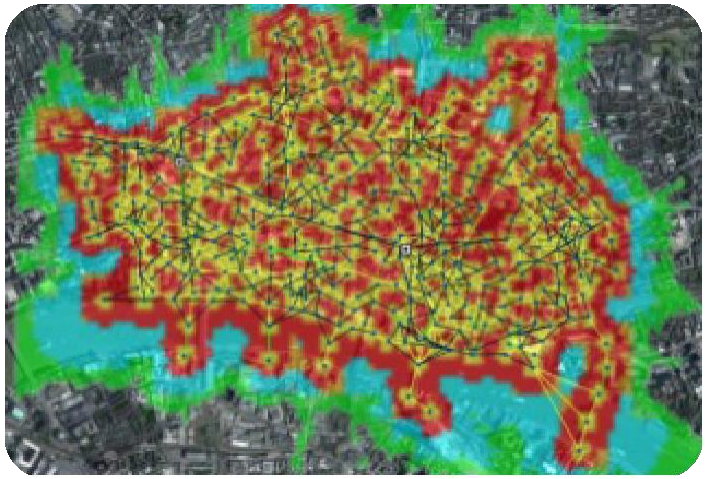

Consumption, Flow rate, Valve Control


Storage & Distribution


Livestock Management

Deployment Example: London





- **Control Management System (CMS)**
  - Street lighting
  - Utilities
  - Parking
- **15,000 connected Wi-SUN devices**
- **12 Wi-SUN border routers**
- **Major benefits**
  - Enables real-time remote management
  - Reduces electrical energy usage
  - Automatically generates maintenance service orders
  - Future proof system that can scale as the city converts old infrastructure to new

Additional information here:

https://wi-sun.org/latest-news/wi-sun-technology-provides-the-platform-for-city-of-london-smart-city-initiative/

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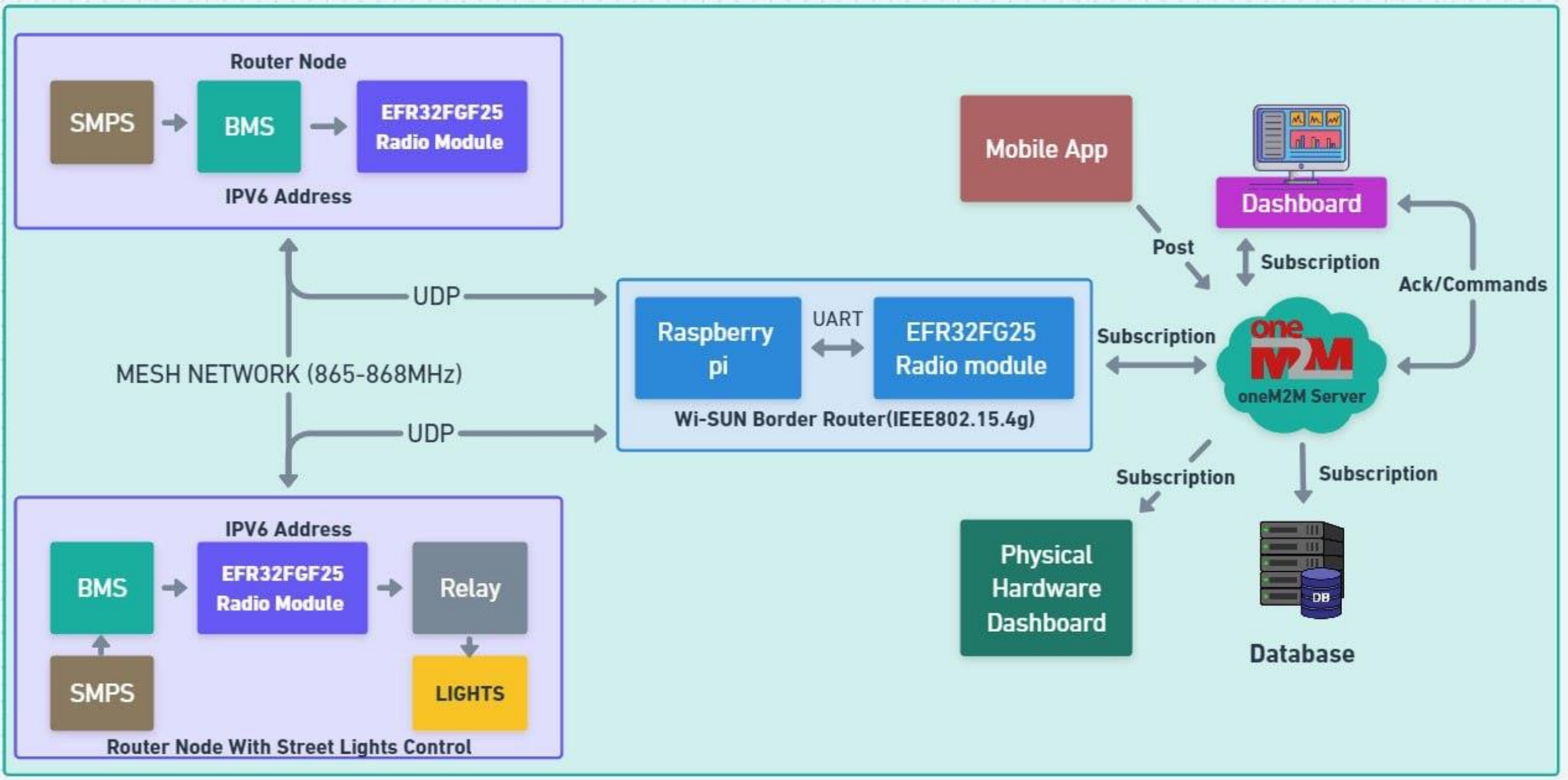
India’s First Wi-SUN Network Launch

