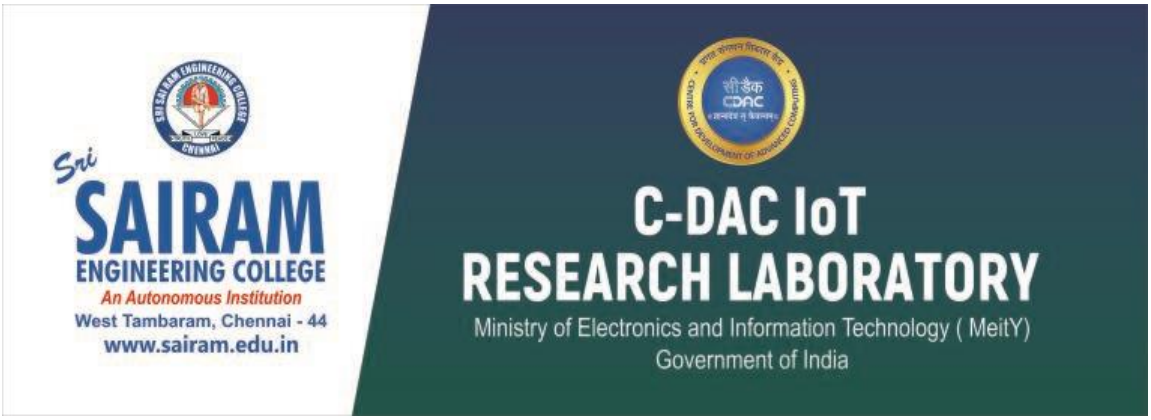


Vision

To design and develop a smart embedded system that makes objects to collaborate with other things through wireless/wired links using specific addressing schemes for real time applications.

Establishment of CDAC IoT Research Lab

Sri Sairam College of Engineering, West Tambaram established the CDAC-IoT Research Laboratory on 24th March 2023 in collaboration with Centre for Development of Advanced Computing, India under the Ministry of Electronics and Information Technology(MeitY). Dr. Sai Prakash Leo Muthu, CEO and Chairman of Sairam Institutions delivered the keynote address. Mr. Shrikrishna, Joint Director and Lead, Firmware development and IoT security, CDAC Bangalore was the Chief Guest at the inaugural event gave an invited talk about the importance of using smart tools like IoT and AI for home and industrial applications. Mr. Sampathkumar Veeraraghavan, Senior Technical Program Management Leader, Amazon graced the occasion. Mr. Naresh, Chief Information Officer, Dr.K. Porkumaran, Principal, Sri Sairam College of Engineering elucidated the importance of the association of CDAC and Sri Sairam Engineering College and the future of Engineering applications augmented by IoT. Dr.R.Azhagumurugan, HoD of the Department of EEE and Dr.K.Renganathan, HoD of the Department of EIE gave the Welcome Address and Vote of Thanks respectively. Deans, Heads of various Departments, Mrs. K. Thirupura Sundari, Mr. R. Sivaprasad, CDAC IoT Research Lab coordinators, Professors and students from various departments participated in the event. The event concluded with a two-day training session on CDAC IoT research lab tools for the students and faculty. Mr. Mohan P, Senior Project Engineer and Mr. Murugan , Principal Technical Officer C-DAC were the trainers for the hands on sessions.

About CDAC

Centre for Development of Advanced Computing (C-DAC), primarily an R &D institution established in March 1988, is a Scientific Society of the Ministry of Electronics and Information Technology, Government of India. Over many years of consistent R&D efforts, C-DAC is today a recognized destination for multi-disciplinary Research Development and deployment of state-of-the-art technologies in Electronics and Information Technology. The broad canvas of C-DAC's Technology offerings range across several thematic areas such as High Performance Computing & Grid Computing, Ubiquitous Computing, Multilingual Computing, Professional Electronics including VLSI & Embedded Systems, Communications and Wireless Technologies, Software Technologies including Open Source Technologies, Cyber Security, Health Informatics, and Education & Training including e-learning. C-DAC has been in the forefront in the implementation of end-to-end solutions in various verticals of economic and social segments. The technologies developed by CDAC have addressed key sectors such as Science and Engineering, Finance, Healthcare, Power, Steel, Agriculture, Cultural Heritage, Industrial controls, Broadcasting & Communications, Education and e-Governance.

