Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

A

Report on

Centre of Excellence for Internet of Things (CoE-IoT)

(2024-2025)

Department of Computer Science Engineering

and

Information Technology

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1. Introduction

This Internet of Thing lab which was established in 2018-19 as the Centre of excellence (CoE) for Internet of things (IoT) at SKIT, Jaipur, Rajasthan as a part of Digital India Initiative to jump start the IoT ecosystem. The department of Computer Science & Engineering and Information Technology aims at educating and training students with sound knowledge and awareness in recent developments in Internet of Things technology. It is well equipped laboratories with latest hardware and software including Raspberry Pi (Mini Computers), Arduino Uno R3Microcontroller Boards, Xilinx Vivado Design Software Suite for high-level Synthesis, Nexys 4 DDR FPGA Boards, ZYBO FPGA boards, NODEMCU ESP8266-12 CH340 Wireless Micro-Controller Boards, Proteus Simulator for Industrial IoT, Lab View Software for System Design and Analysis , NI MYRIO (Mechatronics kits, Embedded Kits, Starter kits),MY RIO 1900 Microcontroller Boards etc., which complement the high standards of the Institute. The Centre of Excellence also comprises distributed facility within the campus such as E-Yantra lab, Printed Circuit Board (PCB) Lab, Field Programmable Gate Arrays (FPGA) Lab etc for developing Industry 4.0 Standard IoT enabled products.

Experts from the industry are periodically invited to give lectures/demonstrations to the students/faculty members on the latest developments in the field. Students are given exposure to industries by industrial visits and industrial training sessions. The Centre will organize and propose specific FDP, Conference, Short Term training programs and workshops for benefits of students and research fellow's start-ups.

It is proposed to have a centralized dedicated administration office comprising of one coordinator from each department, a chief coordinator and other administrative staff under one roof. Coordinator of each department will be synchronizing the activities of the labs under their department for IoT activities.

2. Centre of Excellence for Internet of Things (CoE-IoT)

Vision:

To be a globally recognized Centre of Excellence in the field of IoT, which involves creating a hub of expertise, innovation, and collaboration to drive the development, implementation, and advancement of IoT technologies.

Mission:

The mission of the CoE is to enable the department to be an innovation hub in the emerging technology of the Internet of Things through democratization of innovation, standardization, and the realization of prototype products before deployment of the IoT devices in the public domain, and to support government initiatives on IoT solutions for areas like water, energy, agriculture, health, and security.

3. Objectives:

1. Strategic Planning: Develop a strategic plan that aligns with the vision of IoT CoE by identifying the key focus areas, industry verticals or technology domains for IoT initiatives.

2. Cross-Functional Collaboration: Foster collaboration between different departments and stakeholders within as well as outside organizations.

3. Skill Development and Training: Provide ongoing training and skill development programs for learners to stay updated on the latest IoT technologies, standards, and best practices.

4. Innovation and Research: Foster a culture of innovation by encouraging research and development activities within the CoE. Stay abreast of emerging trends and technologies in the IoT space.

5. Documentation: Maintain thorough documentation for all IoT projects, including design documents, technical specifications, and testing results. Facilitate knowledge transfer by documenting best practices and lessons learned.

6. Prototyping and Proof of Concepts (PoCs): Implement a structured process for developing prototypes and proof of concepts to validate IoT solutions. Use PoCs to demonstrate feasibility, gather feedback, and make informed decisions.