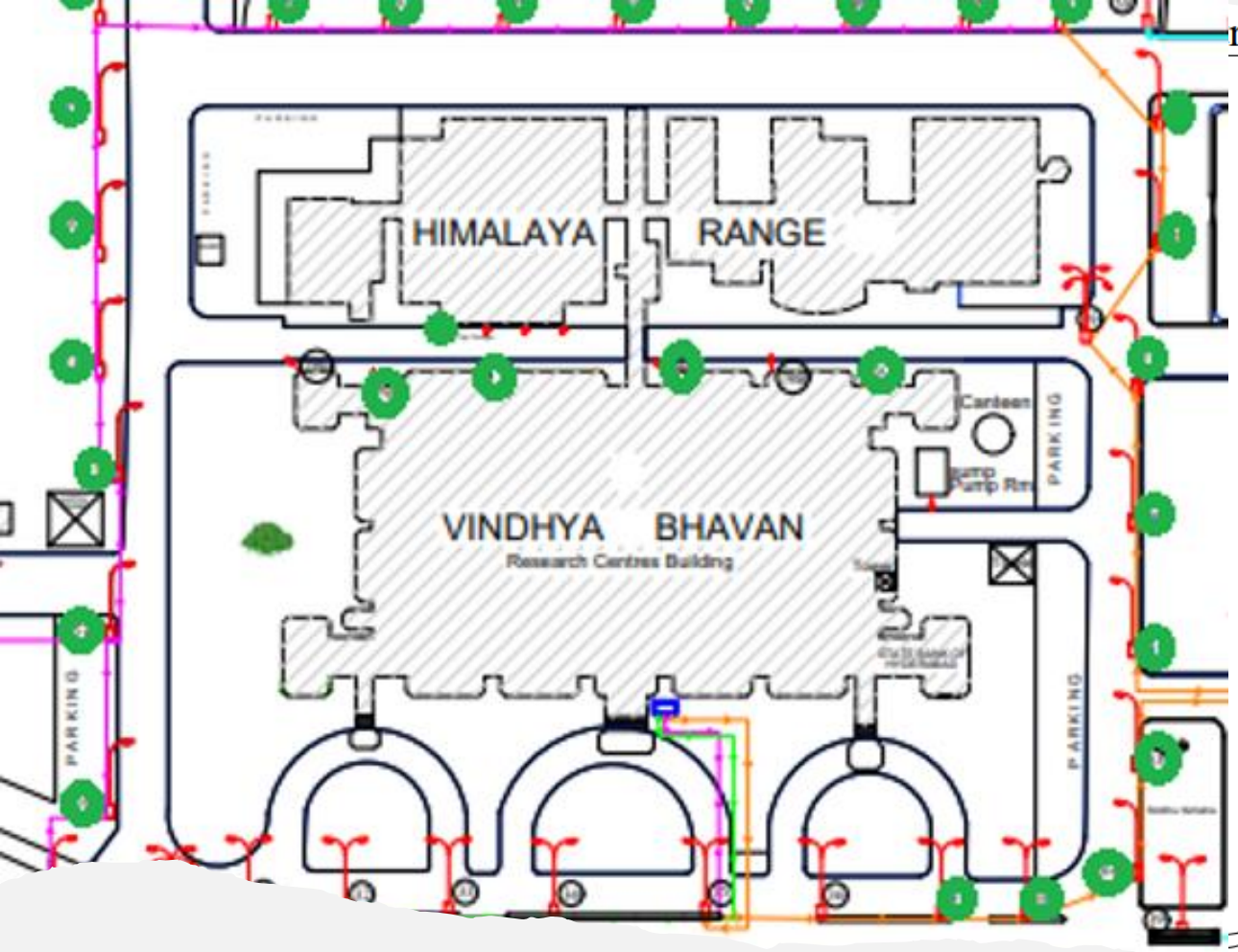
At IIIT-H Campus, Hyderabad, India

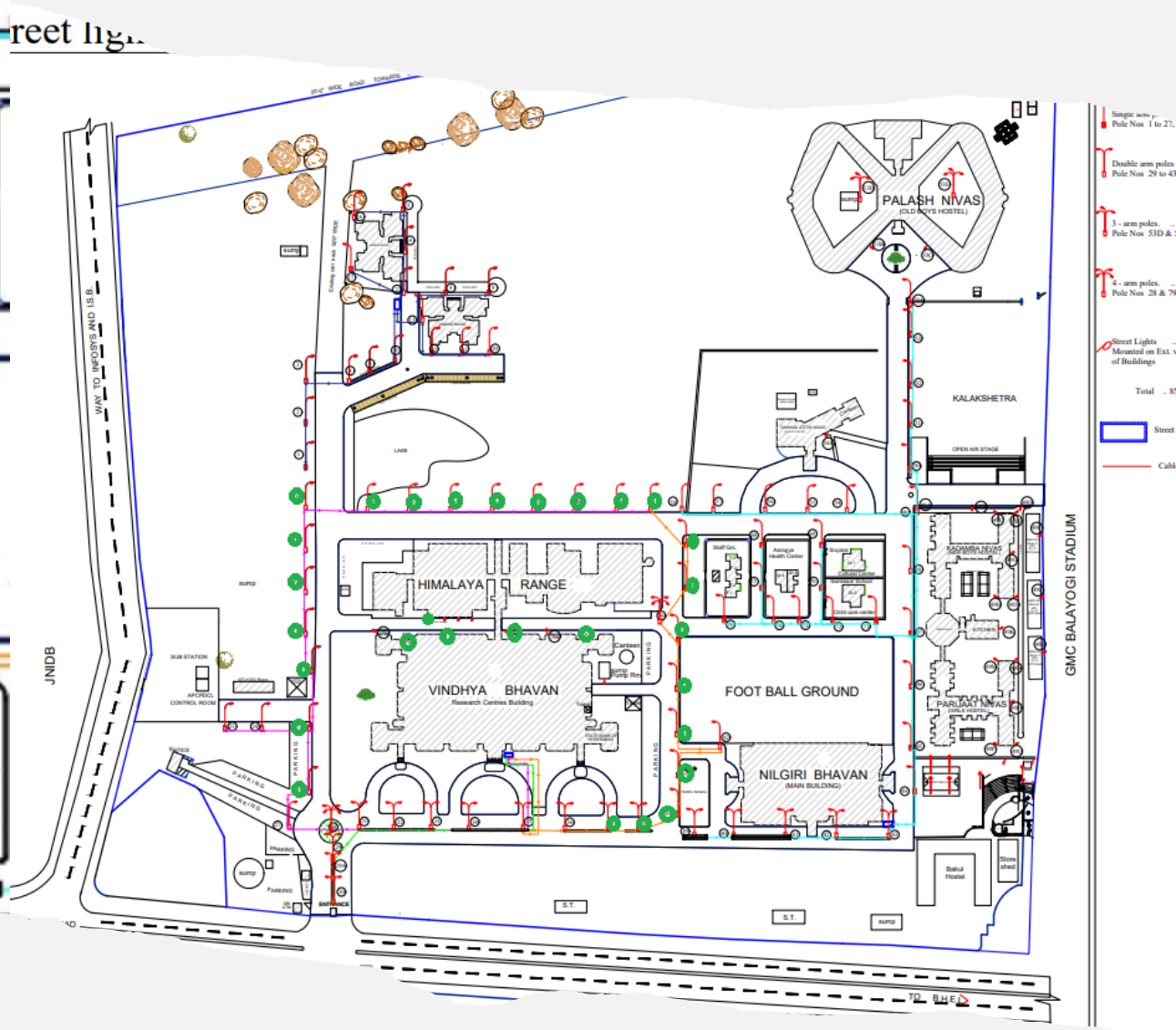
Architecture Diagram



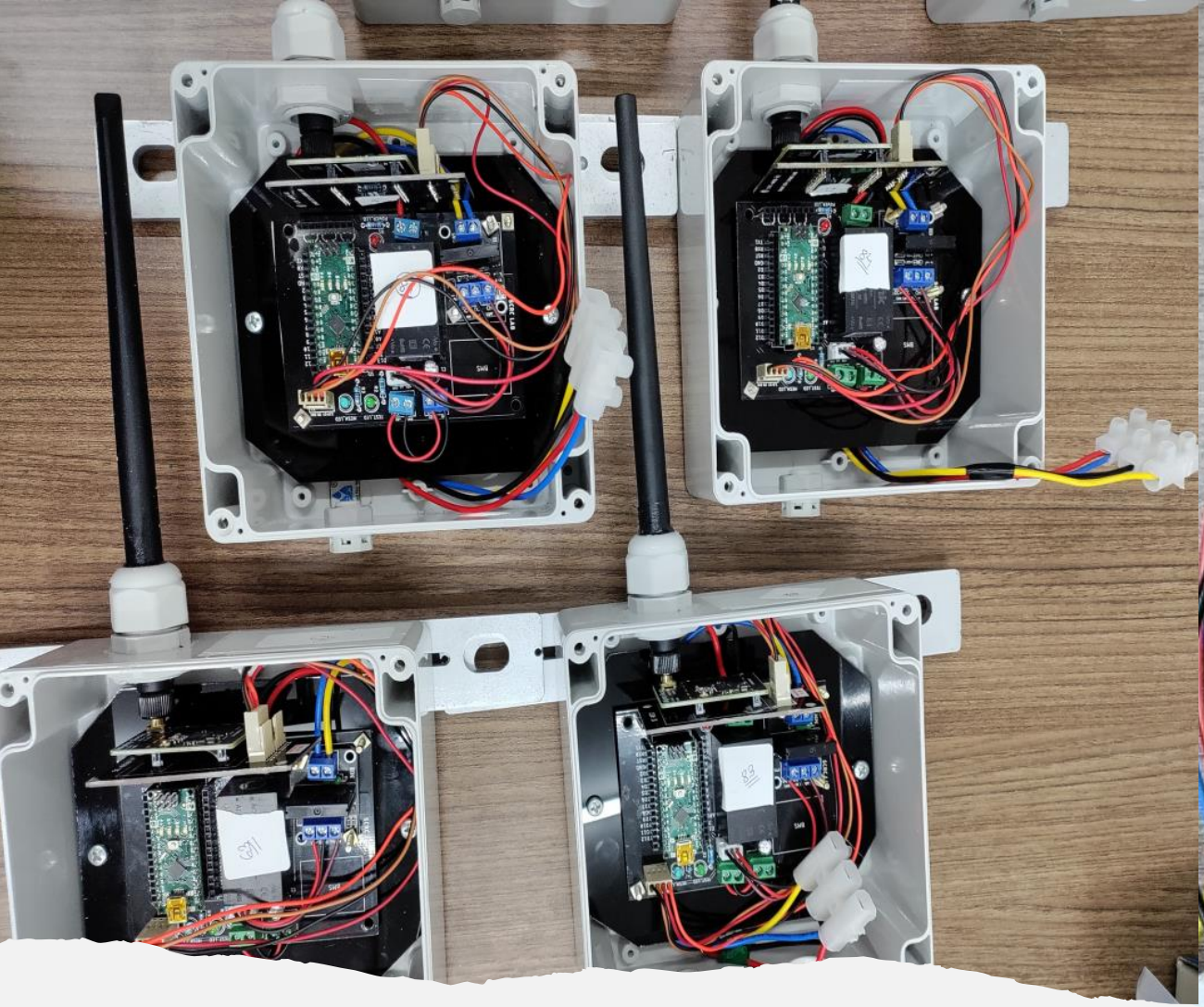
Phase 1 Highlights:

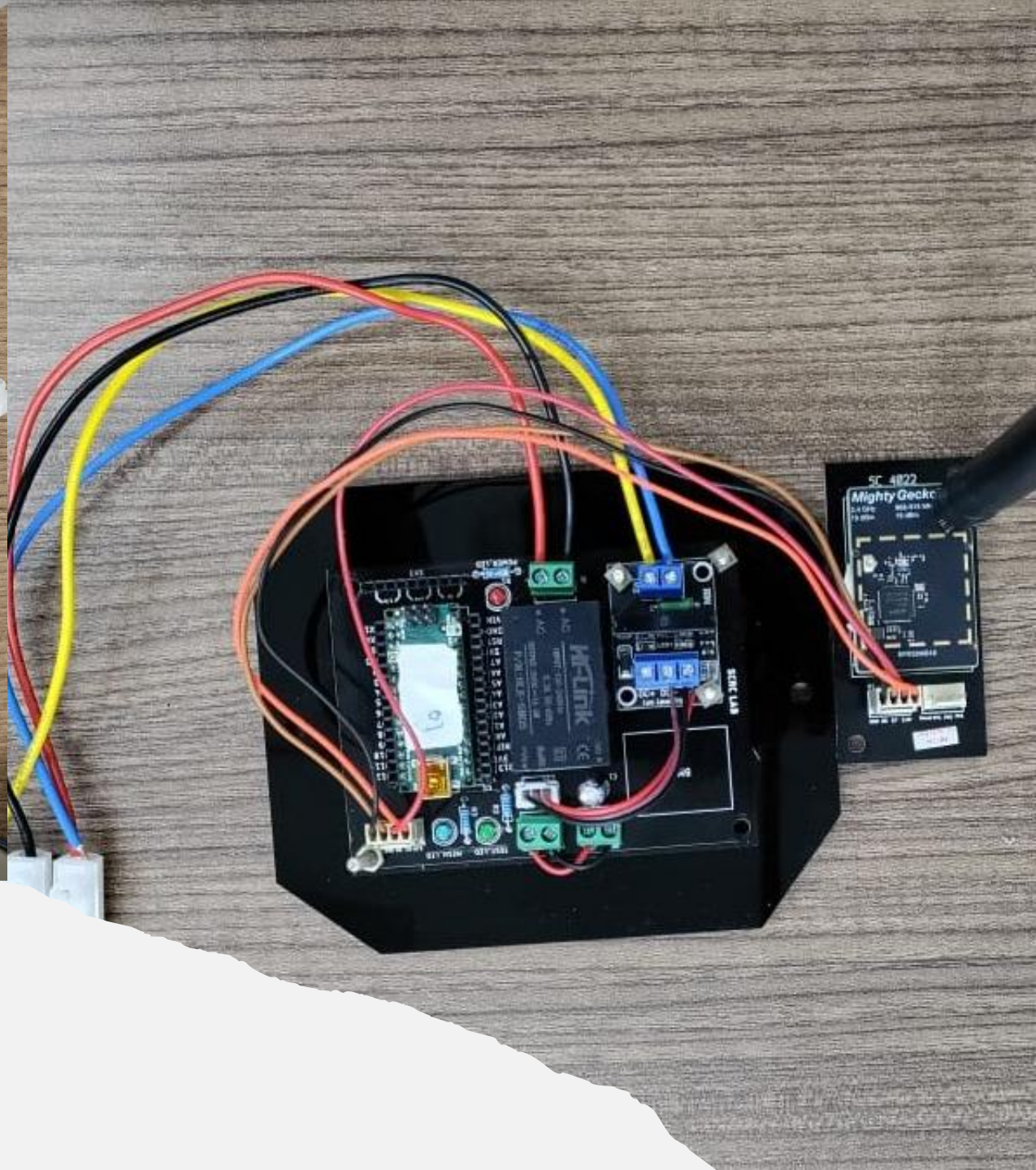
- Date: October 2022
- 30 router nodes based on FG12 radio deployed on light poles
- Border router (BR) placed in the Smart City Living Lab
- FAN 1.0 enabled router nodes and BR control streetlights ON/OFF
- FSK bit rates of 50 Kbps
- Latency and RSSI displayed on the dashboard from the Wi-SUN FAN1.0 network