C-DAC technologies could be used to set up the following Laboratories in any academic institutions

1. Automation and SCADA Lab

2. IOT Lab

Research possibilities:

1. With the advent of Internet of Things applications are limitless and there is a huge scope for R&D in this area.

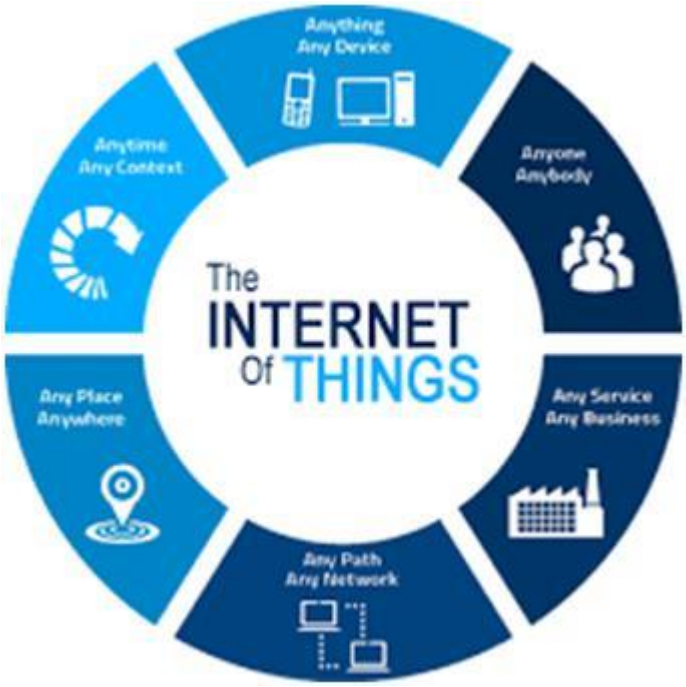
2. Building automation can be done by using Zigbee to effectively deliver solutions for a variety of areas by the design of a multi-sensing, heating and air conditioning systems.

3. Using a wireless sensor network for security monitoring would allow for quickly deployed large-scale intrusion detection. Whenever a sensor node detects motion or is moved from its original location, the node will generate an event, alerting the wireless network that something is wrong

4. WSN/IoT has huge research possibilities for military and medical applications also in the field of Agriculture, Animal Husbandry and disaster management

Internet of Things (IoT) Lab -Facilities

Internet of things (IoT) provides IP connectivity to various ‘’Things’’ apart from general Desktops, Laptops and Mobile Devices. The term "things" means any physical parameter that could be sensed and connected to Internet. For example a device monitoring temperature and humidity at certain location and relaying the data will become a “thing’” in the IoT domain. Sensors are the building blocks of IoT which can collect parameters and low power wireless embedded systems transmit information to gateway devices. Gateway device will make the parameters available over internet so that parameters are globally accessible. Till now there is no dedicated network stack defined for IoT, as it is a heterogeneous network of networks. The most popular protocols used for realization of IoT are Zigbee , 6lowPAN (IEEE 802.15.4), Bluetooth and Wi-Fi.



Ubi-sense: - 15 Nos

Ubi-Sense is a generic sensor board having the following sensors.

- **Sensors**
- **Temperature and Relative Humidity**
- **Light Intensity**
- **Barometric Pressure**
- **Proximity sensing**
- **Buzzer**

All the sensors can be interfaced with microcontroller via I2C bus. It contains additional I2C connector for connecting external I2c compliant sensors to the communications modules. Ubi-Sense mates with Ubimote and BLE mote through their expansion connector and sensor interface libraries are available for all the communication modules. The platform could be used to educate students about MEMS based sensing, sensor interface and applications.

Ubimote

Ubimote is a System on Chip based Low Power and Medium range RF communication module compliant to IEEE802.15.4 supporting a maximum transmitting power of +7 dBm.

Ubimote is a System on Chip based Low Power and Medium range RF communication module compliant toIEEE802.15.4 supporting a maximum transmitting power of +7 dBm. Ubimote supports application development platforms like Contiki OS, Zigbee and custom stacks.

Features:

• Highly integrated System on Chip with ARM Cortex M3 microcontroller with
– Up to 32-MHz Clock Speed
– Up to 32KB of RAM (16KB With Retention in All Power Modes)
– Two timers (16/32 bit)
– 512KB of In-System Programmable Flash
– Supports On-Chip Over-the-Air Upgrade (OTA)
– Battery Monitor and Temperature Sensor
– 12-Bit ADC With 2 Channels and Configurable Resolution
– USB 2.0 Full-Speed Device (12 Mbps)
– Four Universal Serial Communication Interfaces (USCIs)- SPI, UART, I2C
• External Flash Memory
– 8Mb Flash memory, Up to 75 MHz clock frequency
– SPI Interface , Write Protection, Deep Power Down Mode
• RF subsystem
– ISM Band RF Transceiver with RF frequency range 2394-2507 MHz (2.4 GHz)
– IEEE 802.15.4 compliant DSSS baseband modem with 250 kbps data rate
– Low Power (RX -97dBm @ 20 mA, TX 0 dBm @ 24 mA)
– Ultra-low power down mode (<1.3µA)
– Good receiver sensitivity (-100 dBm), Adjacent channel rejection: 44 dB and Alternate channel rejection: 52 dB

