Name of the Department: Computer Science and Engineering (IoT)

Name of Research and Education center: **Industrial Internet of Things (IIoT) Laboratory**

Research & Education Center
INDUSTRIAL INTERNET OF THINGS (IIOT)

About the Center:

An Industrial Internet of Things (IIoT) Research & Education Center serves as a hub for cutting-edge exploration and learning in the realm of connected industrial systems. In this center, Outcome-Based Teaching & Learning thrives through the seamless integration of course projects, research initiatives, and entrepreneurship activities. This synergy provides students with a comprehensive educational experience. Engaging in hands-on course projects, they apply theoretical knowledge to practical scenarios, cultivating essential skills for industry readiness. Focused on leveraging IoT technologies, it delves into the integration of smart sensors, data analytics, and automation within industrial settings. This center facilitates collaborative research initiatives, fostering innovation in optimizing processes, enhancing efficiency, and ensuring industrial resilience.

The primary functions of the center:

While the specific details may vary, an Industrial IoT Research & Education Center typically encompasses the following five primary functions:

1. **Research Hub**: Serving as a focal point for cutting-edge research in Industrial IoT, the center conducts and supports research initiatives, contributing to advancements in technology, systems, and applications within the industrial sector.
2. **Educational Nexus**: The center functions as an educational hub by integrating Outcome-Based Teaching & Learning. It offers courses, workshops, and hands-on experiences, ensuring students acquire practical skills, theoretical knowledge, and industry-relevant expertise in the field of Industrial IoT.
3. **Innovation Incubator**: Fostering an environment of innovation, the center encourages entrepreneurial activities. It provides resources and support for students and researchers to incubate and develop their IoT-related ideas, fostering a culture of creativity and initiative.
4. **Industry Collaboration**: Establishing strong ties with industrial partners, the center facilitates collaboration between academia and industry. This ensures that research and educational activities are aligned with the current needs and trends in the industrial sector, enhancing the practical relevance of the center's initiatives.
5. **Technology Transfer**: The center acts as a conduit for transferring technology and knowledge from research to practical applications in the industry. By bridging the gap between academia and the industrial sector, it facilitates the implementation of research findings and promotes the real-world impact of Industrial IoT technologies.

Major equipments: (along with description / Cost/ photographs):

1. **Smart Green House:**

   A greenhouse is a special structure that is designed to regulate the temperature and humidity of the environment inside. There are different types of greenhouses, but they all have large areas covered with transparent materials that capture sunlight and heat. Cost: 7,99,632/-

2. **ETS IoT KIT:**

   The board can be programmed using the Arduino development environment, and the example code shows you how to both send and receive data via LoRa. Cost: 26000/-

3. **STM32:**

   STM32 microcontrollers are designed to meet the requirements of embedded systems, providing a comprehensive set of features and peripherals on a single chip.

They are optimized for low power consumption and real-time processing, making them suitable for a wide range of applications. Cost: 24,496/-

4. MULTI CHANNEL INDOOR GATEWAY FOR LoRaWAN

Dragino dedicates to promote Open Source IoT solution. Our Open Source products are sold world widely and gain good name in the Open Source Internet of Things filed. Cost: 20,196/-

5. RASPBERRY PI

The Raspberry Pi project originally leaned toward the promotion of teaching basic computer science in schools. The original model became more popular than anticipated, selling outside its target market for diverse uses such as robotics, home and industrial automation, and by computer and electronic hobbyists, because of its

low cost, modularity, open design, and its adoption of the HDMI and USB standards. Cost: 9,247/-

6. WEATHER STATION

A weather station is a combination of instruments used to measure atmospheric conditions to help study the weather and climate of a particular location. Most weather monitoring stations will measure temperature, humidity, air pressure, wind speed and direction, and rainfall, among others. Cost: 1,34,170/-

7. GAS STATION

It effectively detects the presence of hazardous gases like propane and methane and alerts the plant authorities, preventing the premises from unexpected ignition. Moreover, a gas monitoring solution uses gas analyzers to generate alerts regarding the temperature increase. Cost: 1,17,889/-

8. **MULTI MCU:**

Multi MCU trainer kit has on board controllers like (Arduino Uno, Raspberry Pic, ESP32, STM32). This trainer kit also has IoT modules like (Lora Module, ZigBee Module, Bluetooth Module and GSM Module). Using this trainer we can perform various numbers of examples using input and output devices and commination between other devices. Cost: 55,000/-