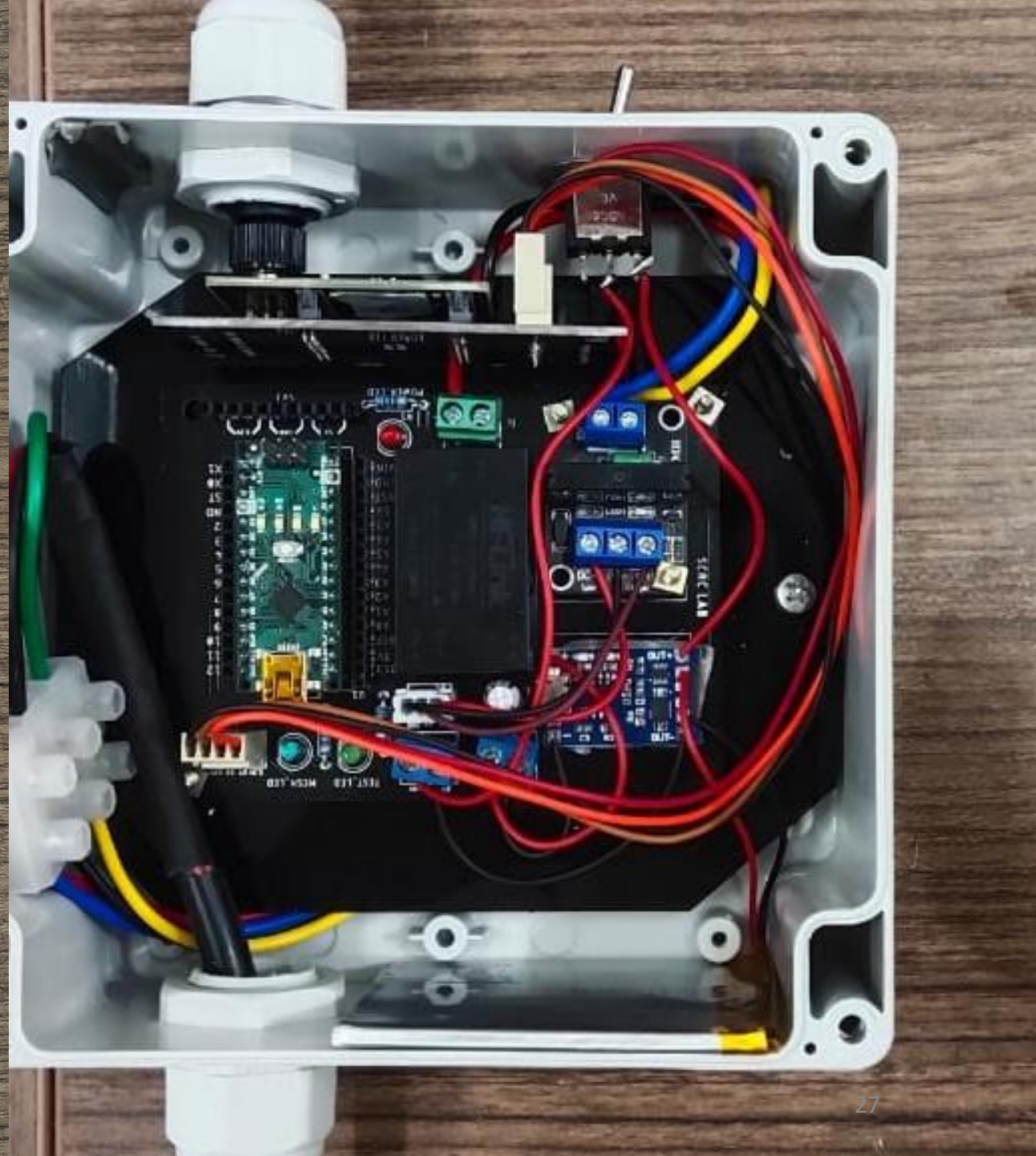


Phase I Deployment Plan in IIIT CAMPUS





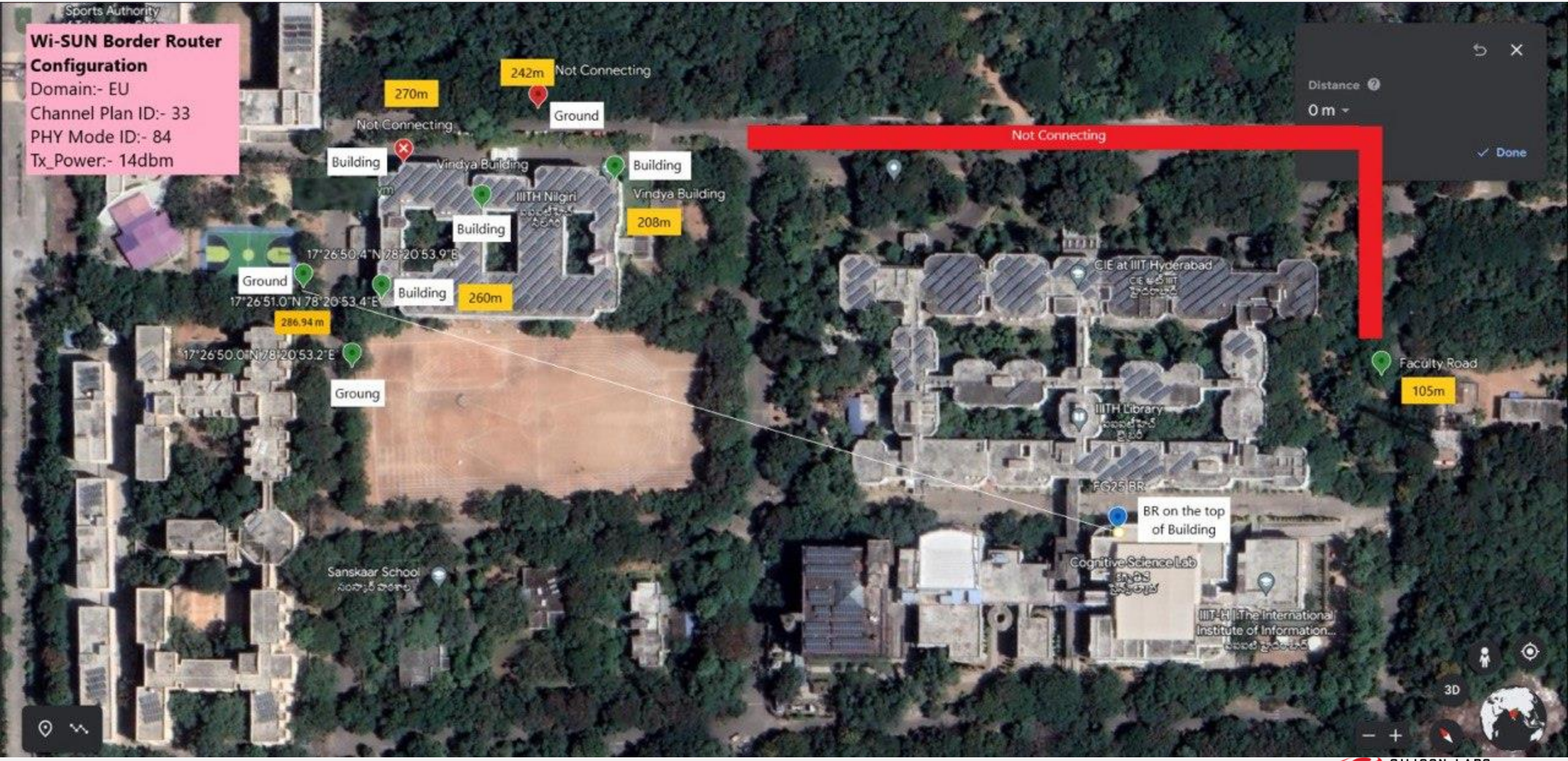
Assembled Wi-SUN Board



Wi-SUN Mobile Node

Wi-SUN Nodes Testing

RANGE TESTING FOR FAN1.0 FSK



Glimpse of Wi-SUN Launch 29th Sep 2022

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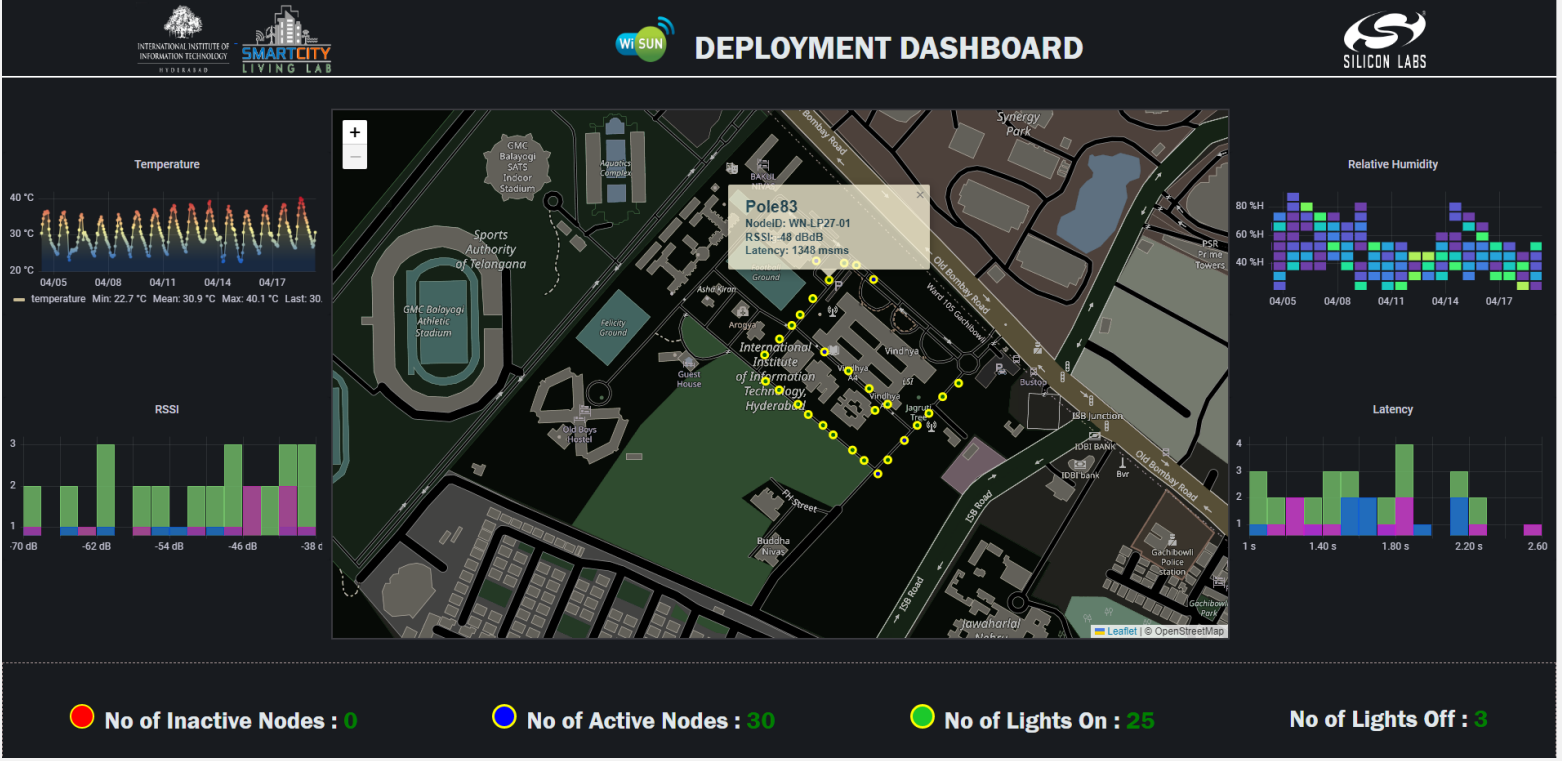
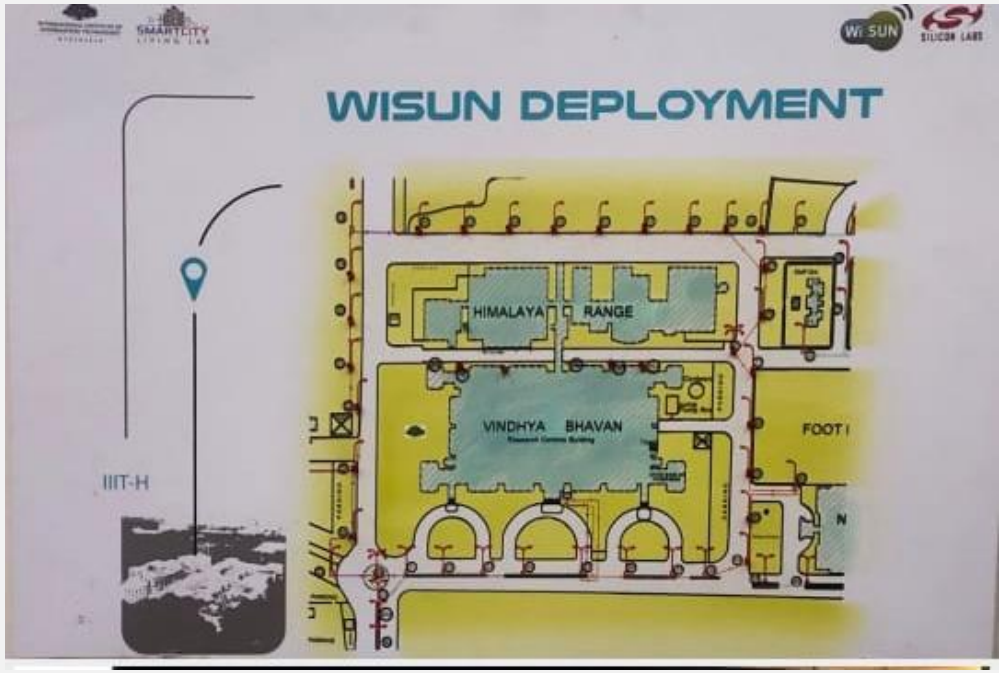
Talks By Silicon Lab Teams





Visualization

Celebrating the success

Visit by Krisztian Kovacs

Glimpses of Wi-SUN Launch 5th May 2023

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Phase 2 Highlights

Date: 5th May 2023

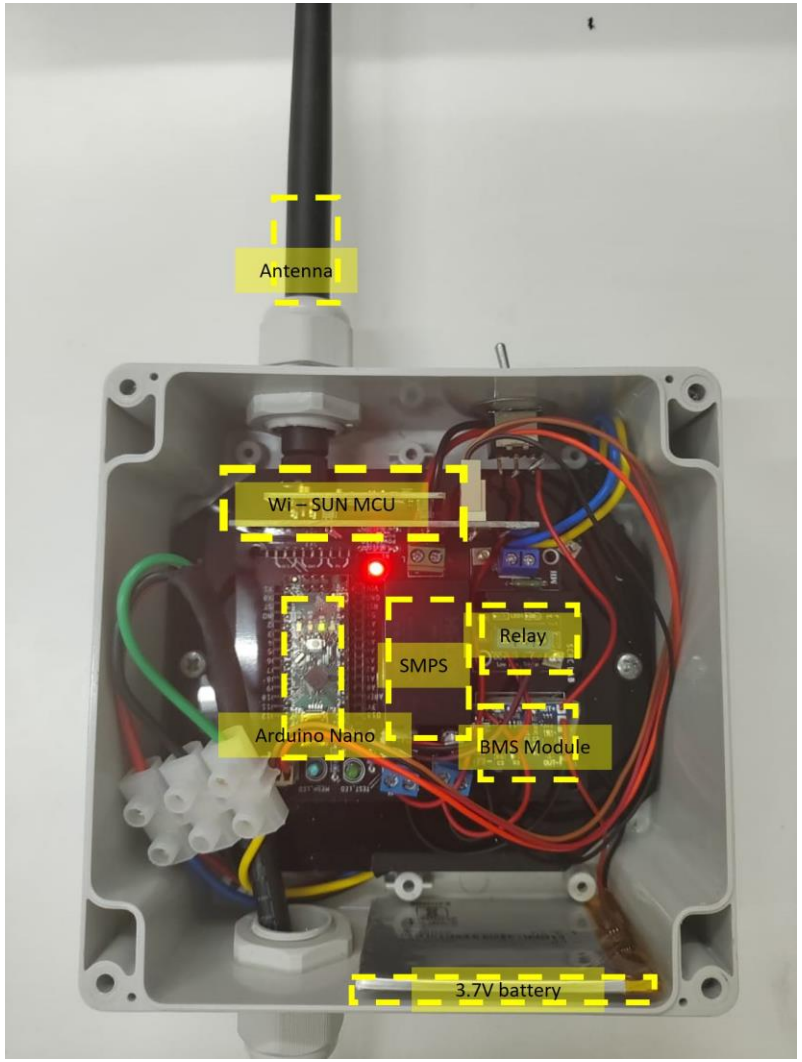
Additional 30 nodes deployed using EFR32FG25 SoC

8 nodes configured with FSK at 150 Kbps, 22 nodes configured with OFDM at 300 Kdbps

Introduction of FAN 1.1 enabling faster communication