• Security sub system
– Future Proof AES-128/256, SHA2 Hardware Encryption Engine
– Optional – ECC-128/256, RSA Hardware Acceleration Engine for Secure Key Exchange

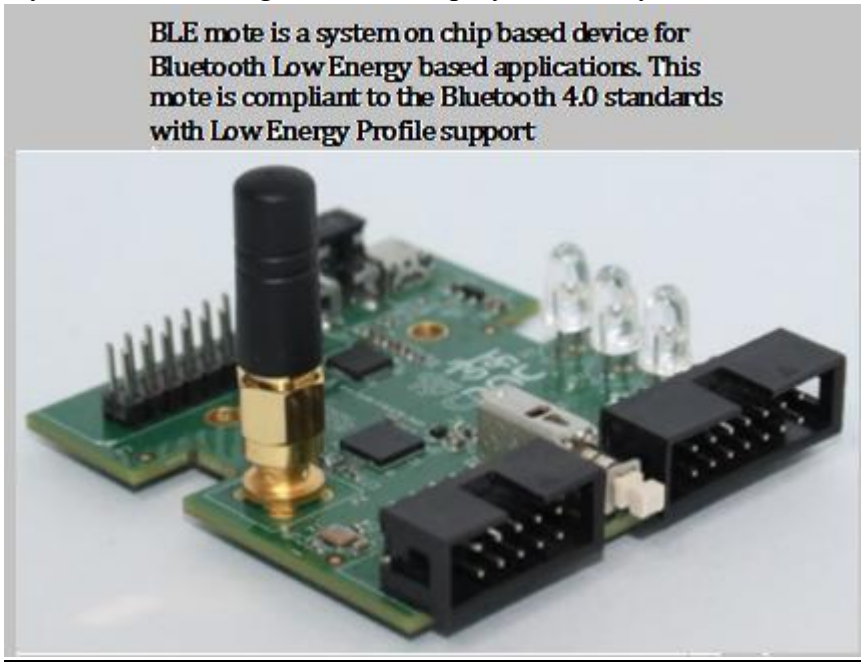
• Expansion headers for connecting Ubi-Sense, Ubi-DAC and external sensors
• Intelligent power system with rechargeable lithium polymer battery and solar energy harvesting

BLEMOTE

BLE mote is a system on chip based device for Bluetooth Low Energy based applications. This mote is compliant to the Bluetooth 4.0 standards with Low Energy Profile support.

Features:
• Highly integrated System on Chip with ARM Cortex M0 microcontroller with
• 256 kB embedded flash program memory, 32 kB RAM
• 1x32 bit Timer & 2x16 bit timers with counter mode
• 8/9/10 bit ADC with 8 configurable channels
• Low power comparator
• Supports various Serial Communication Interfaces like SPI,UART, I2C
• CPU independent Programmable Peripheral Interconnect (PPI)
External Flash Memory
– 8Mb Flash memory, Up to 75 MHz clock frequency
– SPI Interface , Write Protection, Deep Power Down Mode
• RF subsystem
– 2.4 GHz (2.400 to 2.4835 GHz) ISM Band RF Transceiver compliant to Bluetooth 4.0 LE standards
– 250 kbps, 1 Mbps, 2 Mbps supported data rates
– GFSK Modulation
– Programmable Transmit power of +4 dBm to -20 dBm (in 4 dB steps)
– High Receiver Sensitivity (-93dBm in BLE)
– Low Power (Peak Rx -93dBm @ 13 mA, Peak Tx 0dBm @ 10.5 mA)
– Ultra-low power multiple down modes

• Security sub system
– AES Hardware Encryption Engine (AES Electronic Codebook Mode Encryption, AES CCM Mode Encryption)
– Accelerated Address Resolver
– Random Number Generator
• Expansion headers for connecting Ubi-Sense, Ubi-DAC and External Sensors
• Intelligent power system with rechargeable lithium polymer battery



PC Based WingZ Gateway Simulator
Using this software application which is running on PC, user can simulate IoT Gateway functionality.
1. The application has capability to read sensor data from Motes serially and store it into database.
2. Motes i.e. Ubimote, BLE mote can acquire data from Ubi-sense.
3. The sensor data transmission from motes to PC will happen via UART-USB communication.
4. The sensor data will contain Temperature, Humidity, Light Intensity, Pressure, Proximity sensor readings.
5. All the sensor values will be stored in database using this application.