9. **Server and desktop details:**

HP Tower Server Specifications:
HPE ML110 Gen10 3206R 1P 4LFF Server Intel Xeon B-3206R (8-Core, 1.9Ghz) Processor, HPE 32GB DDR4- 2933R Memory, Embedded 2-port 1GbE 332i Adptr, S100i SW RAID, HPE 550W ATX Power Supply Kit, 3 years NBD Warranty, 4LFF HP, HP 2.0 TB SATA LFF HDD, HP USB KB andMouse, HP 1.8.5 Monitor

Desktop:
HP - S01 - PF2008IN - I5/10TH GEN/8GB/512GB SD/WIN11+MS.OFF/19.5"INCH/KBD+MOUSE/WIFI+BT/1YR WARRANTY

Minor equipment details:

1. **ARDUINO UNO KIT**

   Arduino UNO is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board that can be integrated into a variety of electronic projects. This board can be interfaced with other Arduino boards, Arduino shields, Raspberry Pi boards and can control relays, LEDs, servos, and motors as an output.

   Cost: 400/-

2. **Sensors/Actuators:**

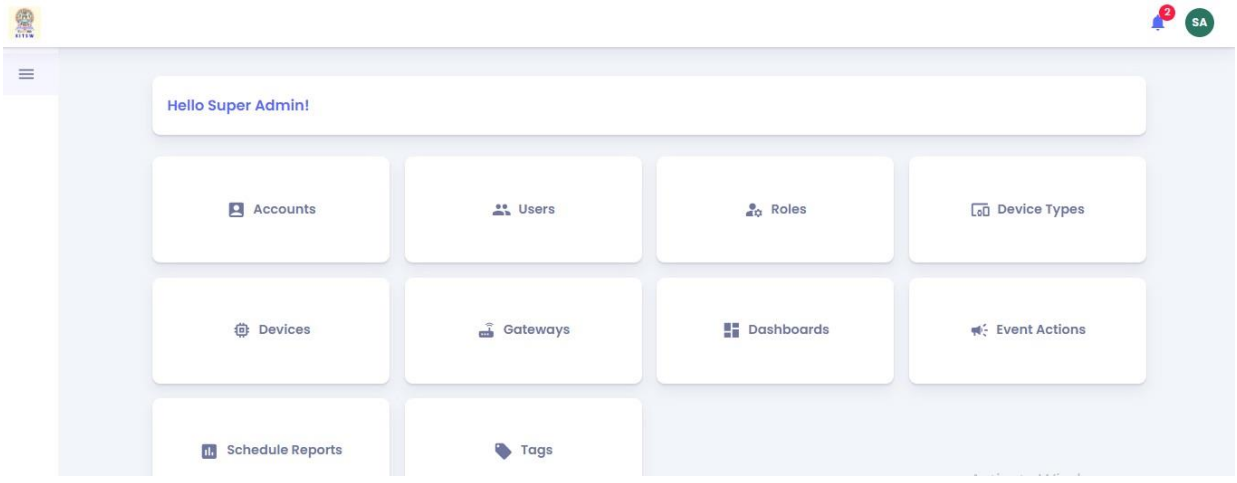
S.NO	Sensors/Actuators	S. NO	Sensors/Actuators
1	RELAYS	13	3-Axis Accelerometer, 3-Axis Magnetometer & 3-Axis Gyroscope
2	BULBS	14	Air pressure sensor & Air quality sensor
3	Ultrasonic sound Sensors	15	Barometer
4	BUTTONS	16	Biometric sensors
5	PIR sensors	17	Flame Sensor
6	Pi-Camera	18	Gas sensors
7	DHT Sensor	19	Hall magnetic Sensor
8	7-Segment Display	20	Hall sensor-Linear
9	3-Axis Accelerometer, 3-Axis Magnetometer & 3-Axis Gyroscope	21	Infrared (Passive IR) Emitter & Infrared Receiver
10	Air pressure sensor & Air quality sensor	22	Laser Emitter
11	Barometer	23	LDR Light Sensor
12	Ball Switch	24	Flame Sensor

Major software list with description:

Web address: https://iiot.kitsw.ac.in

thingZmate is an Industrial IoT solutions platform to monitor and control your devices and analyze the collected data using visualization dashboards in near real-time. This technology can collect data from various devices and analyze the data that is fundamental to usage, productivity and performance. This wireless system feeds accurate, live data into the platform which can then be interpreted by people or analysts, allowing them to make improved and effective decisions.