Deployment of two more border routers to support FAN 1.1 FSK and OFDM

ON/OFF control to more than 130 streetlights



Range Testing for FAN1.1 FSK Nodes

PHASE I & II Deployment

Before Deployment
13 hours/day: 105300 Wh

After Deployment
12 hours/day: 97200 Wh

Energy Savings 1 hour\day: 8100 Wh

Border Router FAN1.1(OFDM 150kbps)
FG25 Router Nodes FAN1.1(OFDM 150kbps) : 22
Control Points: 4 (~150 lights)
Border Router FAN1.1(FSK 50kbps)
FG25 Router Nodes FAN1.1(FSK 50kbps) : 8
Border Router FAN1.0(FSK 50kbps)
FG12 Router Nodes FAN1.0(FSK 50kbps) : 30

~310,082.87 m² area is covered

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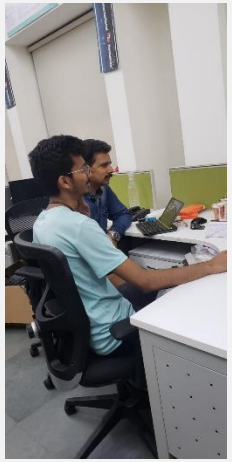
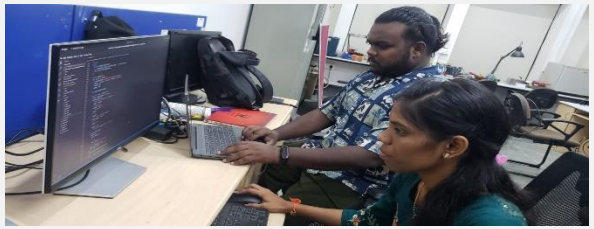
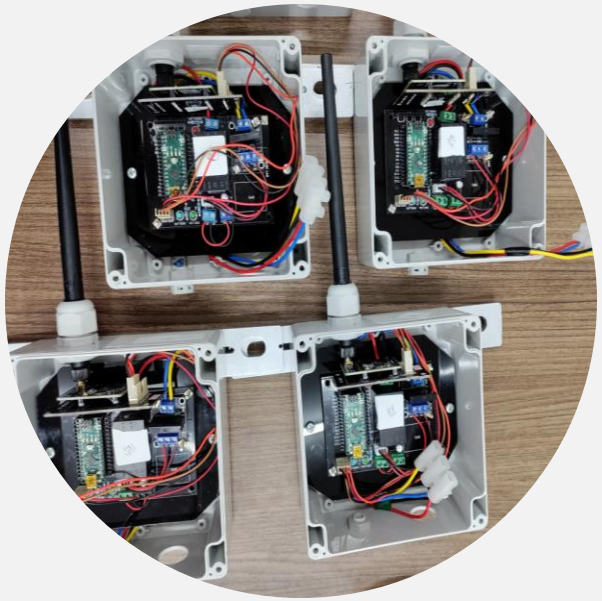
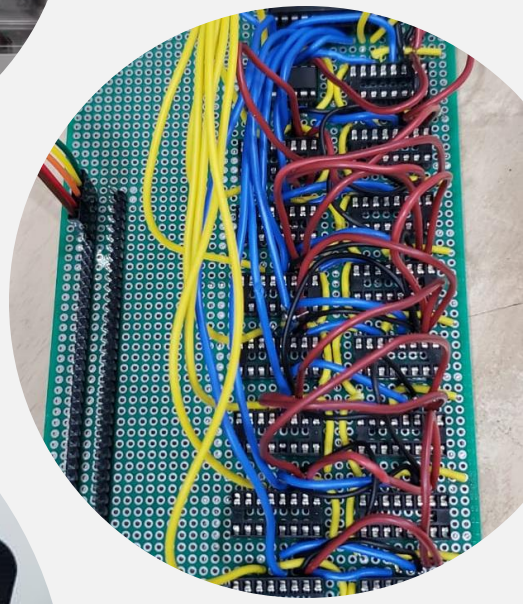
Preparations for Wi-SUN FAN1.1 Launch