4. Benefits of Center of Excellence on IoT

Stakeholder	Benefits
Start-up/Small Medium Enterprises	✓ Use of Open Technology Stack, ✓ Access to Industry experts /Consultants ✓ Showcasing the prototype/project to companies. Access to students to work on projects.
Investors	✓ Future products for cross functional business process

	Enhancement in various industry verticals.
Engineering Service providers, Global MNCs	✓ "Risk free" demand technology lab on demand proficiency centre for skill up-gradation. ✓ Access to industry ready talent, technical experts, and consultants
Academia / Researchers	✓ Availability of technology lab for faculty/researchers. ✓ Industry standard proficiency courses for upgrading skills ✓ Platform for offering special course/consulting projects ✓ Innovative ideas from stack holders, start-up starters, self, etc. ✓ Access to current research papers related to their work. ✓ Team of experts helping them to find research solutions.
Industry	✓ Trained Industry ready students ✓ Innovative Ideas ✓ Prototypes for new products.
Students/jobseekers	✓ Internships on IoT projects ✓ Access to Industry experts/ courses/ showcase of talent

5. Strengths and Resources to support the CoE for Internet of Things

In the subsequent sections, we have highlighted the resources, summary of related FDP/Conferences/workshop/STTPs, research publications, patents, and student's projects with glimpse of Internet of Things lab.

Equipment and Sensors available in the IoT Lab

Sr.no.	Item/Equipments	Quantity
1	Raspberry Pi 3 Model B	10
2	Arduino Uno R3 -Compatible With Cable	25
3	NODE MCU ESP8266-12 CH340 BASED	9
4	ERD Mobile Charger (For Raspberry Pi)	11
5	Bread Board	11
6	HDMI To VGA Converter	2
7	Female To Female Jumper Wire	300
8	Male 2 Female Jumper Wire	300
9	Male 2 Male Jumper Wire	400
10	9 Volt Battery cap	10

11	RF-ID 522	2
12	LM - 35	15
13	7805 IC	5
14	Resistance 1/4 470 ohm	30
15	Arduino Motor Shield	8
16	Arduino lilly	1
17	LM-139	4
18	Joystick	2
19	Screw Driver	1
20	Cutter (For Wire)	1
21	IR Sensor Module	8
22	Display 20*4 (Green)	3
23	Display 16*2 (Green)	10
24	Servo Motor	9
25	Bluetooth HC-05	6
26	HC-SR -04 Ultrasonic	19
27	Gas Sensor Module	3
28	GSM 900	1
29	GPS	3
30	7 Segment Display	8
31	Hall Megnitic Sensor Module	4
32	Water Tempreture Sensor	2
33	Water Level Sensor	2
34	Dust Sensor	1
35	Air Quility Sensor	1
36	Water Flow Sensor	2
37	Soil Moisture Sensor	3
38	Rain Sensor	1
39	Capacitor (100 Micro)	20
40	Relay 2 Channel	2
41	DC Moter	7
42	Diode	2
43	Power Supplt 12V-10A	1
44	Power Supplt 12V-5A	1
45	Switch	11

46	Camera Pi	1
47	Relay 4 Channel	2
48	Sound Sensor Module	10
49	PIR HC-SR 501	10
50	Water Pump (5v-12v)	5
51	Flame	4
52	Camera UNO	2
53	IC2 Module	1
54	WiFi 8266	9
55	RGB LED 5MM	90
56	Potentiometer	26
57	Resistance 1K ohm, 1/4w	400
58	Resistance 330 ohm, 1/4w	400
59	Resistance 10K ohm, 1/4w	400
60	Buzzer	11
61	Soldering Wire	1
62	Heart beat Rate Pulse Sensor Module	2
63	Relay 1 Channel 5V	15
64	DHT-11 Sensor Module	14
65	LDR Without MODULE	15
66	Push Button	90
67	Soldering Stand	1
68	Tester Tapadiya	1
69	Hot Glu gun	1
70	Soldering Flux	1
71	Multimeter Mastech 830 L	1
72	LED Bulb	10
73	Bulb Holder	10
74	2 Pin Plastic Plug top	10
75	2 Core Flexible Copper Wire & Cable (30 M)	1
76	B type USB cable	10
77	Taparia SFH30 Soft Face Hammer with Handle	1
78	Themisto IPA ISO PROPYL RUBBING ALCOHOL (99.9% Pure) (TH-ME40) 400ML	1
79	Taparia CH 340 Claw Hammer with Handle	1
80	WD-40 Smart Straw 300ml | Multipurpose Spray to Clean Rust, Limescale,Jams, Stains, Hinges,	1