Login page



Home Page

Types of projects / research carried out with description:

S. No	Title	Description	Major/mini/course project
1	A Mobile Greenhouse Environment Monitoring System Based On The Internet Of Things	This project introduces a sophisticated Mobile-Controlled Robotic Greenhouse Monitoring System designed to autonomously navigate within greenhouse environments. The robotic vehicle is equipped with sensors to continuously monitor temperature and humidity levels, providing real-time data for greenhouse climate management. The collected environmental data is then utilized to predict the temperature for the next day, aiding farmers in proactive decision-making. Additionally, the robotic system incorporates a high-resolution camera to capture images of plant leaves. Employing advanced image processing techniques, the captured images are analyzed for signs of plant diseases.	Major Project
2	AGRI ROBOT	The main aim of the project is to develop a system in which the detection of the plant disease should be done without the human. A line following robot is developed and it captures the images and send to the owner and the received images are tested using the image processing techniques. The model detects the disease and confirms whether the plant is affected with the diseases or not.	Mini Project
3	Automation of Street lights using IoT	The sole motive of automated streetlight using IoT is the preservation of energy by decreasing the rate of wastage of electricity and manpower. This can be implemented using an IoT Streetlight System. LED Lights combined with LDR can help us regulate the amount of intensity of light unlike LED lamps where it couldn't be possible. The project is implemented on an Arduino board for providing efficient results by regulating the light at various times. The proposed project clearly brings out more efficient way to harness electricity instead of its conventional counterpart.	Course Project

Photographs of working models / application software developed with description:

1. **#Working model1**
   Title: Development of Solar Charging System for Electric Cycle
   Description: A hybrid charging system with solar power for electric bicycles combines traditional charging methods with solar energy to create an eco-friendly and sustainable charging solution. The system includes solar panels installed on the electric bicycle, a solar charge controller to regulate voltage and current, a high-capacity rechargeable battery pack for energy storage, and the option for traditional electric grid charging. Intelligent charging logic prioritizes solar charging when sunlight is available, seamlessly switching to grid charging when necessary. The system features a user interface displaying charging status and source, efficiency optimization through MPPT algorithms, safety mechanisms to prevent overcharging and overheating, a lightweight design, and integration with other e-bike components. Connectivity and data logging capabilities allow users to monitor and control the charging system. Collaboration with experts in solar energy, electrical engineering, and battery technology is crucial for designing a safe and efficient system.

   Photographs of working model:

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Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506015, TELANGANA, INDIA
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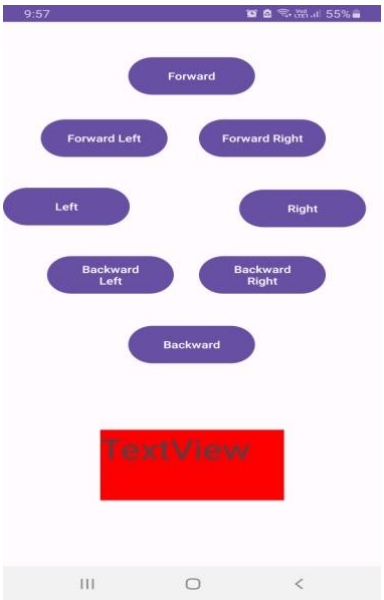
website: www.kitsw.ac.in E-mail: principal@kitsw.ac.in : +91 9392055211, +91 7382564888

2. **#Working model2**

Title: A Mobile Greenhouse Environment Monitoring System Based On The Internet Of Things

Description: This project introduces a sophisticated Mobile-Controlled Robotic Greenhouse Monitoring System designed to autonomously navigate within greenhouse environments. The robotic vehicle is equipped with sensors to continuously monitor temperature and humidity levels, providing real-time data for greenhouse climate management. The collected environmental data is then utilized to predict the temperature for the next day, aiding farmers in proactive decision-making. Additionally, the robotic system incorporates a high-resolution camera to capture images of plant leaves. Employing advanced image processing techniques, the captured images are analyzed for signs of plant diseases, and battery technology is crucial for designing a safe and efficient system.