List of experiments on IoT Kit
1. Embedded Programming
1.1. Toggling LEDs
1.2. Transmitting a string through UART
1.3. Controlling LEDs blinking pattern through UART
1.4. Echo each character typed on serial terminal.
1.5. Digital IO configuration.
1.6. Timer based LED Toggle.
1.7. On-chip Temperature measurement through ADC.

2. RF experiments

2.1. Point to point communication of two Ubimotes over the radio frequency.

2.2. Multi-point to single point communication of Ubimotes over the radio frequency.

3. Experiments on interfacing with UbiSense

3.1. I2C protocol study

3.2. Reading Temperature and Relative Humidity value from the sensor.

3.3. Reading Light intensity value from light sensor.

3.4. Reading of atmospheric pressure value from pressure sensor.

3.5. Proximity detection with IR LED.

3.6. Generation of alarm through Buzzer.

3.7. Transmitting the measured physical value from the UbiSense over the Air.

4. WSN Applications

4.1. Demonstration of a peer to peer network topology using coordinator and end device network device types.

4.2. Demonstration of peer to peer communication between coordinator and end device through Router.

4.3. Establishing Many to one Communication (Star Network Topology)

4.4. Establishing Tree Network Topology

4.5. Establishing Cluster Tree Network

5. IOT applications

5.1. IP based lighting control

Photos:

Address by Dr.K.Porkumaran, Principal,
Sri Sai Ram Engineering College, Chennai

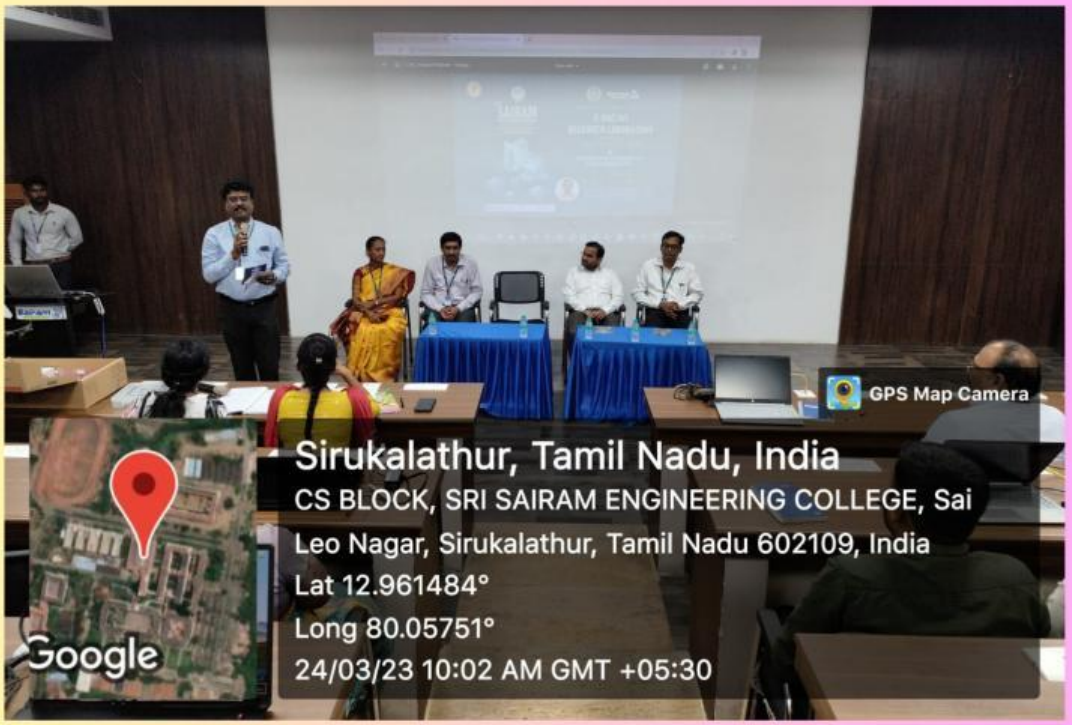
Felicitation of Chief Guest by Dr. Sai Prakash Leomuthu,
CEO & Chairman, Sairam Institutions

Felicitation of Trainers by Dr.K.Porkumaran, Principal ,SEC
and Dr.R.Azhagumurugan, HOD/EEE

INAUGURAL ADDRESS by the Chief Guest
Mr Shrikrishna S Chippalkatti,
Joint Director & Lead, Firmware development and IoT security,
C-DAC Bangalore

PRESIDENTIAL ADDRESS by Dr.SAI PRAKASH LEOMUTHU,
CEO & CHAIRMAN, SAIRAM INSTITUTIONS

Special Address by Mr. Sampathkumar Veeraraghavan,
Senior Technical Program Management Leader, Amazon



COMMENCEMENT OF HANDS ON TRAINING SESSIONS

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