Assembling of PCBs





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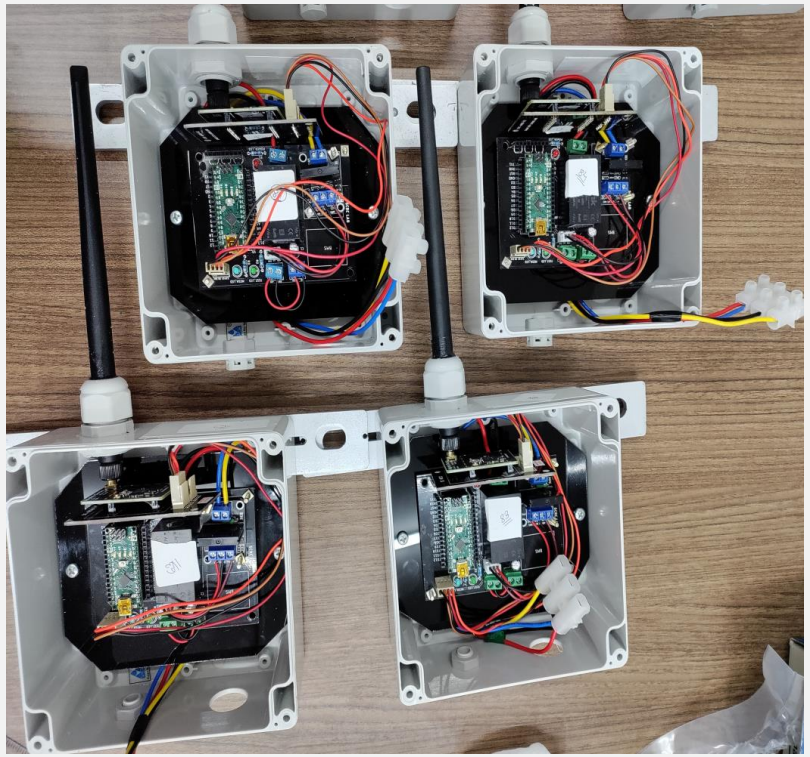
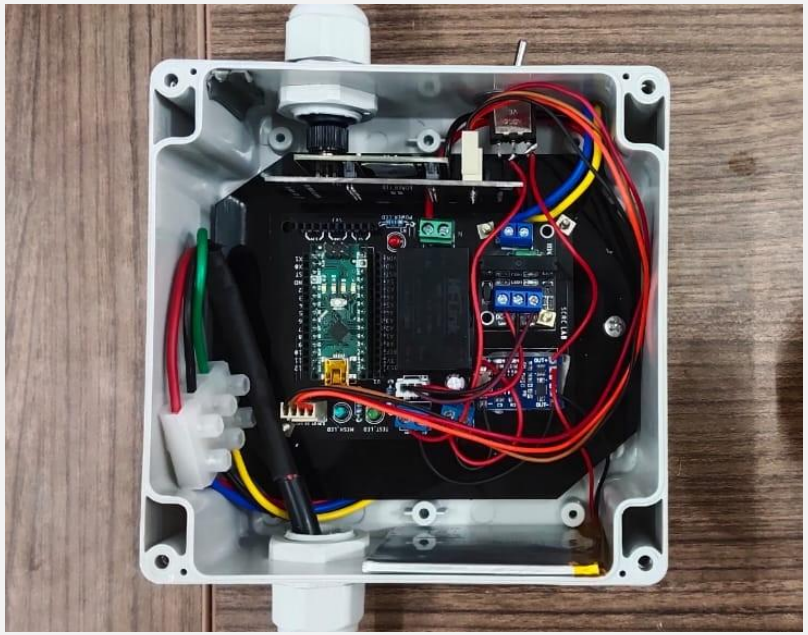
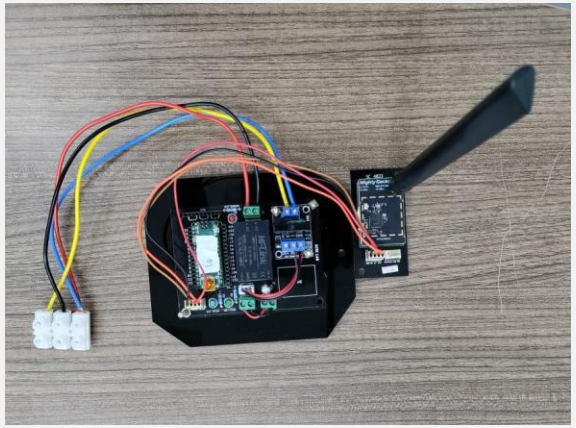






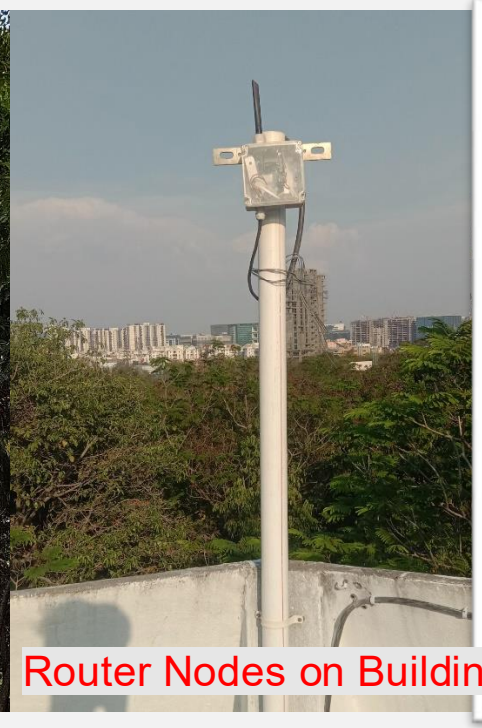
Assembled Wi-SUN Board

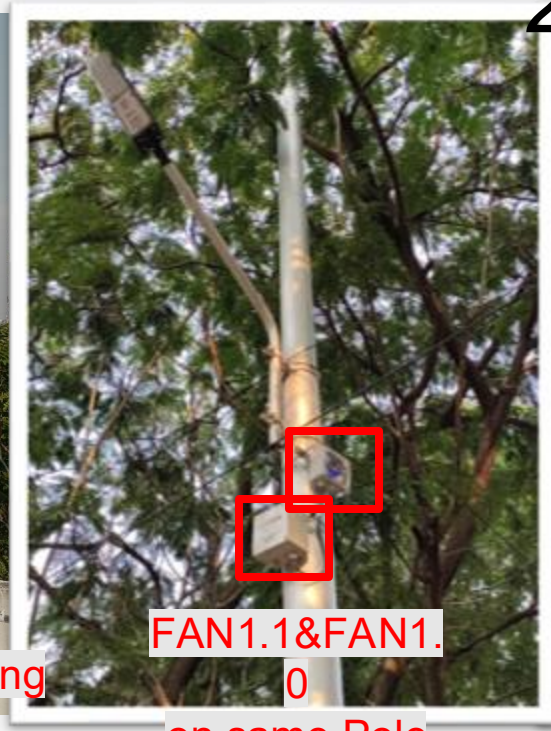
Deployed Nodes

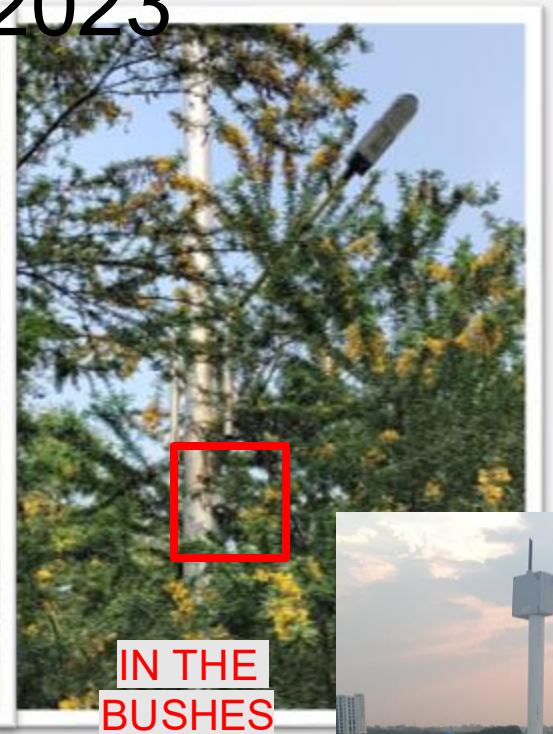
March-May, 2023


Border Router


Router Nodes


Router Nodes on Building


FAN1.1&FAN1.0 on same Pole


IN THE BUSHES

Night View


FAN1.0 Nodes


Border Router


The
Living Lab
Model


INTERNATIONAL INSTITUTE OF
INFORMATION TECHNOLOGY


Mr. Daniel Cooley
Smart City Living Lab,
IIIT- Hyderabad

In News

స్మార్ట్ సిటీ లివింగ్ ల్యాబ్ భాగస్వామిగా సిలికాన్ లా

వినూత్న వైర్‌లెస్ టెక్నాలజీ
ఆవిష్కరణకు శ్రీకారం
స్వాగతించిన ట్రిపుల్ ఐటీ హైదరాబాద్

యదుర్గం: ట్రిపుల్ ఐటీ హైదరాబాద్‌లోని స్మార్ట్ సిటీ లివింగ్ ల్యాబ్‌తో కలిసి పనిచేసేందుకు సిలికాన్ ల్యాబ్స్ ముందుకొచ్చింది. స్మార్ట్‌సిటీ లివింగ్‌ల్యాబ్ మొదటి కార్పొరేట్ వ్యవస్థాపక భాగస్వామిగా సిలికాన్‌ల్యాబ్ చేరనుంది. ఈ మేరకు సోమవారం ట్రిపుల్‌ఐటీ అధికారులు ఒక ప్రకటన విడుదల చేశారు. ఈ రెండు సంస్థలు కలిసి పరిశోధనతోపాటు ప్రపంచంలోని నగరాల కోసం సరికొత్త వినూత్న వైర్‌లెస్ టెక్నాలజీని ఆవిష్కరించేందుకు కలిసి పనిచేయాలని నిర్ణయించారు.