	Chains and Surfaces | All Purpose Cleaner for Home Improvement, Loosen Stuck & Rusted Parts	
81	**Taparia WCB32 Steel (32mm) Bevelled Edge Chisel (Blue and Silver)**	**1**
82	**Buildskill 5M Measuring Tape, Precision Measurement Tape, Inch Tape**	**2**
83	**Rpi shop - Copper Wire Lug, Battery Cable Ends Eyelets Crimp Tubular Ring Terminals Connectors, Insulated, Fit Cable Size:1.5 Sqmm Bolt Mouth Size: 5.2mm pack of 50 Pcs**	**1**
84	**e4u 40 Pin FRC Cable With Female To Female 2.54mm Pitch Connector 48" Long**	**1**
85	**Uptodateproducts Adjustable Soldering Clamp PCB Holder for Circuit Board Holder Motherboard PCB Frame Stand Clamp Printed Helping Hand Soldering Repair Tool(360 Degree Rotation)**	**1**
86	**120mm PVC PC Cooler Fan Dust Filter Black 6pc with screws (120mm, 6 Pc Pack)**	**1**
87	**9 inch Rack Gear Big Linear Rack for Rack and Pinion Mechanism**	**2**
88	**Taparia MDTN82 Plastic Digital Tester with LCD Display and Neon Bulb (Black) with 814 Steel Line Tester (Green, 4 cm)**	**1**
89	**LipiWorld 4 Pin Molex Male to 2 Ports Molex IDE Female Power Supply Y Splitter Adapter 17Cm Cable for PC,Cooling Fan CD Driver Hard Disk (Molex 4P Male to Dual Female Pack-2),Multi-colored**	**2**
90	**500pcs 3mm LED Light Assorted Kit DIY LEDs Set (100pcs Each Color) White, Yellow, Red, Green, Blue**	**2**
91	**AUTO BOTIX PCB Micro Drill Machine MB140 With Power Supply with Free Drill Bits**	**1**
92	**WADFOW Ratchet Crimping Plier, 【For NON-Insulated Terminals and Butt Connectors】 Crimping Tool, Wire Stripper, 0.5-6mm², AWG: 20-10, Crimper Adjustable Ratchet Tools**	**1**
93	**amazon basics 36-Piece Allen Wrench/Hex Key Set - Inch/SAE and Metric**	**1**
94	**Taparia 1621-8 Steel (210mm) Combination Plier with Joint Cutter (Red and Black)**	**1**
95	**Batteries Balance Board, Battery Active Equalizer 30mV Accuracy 1.2A 2.0V-4.5V with Light for Lipo (1~4S)**	**1**
96	**QZ Active Powered USB Hub, 7 Port USB Hub with 12V 3A 36W Power Adapter, USB 3.1 Gen 1**	**1**