Photographs of working model:



3. **#Working Model3**

Title: An Iot And Deep Learning Based Smart Blind Assistant

Description: The smart blind stick's IoT features allow for smooth connecting to the user's smartphone, which serves as a voice assistant. This voice assistant offers real-time information about its surroundings, such as detected obstructions, gas levels, and identifiable items. The device uses modern communication protocols to enable low-latency data flow between the smart blind stick and the user's smartphone.The addition of ultrasonic sensors improves the stick's capacity to identify impediments at varied distances, ensuring the user receives early warnings. The gas sensor adds an extra degree of safety by detecting dangerous substances in the environment. In the event of an accident, the accelerometer sends immediate alerts to the user and their emergency contacts.The proposed smart blind stick is a comprehensive solution that not only improves basic navigation but also prioritises user safety through real-time environmental monitoring and accident detection. The combination of IoT and deep learning technology improves the stick's adaptability to various contexts, making it a useful tool for visually impaired people in their daily life.

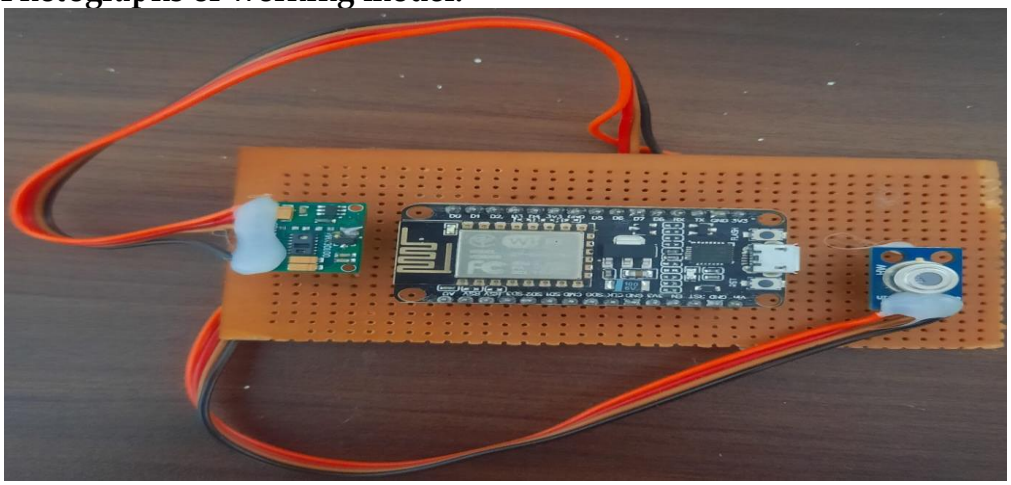
Photographs of working model:

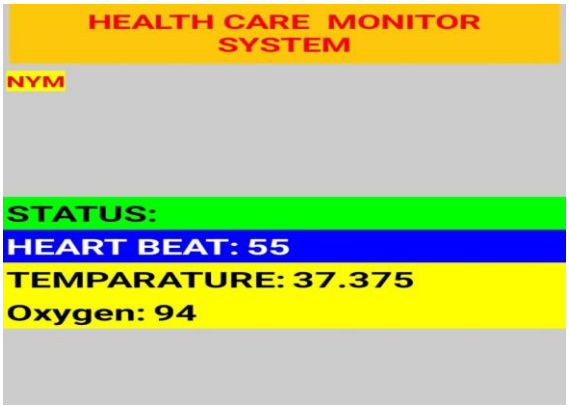
4. **#Working Model4**

Title: Smart Healthcare System using Fuzzy Neural Networks

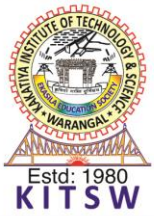
Description: The MAX30100 is a sensor module designed for heart rate and blood oxygen (SpO2) monitoring. It is commonly used in wearable devices such as fitness trackers and smart watches. It can be used to measure the heart rate of an individual by detecting the pulsatile signal from blood flow. In addition to heart rate monitoring, the MAX30100 can also estimate the blood oxygen saturation level (SpO2) by measuring the absorption of light at different wavelengths. The MLX90614 is an infrared (IR) non-contact temperature sensor. It is commonly used for measuring the temperature of an object without direct contact. It measures the temperature of an object by detecting the infrared radiation emitted by the object. These two sensors are connected to ESP8266. Here, ESP8266 is used instead of Arduino UNO because ESP8266 contains inbuilt WiFi and doesn't need any external modules like Bluetooth module for transmitting data to cloud.