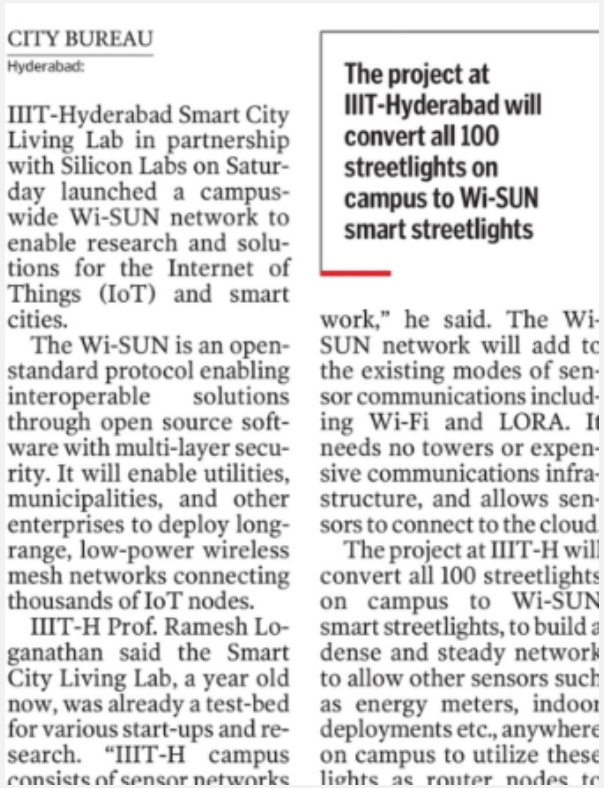
స్మార్ట్ సిటీల రూపకల్పనలో ముఖ్యభూమిక

స్మార్ట్ సిటీ లివింగ్ ల్యాబ్ భారత ప్రభుత్వ స్మార్ట్ సిటీస్ మిషన్‌లో ముఖ్యపాత్ర పోషించడం, వచ్చే ముప్పయ్యేళ్ల కాలంలో 100 నగరాలలో రూ.100 కోట్ల పెట్టుబడితో స్మార్ట్ సిటీల రూపకల్పన చేయనుండటం సిలికాన్ ల్యాబ్స్‌తో భాగస్వామి కావడం ప్రాధాన్యత సంతరించుకుంది.

ట్రిపుల్‌ఐటీలోని స్మార్ట్ సిటీ రీసెర్చ్ సెంటర్‌లో భాగమైన స్మార్ట్ సిటీ లివింగ్ ల్యాబ్స్‌కు కేంద్ర ఎలక్ట్రానిక్స్, ఇన్ఫర్మేషన్ టెక్నాలజీ మంత్రిత్వశాఖ, స్మార్ట్ సిటీస్ మిషన్, తెలంగాణ ప్రభుత్వం, యూరోపియన్ బిజినెస్ అండ్ టెక్నాలజీ సెంటర్, ఆమ్‌స్టర్‌డామ్ ఇన్నోవేషన్ అరేనా అందిస్తున్నాయి.

- వైర్‌లెస్ పరికరాల రూపకల్పనలో ల్యాబ్స్ నైపుణ్యం స్మార్ట్ సిటీల కోసం పర్యవరణ, పర్యావరణ వ్యవస్థను నిర్మించాలను మెరుగు పర్చేందుకు భాగస్వామ్యం తోడ్పడనుంది.
- ట్రిపుల్‌ఐటీ లోని స్మార్ట్ సిటీ లివింగ్ సిలికాన్‌ల్యాబ్ భాగస్వామిగా మారడం ద్ర ఎలక్ట్రానిక్స్, ఇన్ఫర్మేషన్ టెక్నాలజీ క్టర్‌డాక్టర్ అజమ్‌గార్గ్, సిలికాన్ లా డియా ఉపాధ్యక్షులు డాక్టర్ మనీష్ ట్రిపుల్‌ఐటీ రీసెర్చ్ అండ్ ఇన్నోవేషన్ ప్రొఫెసర్ రమేష్ లోగనాథన్, యూ బిజినెస్ అండ్ టెక్నాలజీ సెంటర్ డైరెక్ట్ టవాన్‌నూర్డ్ స్వాగతించారు. వచ్చే ఆ దేశంలోని ఒక్కో నగరంలో రూ. 100 టతో వంద నగరాలను స్మార్ట్ సిటీలు స్తున్న తరుణంలో ఈ భాగస్వామ్య దోహదం చేస్తుందన్నారు.
- పరిశ్రమల, విద్యాసంస్థల మధ్య నూతన ఆవిష్కరణలు, సాంకేతిక మరింత వృద్ధికి కీలకం కానుందని ప్రాయపడ్డారు.

Wed, 23 June 2021
https://epaper.sakshi.com/c/61335413



CITY BUREAU
Hyderabad:

IIIT-Hyderabad Smart City Living Lab in partnership with Silicon Labs on Saturday launched a campus-wide Wi-SUN network to enable research and solutions for the Internet of Things (IoT) and smart cities.

The Wi-SUN is an open-standard protocol enabling interoperable solutions through open source software with multi-layer security. It will enable utilities, municipalities, and other enterprises to deploy long-range, low-power wireless mesh networks connecting thousands of IoT nodes.

IIIT-H Prof. Ramesh Loganathan said the Smart City Living Lab, a year old now, was already a test-bed for various start-ups and research. "IIIT-H campus consists of sensor networks

The project at IIIT-Hyderabad will convert all 100 streetlights on campus to Wi-SUN smart streetlights

work," he said. The Wi-SUN network will add to the existing modes of sensor communications including Wi-Fi and LORA. It needs no towers or expensive communications infrastructure, and allows sensors to connect to the cloud.

The project at IIIT-H will convert all 100 streetlights on campus to Wi-SUN smart streetlights, to build a dense and steady network to allow other sensors such as energy meters, indoor deployments etc., anywhere on campus to utilize these lights as router nodes to

...ం.. ఉపయోగాలు అనే

సాంకేతికత ఆవిష్కరించిన సందర్భంగా అచార్యులు

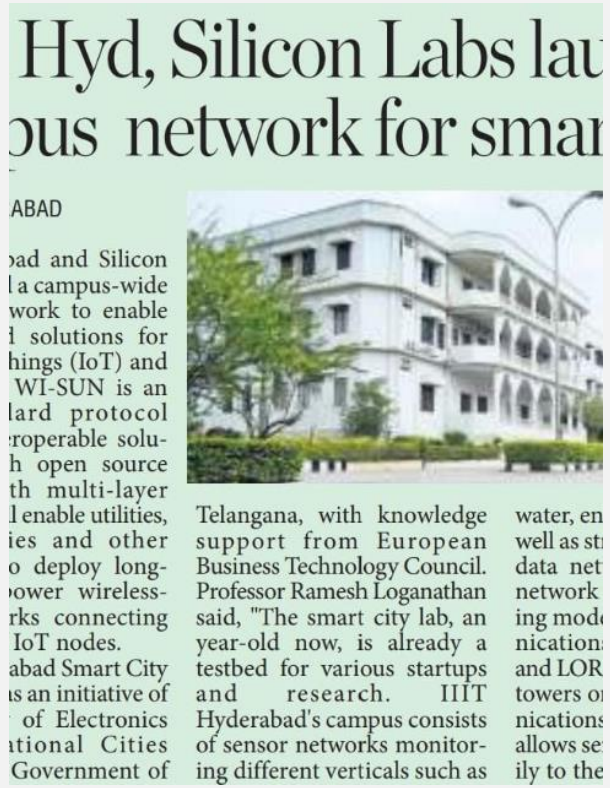
వై-సన్ సాంకేతికతతో పనిచేస్తున్న వీధి దీపం

భాగంగా అత్యాధునిక సాంకేతికతలను అందుబాటులోకి తీసుకొస్తోంది.