97	ATORSE® 20Pcs Hss Steel Twist Drill Bit Set 0.3-1.6Mm for Electric Grinding Drilling	1
98	Electronic Spices 10pcs SPDT Mini Toggle Switch 3-Pin 2 Position ON/ON Miniature Toggle Switch 6A 125V AC Toggle Switch	1
99	BLACK+DECKER BDHT22148 174mm 6-Piece Steel Needle File Set for Cutting & Smootheing Out Surfaces Ideal for Wood, Metal, Plastic for Home & DIY Use, ORANGE & BLACK	1
100	OSFT Solder Wire 60/40 with 2.2% Flux Rosin Core for Electrical Soldering Diameter 0.031 Inch/0.6mm (0.8mm - 250gm)	1
101	2 Pack Steel Wool, 3.2"x7.5 Ft Control Fill Fabric, Gap Blocker, Brass Wool to Protect Annoying Animals Away from Holes, Pipeline, Wall Cracks, Vents in Garden, House, Garage	1
102	TRENDING Special Wire Stripper for Electrician Decrustation Pliers Multi-functional wire stripper and cutter, wire cutter tool, wire cutter stripper, wire cutter plier, (WIRE STRIPPER)	1
103	Bosch Professional HSS Twist Drill Bit Ground (1, 2, 3, 4, 5, 6, 7, 8, 9, 10 mm) (10 pcs set)	1
104	THEMISTO - built with passion 5 in 1 Satinless Steel Tweezer Set (Powder Coated), Black	1
105	Aadvay Enterprises Copper and Aluminium Wire/PCB Components Soldering Cutting Cutter/Stripper/Piler	1
106	amazon basics Multi-Purpose Wire Stripper and Cutter Set of 1	1
107	Aone Helping Double Third Hand with Alligator Clamps Hands-Free Holder & Platform for Soldering, Welding, Jewellery Making & Repair, Watchmaking, Model Making & Hobby Crafts DIY	1
108	amazon basics 58-Piece Screwdriver Set - Precision Slotted, Phillips, Torx	1
109	Aone Helping Double Third Hand with Alligator Clamps Hands-Free Holder & Platform for Soldering, Welding, Jewellery Making & Repair, Watchmaking, Model Making & Hobby Crafts DIY	2
110	Alkon Plastic 60 Drawers Component Organisers [Aco60] With Multiple Drawers For Small Parts Storage (60 Drawers)	1
111	Premium Heat Resistant 932°F Silicone Soldering Mat, Large Anti Static Magnetic Electronic Repair Work Mat for BGA and Gun Soldering Iron, Workbench, Cell Phone Laptop Repair, 17.7" *11.8 "	2

112	**Yellow Tommy Plastic Storage Organiser (YTSB039) | Tool Box | for Electronic, Jewellery, Medicine, Nuts Screws Bolts, 64 Drawers, Wall Hanging (LWH: 52 * 16 * 37 cm, 3.5Kg)**	**1**
113	**Waterproof Ultrasonic Obstacle Sensor**	**2**
114	**Cartoon Ultrasonic Sensor Mounting Bracket For HC-SR04**	**6**
115	**500pcs 3mm LED Light Assorted Kit DIY LEDs Set (100pcs Each Color) White, Yellow, Red, Green, Blue**	**2**
116	**OceanLabz ESP32 WROOM-32 C Type CP2102 USB Dual Core WiFi + Bluetooth 38 Pins | Pre-Loaded with Tested Code**	**5**
117	**Amazon Prime Membership**	**1**
118	**Single Side 15X20cm thickness 1.5mm Copper Clad Printed Circuit Board**	**4**
119	**NTC MF52 100K ohm 3950 Thermistor 1% (Pack of 5)**	**5**
120	**CJMCU-219 INA219 I2C Interface No Drift Bi-directional Current / Power Supply Monitoring Module**	**12**
121	**600 pcs. Metal Film Resistor Assorted kit - 30 Kinds**	**4**
122	**CP2102(6-pin) USB 2.0 to TTL UART serial converter**	**1**
123	**EasyMech Bracket for NEMA 23 Stepper Motor - BEND**	**2**
124	**Leadshine DM542 Digital Stepper Motor Driver**	**1**
125	**SONOFF DS18B20 Waterproof temprature sensor (RJ9 4P4C connector)**	**1**
126	**ADS1115 16-Bit ADC- 4 Channel with Programmable Gain Amplifier**	**1**
127	**Yihua 938D+ Upgrade Version Dual Soldering Iron SMD Soldering Station - 130W**	**1**
128	**IIC/I2C Serial Interface Adapter Module (Made In India)**	**20**
129	**PC817 4 CH Optocoupler Isolation Module**	**10**
130	**BM730 3 in1 Voltage Current Power Meter DC0-100V 10A 4-Digit Digital Voltmeter Ammeter Watt Meter**	**4**
131	**PCI-E PCIE 8p female to 2 port dual 8 pin 6+2p male GPU graphic vedio card power cable cord 18AWG wire 20cm**	**4**
132	**SIM A7672S 4G LTE + 2G + GNSS Development Board - With GNSS**	**1**
133	**[4G LTE Antenna 3.5dBi - Foldable](#)**	**1**
134	**GPS Antenna with UFL Female connector**	**1**
135	**RF Cable IPX to SMA Female - 15cm Length**	**1**

