Report on **“Industrial IoT / Embedded Microcontroller,”**

INTRODUCTION

The Department of ELECTRICAL AND ELECTRONICS ENGINEERING organized a three-day workshop on **“Industrial IoT / Embedded Microcontroller,”** where we were introduced to the practical world of Arduino and embedded systems. Throughout the workshop, we got hands-on experience with the **Arduino Uno board**, various important **sensors**, and several real-time mini-projects that helped us understand how IoT applications actually work. Along with the practical sessions, the resource persons also explained the **theory, principles, and the code** behind each experiment, which made it easier for us to connect the concepts with real implementation. This workshop gave us a clear idea of how embedded microcontrollers are used in industries and how IoT systems are built from scratch.

OBJECTIVE

- To introduce students to the basics of Industrial IoT and embedded microcontroller systems.
- To provide hands-on experience using the **Arduino Uno board**.
- To help students understand the working principles of commonly used sensors.
- To guide students in writing and understanding embedded C/Arduino code for real-time applications.
- To demonstrate simple IoT-based projects and teach the logic behind them.
- To build confidence in circuit building, debugging, and practical implementation.

- To make students comfortable working with microcontroller-based hardware.

RESOURCE PERSONS

Resource Persons

The workshop was led by Mr. P. M. Prabhu, Program Director at Avinya Networks, Bengaluru. He is an alumnus of the Indian Institute of Science (IISc) and has extensive industrial experience spanning steel plants, power sectors (nuclear, hydro, and thermal), and large-scale industrial projects. His sessions focused on practical aspects of Industrial IoT and embedded applications, combining technical depth with hands-on demonstrations that aligned with the workshop objectives.

The session coordinator is at Avinya Networks, Bengaluru. She provided continuous support to the participants during the lab exercises and ensured smooth conduct of all activities throughout the workshop.

DAY 1

Session 1

The first session of Day 1 began with a formal introduction of the resource persons by our lecturer, **Mr. Madhusudhan,** and **Dr. Harini V Ma'am**, followed by a short invocation song. After the inauguration, the resource persons officially commenced the workshop.

We started the day by gaining a clear understanding of the **Arduino Uno board**, its components, features, functions, and real-time applications. This foundational explanation helped us understand when and how the microcontroller is used in embedded systems.

Our first hands-on activity was building a **door sensor project**. We learned the complete working principle behind the sensor, wired the circuit ourselves, and wrote the Arduino code required for its operation. Being our first-ever

microcontroller-based project, seeing the circuit work successfully was extremely exciting and motivating for all of us.

We then proceeded to work with a **bump sensor**. Using the bump sensor, we simulated the functioning of an electric car. This was followed by our introduction to a **DC motor and relay module**, which we used for the first time. We learned reverse motion, and we built the circuit accordingly. During this task, we also understood how to identify and fix common bugs that occur while working with Arduino hardware.

Towards the end of Session 1, we were introduced to the concept of **Arduino board clouding**, which included how cloud-based platforms are used to control and monitor Arduino boards remotely.

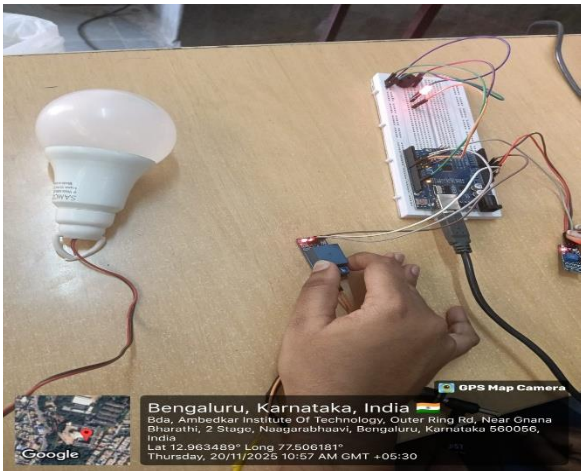
Session 2

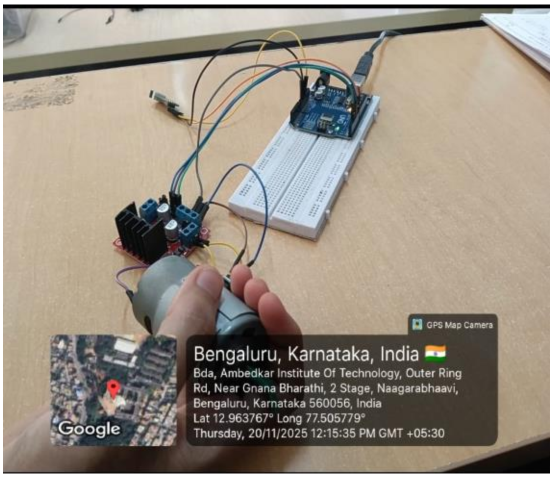
Session 2 began with a hands-on experiment on measuring the **water level in a container**. Through this activity, we learned the working principles of **I²C (Inter-**

Integrated Circuit) communication and how the water level sensor operates. We connected the components step-by-step, uploaded the corresponding code, and observed the live output as the water level changed.