వై-సన్ స్మార్ట్ వీధి దీపాలు

కేంద్ర ఎలక్ట్రానిక్స్ అండ్ ఐటీ మంత్రిత్వ శాఖ, జాతీయ స్మార్ట్‌సిటీస్ మిషన్, తెలంగాణ ప్రభుత్వం సంయుక్త భాగస్వామ్యంతో ట్రిపుల్ ఐటీలో స్మార్ట్‌సిటీ లివింగ్ ల్యాబ్ ఏర్పాటైంది. దీనికి యూరోపియన్

వాణిజ్య సాంకేతిక మంత్ర సాంకేతిక సహకారం అం కాన్ ల్యాబ్స్, ఇంటెల్, సె కార్పొరేట్ భాగస్వాములు ప్రాజెక్టులో భాగంగా విద్ లకు ప్రత్యేకంగా సెన్సర్లు రకాల సమాచారాన్ని సేక కెమెరా, స్పీకర్‌ను అమర్చి వాతావరణ పరిస్థితులను వేసి ప్రదర్శించడం, ప్రజ ఇప్పుడు వీధి దీపాలను వీధి దీపాలుగా మార్చార వాతావరణ పరిస్థితుల ప పరీక్షించి విజయవంతంగా గుర్తించారు. "స్మార్ట్ సిటీ ల్యాబ్‌లో భాగంగా ట్రిపుల్ విద్యుత్ సరఫరా, గాలి విద్యుదుత్పత్తి వంటివి సె పనిచేస్తున్నాయి. ఇప్పటికే లోరా వ్యాన్ సాంకేతికత సన్ సాంకేతికత పనిచేస్తు ట్రిపుల్‌ఐటీ కో ఇన్నోవేషన్ రమేశ్ లోగనాథన్ చెప్పా



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ABAD

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Telangana, with knowledge support from European Business Technology Council. Professor Ramesh Loganathan said, "The smart city lab, an year-old now, is already a testbed for various startups and research. IIIT Hyderabad's campus consists of sensor networks monitoring different verticals such as water, en
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SILICON LABS

Glimpses of Wi-SUN Launch 7th March 2024

SILICON LABS

Phase 3 Highlights

Introduction of battery-powered Limited Function Nodes (LFNs) using EFR32FG28 SoC

LFNs to enhance connectivity to the cloud for various sensor devices

Over-The-Air Device Firmware Upgrade

Completion of the Smart City PoC by the end of February 2024

Visualization

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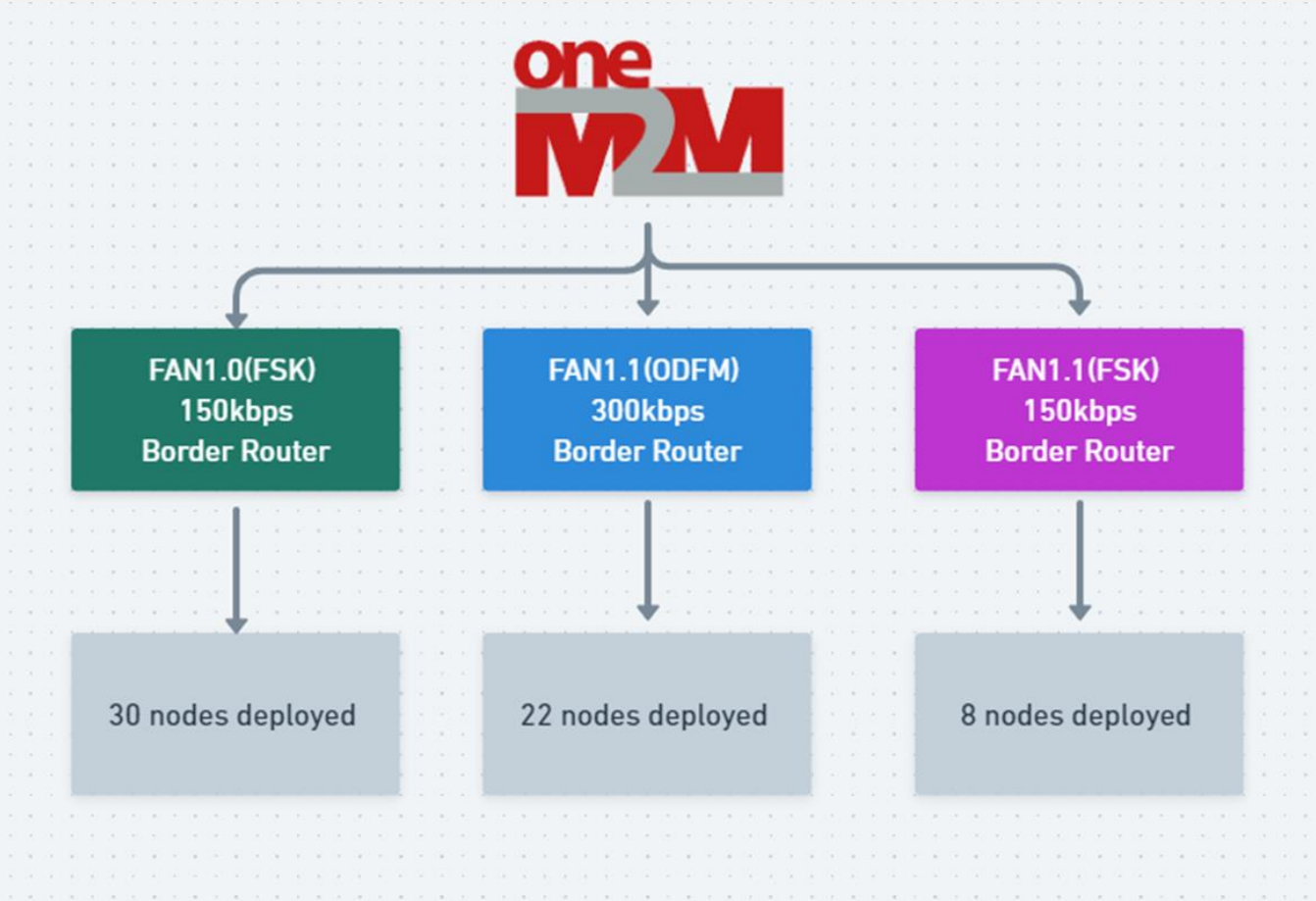
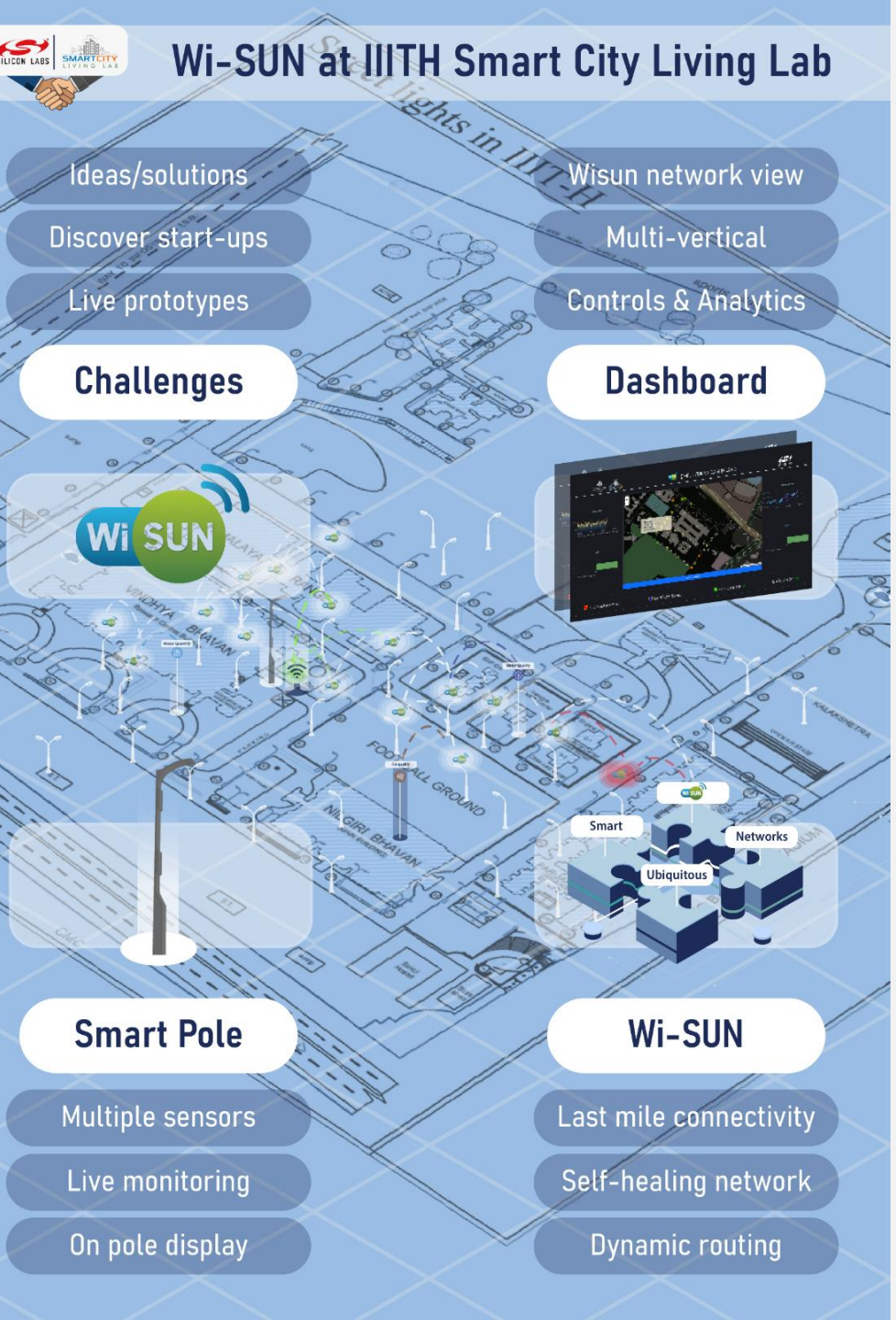
60 Wi-SUN Nodes Deployment





Big win: Wi-SUN project With Silicon Labs

- Campus Wide Wi-SUN Backbone network deployment
- More than 130 streetlights controlled through Wi-SUN
- Phase 3 deployment with 5 Leaf nodes interfaced with various utilities on March 7th, 2024
- Planning Phase 4 deployment connecting with various utilities
- Wi-SUN Smart City Challenge conducted and Three winner Identified after the POC at Smart City Living Lab.


Kohli Research Block

Glimpses of Smart City Challenge 25th September 2024

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Challenge - Scope

Scope

- The Wi-SUN Grant Challenge is being planned to get launched by Smart City Living Lab, IIITH in association with Silicon labs together in **May 2024 - September 2024 time frame**
- It is being launched to find viable solutions for various utility monitoring devices using the Wi-SUN network including FAN1.1(FG25) – FSK FFN's; FAN1.1(FG25) Wi-SUN Border Router, and FG28 LFNs (Leaf Nodes)
- This aims to support hardware innovators/ Start-ups/ Academic Institutions to develop workable prototypes utilizing the Wi-SUN RF mesh.
- This challenge is proposed to encourage hardware start-ups and MSME's to make best utilization of Wi-SUN network.
- The Final winners will be awarded a grant amount.
- Grant Challenge thus enable young entrepreneurs to initiate technology start-up companies for commercial exploitation of technologies they developed.