136	Cleaning BRUSH	6
137	LED Display Board	1
138	FSRMCCIVLX339004	3
139	LED Driver	1
140	BIGIMALL 2 Pack Acrylic Wall Sign Holder 9x12 Vertical, Clear Plastic Picture Frame, Wall Mounted Design, Support No Drilling	8
141	Waveshare RGB Full-Color LED Matrix Panel	1
142	Aspa Solar DC MCB 500V 2 Pole 40A SIBASS Miniature Circuit Breaker	2
143	18650 SMD/SMT High-Quality Single Battery Holder	20
144	Walk On Air USB Type-C Breakout Female Connector (Receptacle)	6 Pin USB C Female Socket to 2.54mm Breakout Board	Type C PCB Development Board (Pack of2)	3
145	REES52 10Pcs USB Type A Female Breakout Board 2.54mm Pitch Adapter Connector DIP Socket Breakout Board for Power Supply, 4 Pins Pinboard Mini Breakout Board	1 (10 Pcs)
146	Tap Dispenser	1
147	Raspberry Pi 2 W Zero Starter Kit for Raspberry Pi Zero W and Pi Zero 1.3 (Acrylic Black)	B07L93QMD6 (RS1009-01) HSN:85381010	1
148	FREENOVE Breakout Board for Raspberry Pi 4B / 3B+ / 3B / 3A+ / 2B / 1B+ / 1A+ / Zero W/Zero, Terminal Block HAT, GPIO Status LED	B0BFB618CJ (4372220249)	1
149	Optocoupler Isolation Board, 8CH Optocoupler Isolation Module DC 3.3V 5V 8-Channel PNP NPN Low High Level Output Signal Converter	B08LYQQ7X6 (BS-SO-B08LYQQ7X6)	1
150	Dell-U2424HE, 23.80" (60.45 cm), 1920 x 1080 at 120 Hz, IPS-Panel, Aspect Ratio 16:9, Response Time 5 ms (Fast), 2 x DP Port, 1 x HDMI, 2 x USB Type-C, 3 x USB Type-A, 1 x Audio Out, 1 x RJ45 Port	B0CP18HHY1 (B0CP18HHY1)	1
151	Raspberry Pi Zero 2 W Dvelopment Board with Quad-Core CPU, Bluetooth BLE 4.2 and Antenna	B09PDG21LZ (B09PDG21LZ) HSN:84733020	1
152	CALANDIS® 10 Pcs 12V DC 8mm Power Indicator Signal Light XD8-2 Led Light Bulb Yellow	B0B6P7WV1T (51009394CL)	2
153	xcluma PC817 8 Channel Optocoupler Isolation Board DC 3.6-30V Driver	B09H2QDDGG (BE-002382)	1