Photographs of working model:





Mobile application



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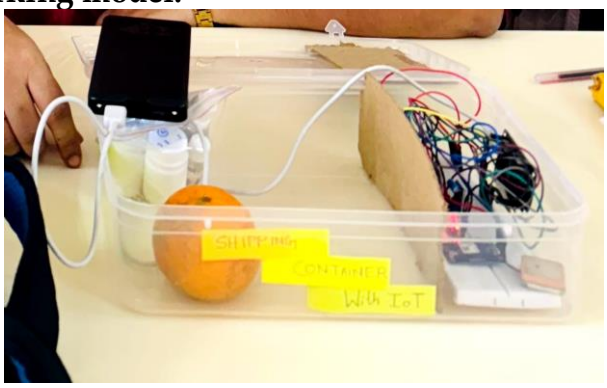
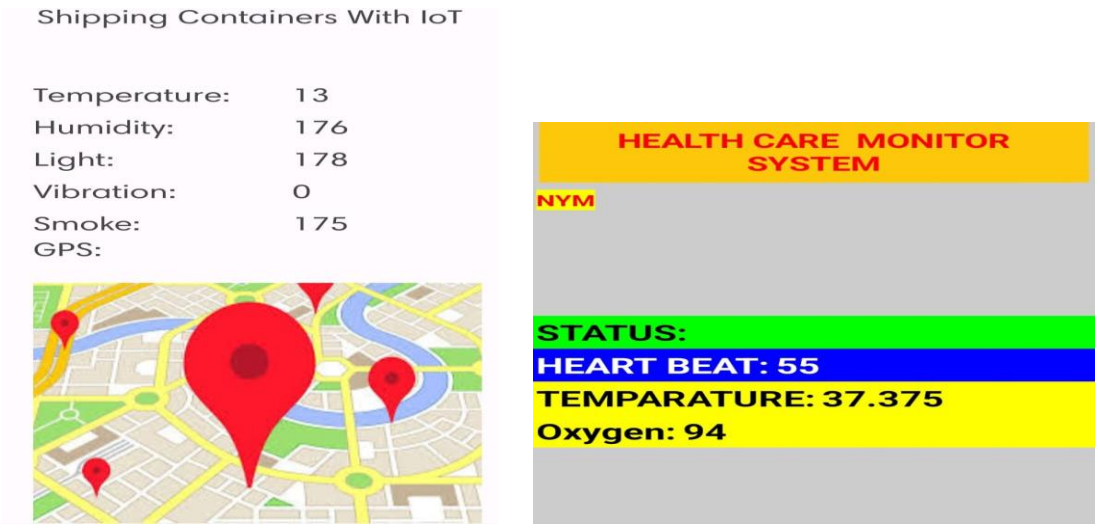
5. **#Working Model5**

Title: Shipping Container With IoT: A Smart Way to Monitor Environment And Location

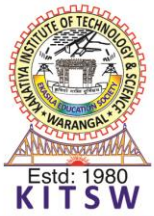
Description: The MAX30100 is a sensor module designed for heart rate and blood oxygen (SpO2) monitoring. It is commonly used in wearable devices such as fitness trackers and smart watches. It can be used to measure the heart rate of an individual by detecting the pulsatile signal from blood flow. In addition to heart rate monitoring, the MAX30100 can also estimate the blood oxygen saturation level (SpO2) by measuring the absorption of light at different wavelengths. The MLX90614 is an infrared (IR) non-contact temperature sensor. It is commonly used for measuring the temperature of an object without direct contact. It measures the temperature of an object by detecting the infrared radiation emitted by the object. These two sensors are connected to ESP8266. Here, ESP8266 is used instead of Arduino UNO because ESP8266 contains inbuilt WiFi and doesn't need any external modules like Bluetooth module for transmitting data to cloud.

Photographs of working model:





Mobile application



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Details of Faculty Incharge for Research and Education Center: (Photo, Contact details)

D. Kumar Dorthi
Assistant Professor,
Dept. of CSE (Networks)
Email Id: drkumar.csn@kitsw.ac.in
Mobile : 09550944054