Some of the focus Areas

- Smart Energy Solutions
- Battery powered Smart Utility (Water/Gas) solutions
- Edge Intelligence
- Network Security
- Long Battery Life
- Environment and Clean Energy Solutions
- Mobility and Transport
- Predictive Maintenance
- Smart cities & factories
- Waste Management
- Smart Agriculture
- Solar harvesting

Challenge Kit - HW & SW Development platform

HW kit

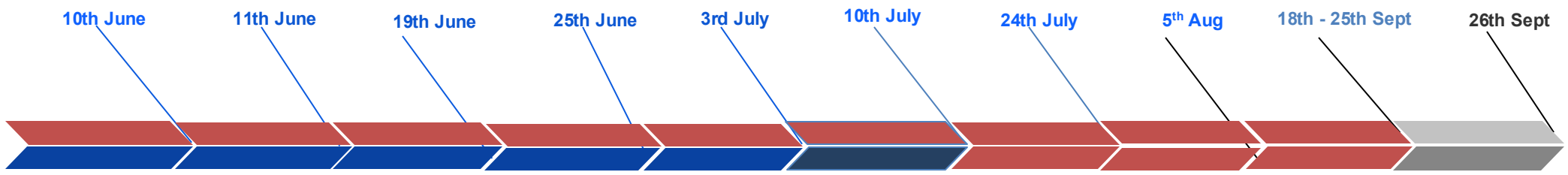
- FG28 Explorer board - xG28-EK2705A
- 4-port SparkFun Qwiic MultiPort (I2C)
- Custom base board
- Battery - NCR18650GA 3300mAh

SW Development - Simplicity Studio 5

Silicon Labs Wi-SUN SDK Links -

- **Getting Started with Simplicity Studio 5 User Guide**
  - https://docs.silabs.com/simplicity-studio-5-users-guide/latest/ss-5-users-guide-getting-started/
- **Silicon Labs Simplicity SDK(Supports Series 2 Devices)**
  - https://github.com/SiliconLabs/simplicity_sdk
- **Getting Started with Wi-SUN Linux Border Router**
  - https://github.com/SiliconLabs/wisun-br-linux
- **EFR32 Wi-SUN Application Examples**
  - https://github.com/SiliconLabs/wisun_applications
- **Wi-SUN Node Monitoring Application (This can be used to make any kind of application and CoAP/UDP communication)**
  - https://github.com/SiliconLabs/wisun_applications/tree/main/wisun_node_monitoring
- **EFM32 and EFR32 32-bit MCU Peripheral Examples**
  - https://github.com/SiliconLabs/peripheral_examples

Smart City Living Lab Challenge



PRESENT STATUS

- Total Registrations for Webinar = 600
- Attendees at Webinar = 203

- Total concepts submitted as of 10th July = 266
  (Colleges = 198
  Startups = 68)

Screening Process:

- Stage 1 - Disqualified = 176; Qualified - Students = 54; Startups = 36
- Stage 2 - Qualified - Students = 8; Startups = 8
- Final 10 - Interview round (Zoom call) = Students = 4; Startups = 6

PRIZE MONEY

- Grand 1st Prize = 500,000 INR (~ 6K USD)
- 2nd Prize = 200,000 INR (~ 2.4K USD)
- 3rd Prize = 100,000 INR (~ 1.2K USD)

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Glimpses of Wi-SUN Smart City Challenge 26th September 2024

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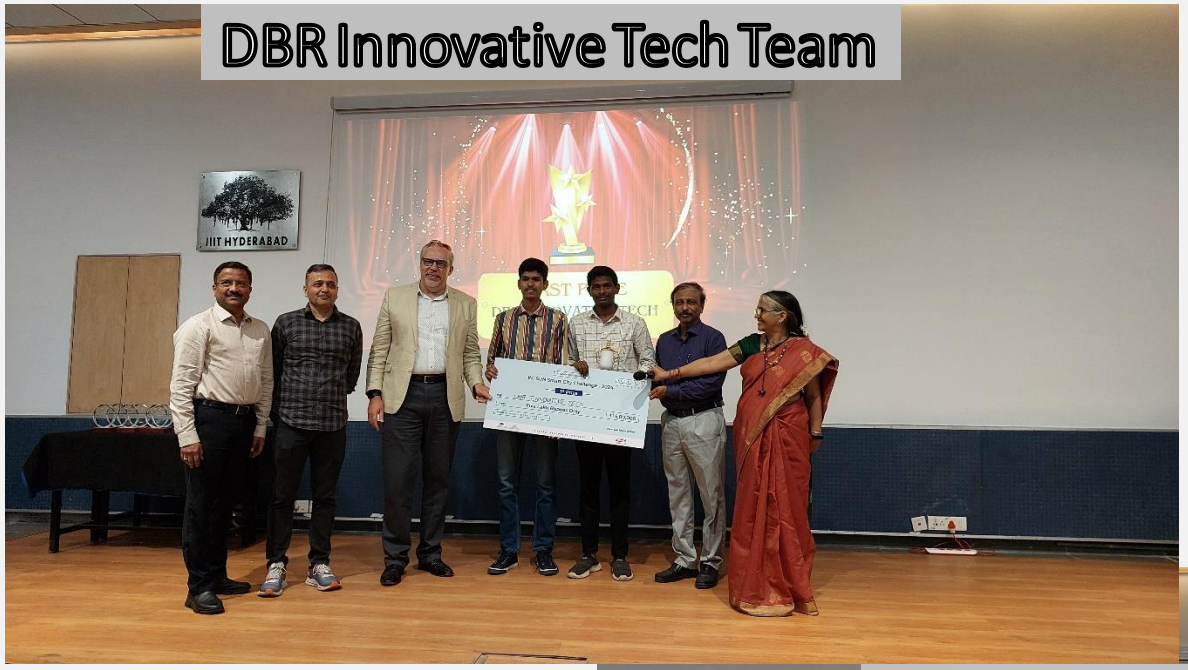
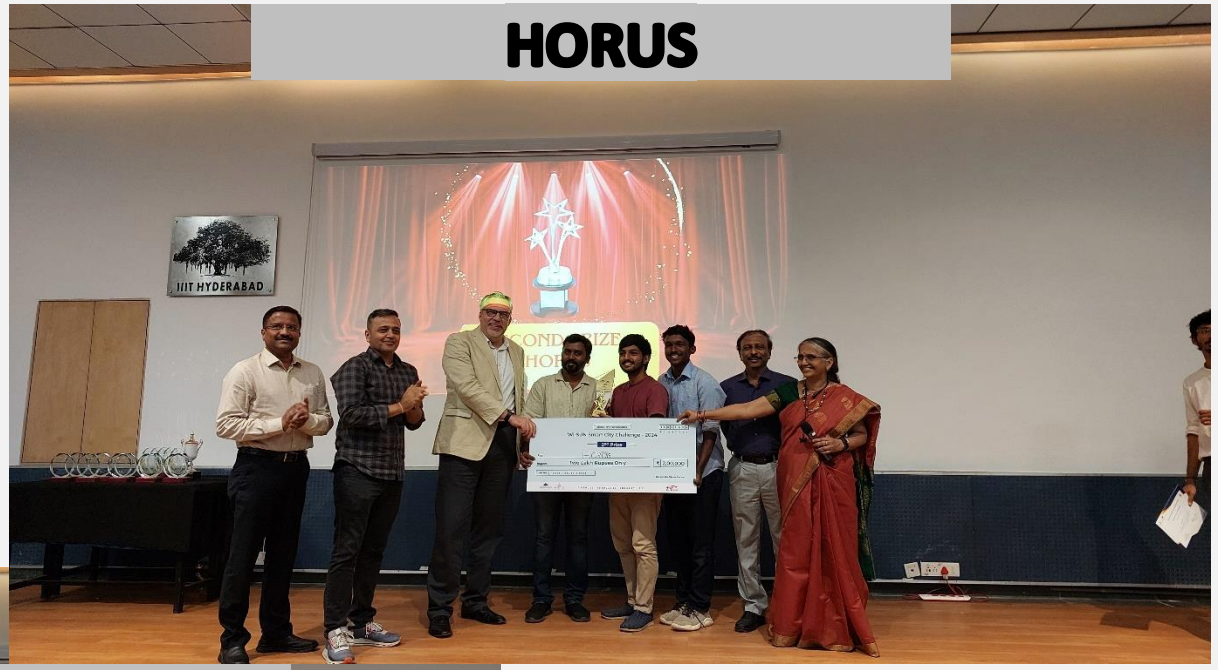
FINALIST TEAMS

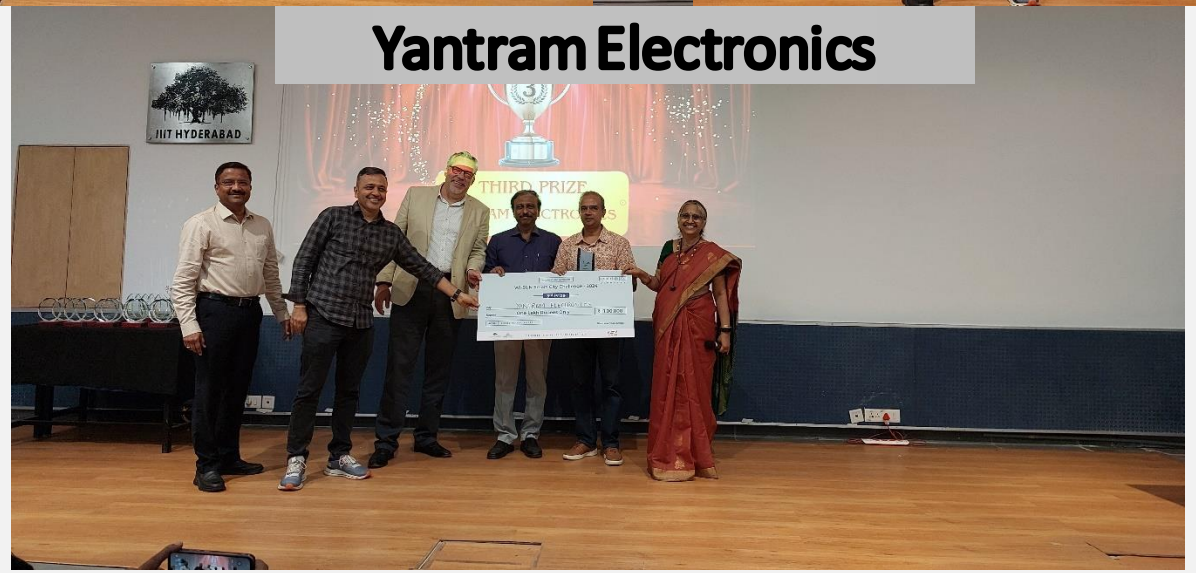
DBR Innovative Tech Team



HORUS



Yantram Electronics



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Q&A

Thank You!