154	INSIGNIA LABS - 5PCS Push-button Switch - SPST Off-On | PUSH TO ON SWITCH | B09C2B9FRV (7G-TL3P-Y8XQ)	2
155	Dual 18650 Lithium Battery Shield V8 3V1A 5V 3A Micro USB Power Bank Battery Charging Module For Raspberry Pi Wi£ ESP8266 ESP32	1
156	5.0 Inch 800x480 RS232 HMI LCD Display Capacitive Touch 16MB Flash SD interface Buzzer with cable and adaptor	1
157	Storage Plastic box from D-Mart	2
158	Storage Plastic box from D-Mart	1
159	Storage Basket from D-Mart	5
160	PVC Table Mat from D-Mart	5
161	Power Supply Cooler Master	1
162	BTS7960	6
163	Fan DC 12 Volt	2
164	TLP IC	21
165	817 IC	22
166	OLED	2+1
167	5 Inch LCD	2
168	TB 6600	3
169	Break Out Board ESP-32	6
170	Bread Board	3
171	MOSFET Module	21
172	Voltmeter	2
173	Ammeter	2
174	MCB	4
175	MCB Cover	3
176	ONN OFF Switch	20
177	Five Pin Socket	2
178	Three Pin Socket	10
179	Holder	1
180	Lipo Charger	1
181	Three Pin Top	3
182	DC USB Mudule	3
183	Power Supply Cooler Master	2
184	DC to DC Converter 24V	1
185	DC to DC Converter 5V	1

186	POE Switch 10 Port	1
187	SFP Module	2
188	Optical Fiber Cable	2
189	PCB Coating	1
190	PCB Cleaner	1
191	RAM 8 GB	1
192	817 8 Pin Module	1
193	RGB Strip	1
194	Drill Bit Set	1 Set (10)
195	ADS1115	2
196	LED Strip	1
197	Battery Charging Module (TP5000)	2
198	Battery Charging Module (TP5100)	1 Set (5)
199	Battery Holder	1 Set (10)
200	Lipo Battery Charging Board	1
201	Micro USB Cable (Type - B)	2
202	USB Type - C Cable	2
203	SMD Component Resistance	100
204	Card Reader	1
205	SSD	1
206	Hole Saw Set	1 Set (11)
207	Adapter (5v, 5amp)	1
208	Managed Switch (24 Port)	1
209	Stapper Motor	1
210	Stepper Motor Coupler	2
211	Clamp	4
212	Sun Board 120*140 cm	1
213	Wire Cable 3 Coils	3
214	Wire Cable 2 Coils	2
215	100 Watts Flood Light	1
216	CPU Power Connector (4 Pin Male to 8 Pin Female)	1
217	Power Supply Splittor Adapter	1
218	ESP 32 WROOM	2
219	ATX Power Supply	3

6. IoT Related FDPs/Workshops/Conferences and Other Events Organized

S. No	Year	Name of the Workshop/ Seminar	Date From-To	Link to the Activity Report on the Website	Number of Participation
1	2024-25	Unlocking the power of IoT	07-09-2023 to 11-09-2024	https://www.skit.ac.in/images/Unlocking_the_power_of_IoT.pdf	41
2	2024-25	45 Days internship	01-07-2024 to 14-08-2024	https://www.skit.ac.in/images/Full_stack_Cloud_Native_JavaJEE_Development.pdf	30
3	2024-25	Introduction to Cloud Computing and AI	04/10/2024	https://www.skit.ac.in/images/Introduction_to_Cloud_Computing_and_AI.pdf	49

7. Consultancy Project

S.No.	Year	Date From-To	Amount	Company and Project Detail
1.	2024-25	09/07/2024 to 31/12/2024	1,20,000/-	Hardware integration and Packaging for IOT Sensor Modules. Dotsquares Technotogies lndia Pvt. Ltd. Apparel Park lndustriai Area, CP4-2281229, Mahal Rd, Jagatpura, Shri Kishanpura, Jaipur, Rajasthan, 302017

8. IOT Related National Patents

1. Shirish Nagar ID : 202541014640 (India) Automatic Municipal Water Dispensing System By using IOT and RTC

2. Sumit, Priya Gupta, Mani Butwall, Neha Mathur ID : 445430-001 (India) IOT BASED WEARABLE MEDICAL MONITORING DEVICE

9. Student Projects

1. MQTT Server

An MQTT server (or broker) is a central system that allows devices to communicate using the publish/subscribe model. It is commonly used in IoT projects to send and receive sensor data.
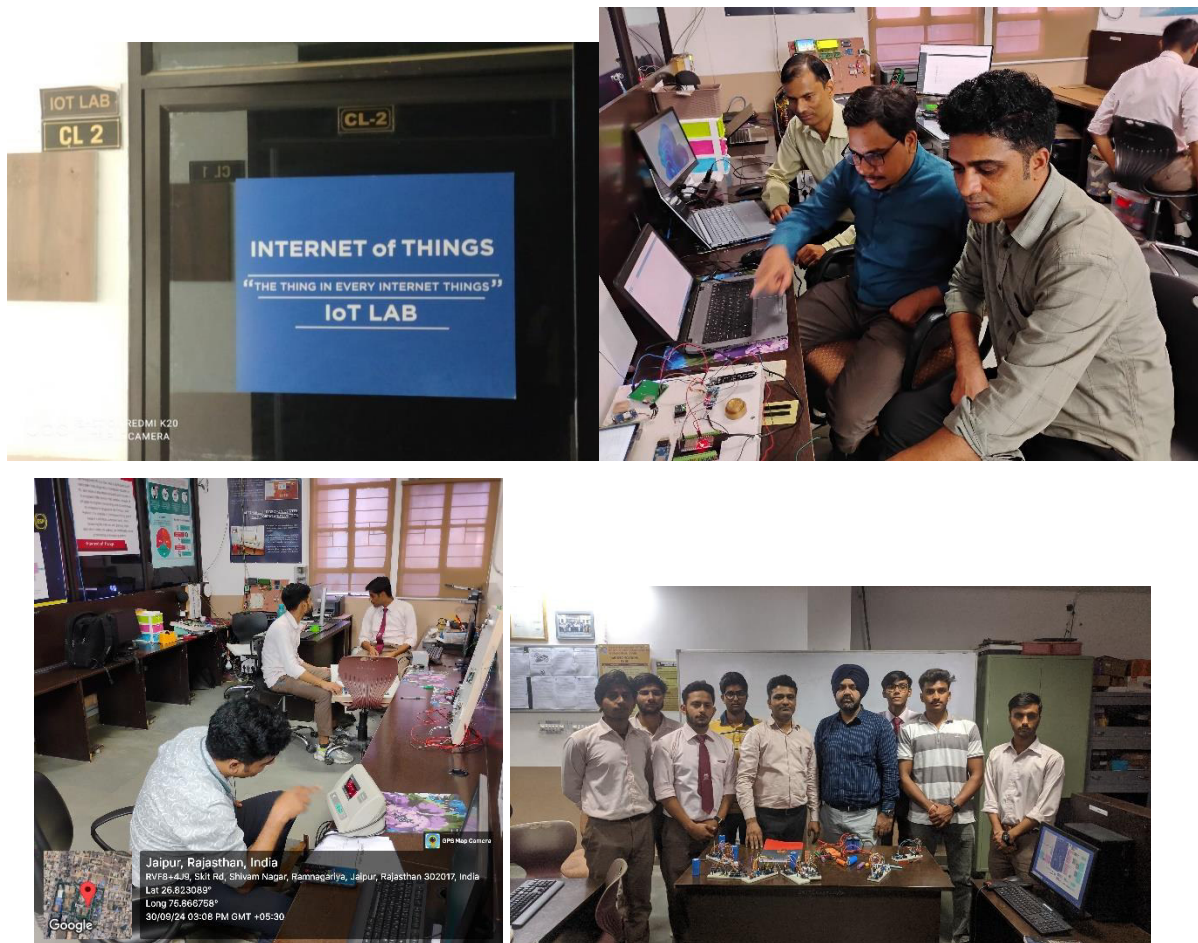
2. Battery Management System

A Battery Management System (BMS) is a crucial system used to monitor, control, and

protect a rechargeable battery pack. It ensures safe operation, longevity, and efficiency of the battery by managing charging, discharging, and balancing cells.

3. **Industrial Data Logging System Using MQTT**

An Industrial Data Logging System collects, stores, and transmits real-time sensor data from industrial machines or environments. This project uses MQTT (Message Queuing Telemetry Transport) for efficient data communication between devices and a central server or cloud platform.

10. Glimpse of IoT Lab

11. IoT Faculty Expert Group

	Department of Computer Science Engineering & Information Technology		
	Research Group: IoT		
S. No.	**Faculty Name**	**Designation**	**Area of Expertise**
1.	Prof. (Dr.) Anil Chaudhary	Head of Department (IT)	Programming, Hadoop, IoT, High-Performance Computing
2.	Prof. (Dr.) Mehul Mahrishi	Head of Departm ent (CSE)	Big Data Analytics in Machine Learning, IoT Devices, IoT Security
3.	Dr. Yogendra Gupta	Associate Professor (CSE)	Embedded Systems, IoT Devices, Smart Sensors, VLSI
4.	Dr Sarabjeet Singh	Associate Professor (CSE)	Embedded Systems, IoT Devices, Smart Sensors, VLSI
6.	Mr. Dinesh Kumar	Assistant Professor (ECE)	IoT Circuit Design, Embedded Systems

12. IoT Software Components (Open Source & Other Platforms)

S. No.	**Name of Component**	**Description**
1.	**IBM Watson IoT Platform**	SKIT is IBM CoE under which the faculty members and student scan access IBM software tools like WID, RAD, DB2, WAS etc. and has access to IBM Cloud. Certifications like Robotics and TJBot are also provided under this initiative.

2.	**Microsoft Azure IoT Central**	Under Microsoft Ed-vantage Initiative, SKIT is recognized Microsoft Cloud Competency Center under which the faculty members and students can access various features and services of Azure Cloud. Certifications like IOT-BOT, Microsoft Innovative Educator are also provided to students And faculty members under this initiative.
3.	**Shakti Processors (IIT Madras)**	Open-source processor development initiative by the RISE group at IIT-Madras.
4.	**Shakti Software (IIT Madras)**	Software Development Kits and IDE's readily available to build applications on SHAKTI
5.	**RISC-VISA**	Free and open-source ISA
6.	**Arduino**	Integrated development environment (IDE)
7.	**Devicehub.net**	Universal interface for IoT and M2M
8.	**IoT Tool kit**	Intelligent object API gateway service
9.	**Open WSN**	Repository for IoT hardware and software projects
10.	**Particle**	Suite of hardware and software for building IoT devices, applications and services
11.	**Site Where**	Deployment tool
12.	**Thing Speak**	IoT application and API
13.	**Webinos**	web-based application platform for the IoT
14.	**Zetta**	API based IoT platform based on Node.js
15.	**Node-RED**	Visual tool for lining the Internet of Things
16.	**Flutter**	Programmable processor core
17.	**M2M Labs Mainspring**	Application framework for developing M2M applications
18.	**Things Board**	Data collection, Processing, Visualization, and Device Management tool kit
19.	**Kinoma**	Marvell Semiconductor hardware prototyping platform
20	**Kaa IoT Platform**	Multi-purpose middleware platform
21.	**DSA**	Open-Source Platform & Tool kit for Internet of Things Devices, Services and Applications.
22.	**Thinger**	Scalable cloud base for connecting devices. It supports Raspberry Pi, Intel Edison, ESP8266.

23.	**Open Remote**	Open-Source IoT platform
24.	**gem5**	Simulator for computer-system architecture

13. Future Scope of IoT Lab

The future of IoT has the potential to be limitless. In general, AI and machine learning programs are paired with IoT devices to provide proper automation. As a result, the Internet of Things (IoT) has broadened its field of application across various industries. IoT has found many applications in the fields of medicine, transportation, farming, manufacturing and automation. In the present scenario, the appliances of a laboratory like lights and fans are left on, even when not in use, which leads to a rise in power consumption of the laboratory. IoT can be used to automate the laboratory which will help in effective power consumption, minimal human assistance required and easy monitoring of the laboratory.