Following this, we were introduced to the **Serial Peripheral Interface (SPI)** of the Arduino Uno. The trainers explained the purpose of SPI communication, the roles of **MOSI (Master Out Slave In)** and **MISO (Master in Slave Out)** pins, and the role of the clock signal. We also understood the differences between **I²C** and **SPI** devices, especially in terms of speed, number of wires required, and use cases.

By the end of Day 1, both sessions gave us strong exposure to sensors, interfacing concepts, coding logic, and practical debugging, building a very solid foundation for the next two days of the workshop.





Day 2

SESSION 1

The second day of the workshop began with an inspiring story about the establishment of the Indian Institute of Science (IISc), which set a motivational tone for the day. This was followed by an interactive recap of all the concepts learned on Day 1, helping us revise the fundamentals of Arduino UNO, sensors, and microcontroller basics.

We then moved on to a deeper study of the **Arduino UNO board embedded with the ATmega328P microcontroller**, learning about its clock system, internal functions, and different clock sources. This helped us understand how timing and processing occur within the board.

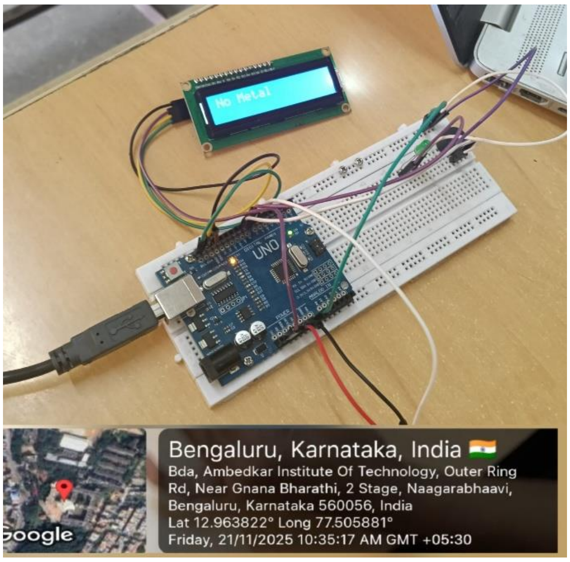
The first activity of the day involved working with the **DHT11 sensor**. We learned its purpose, internal structure, and the basic principles behind temperature and humidity measurement. We built our own temperature–humidity monitoring setup, coded the interface, and observed real-time sensor output. Watching the sensor respond accurately to environmental changes was a very exciting experience for all of us.

Next, we were introduced to the **NJK inductive proximity sensor**. We understood how proximity sensors are constructed, how they detect metallic objects, and their relevance in industrial automation. We interfaced the NJK sensor with the Arduino UNO, performed connections, and tested various materials. This hands-on activity helped us clearly understand the sensor's working and its real-time industrial applications.

SESSION 2

The second session started with learning about **servo motors** and how to control their angular movement through the Arduino UNO. We explored the internal structure of a servo motor and performed a practical interface using Arduino power. Following this, we learned how a **joystick module** works, how it is constructed, and how it senses direction and movement. We built a joystick-controlled servo mechanism and tested its functionality, which gave us a strong understanding of control systems.

We then worked on one of the most exciting projects of the workshop—a **soil-moisture-based irrigation system**. In this project, we used a soil moisture sensor to automatically activate a submerged motor that pumps water when the soil becomes dry. Understanding the logic, design thinking, and practical relevance behind this project was truly fascinating. This activity clearly demonstrated how embedded systems and IoT can contribute to smart agriculture and practical field applications. It was one of the most enjoyable and meaningful hands-on experiences of the entire workshop.



DAY 3

SESSION 1

The third day of the workshop began with an experiment using an **LDR (light-dependent resistor) sensor**. We created a simulation where a light turned on automatically when the surroundings became dark. This activity helped us understand how LDRs detect changes in illumination and how this concept is applied in real-world automatic lighting systems.

We were then taught the complete **theory behind LDR operation**, including resistance variation, voltage dividers, and analog readings in Arduino. With the prior experience gained from the previous sessions, we collectively explained the code for the experiment—each student took turns to interpret different parts of the program. This collaborative explanation strengthened our understanding of conditional statements, threshold values, and sensor-based automation in microcontroller programming.

Later, our **faculty members and the Head of Department (HOD)** joined the session. We gave feedback, shared our experiences, and discussed the key learnings from the workshop. Our faculty also asked a few engaging questions to encourage interaction and assess our understanding, and we were able to confidently answer them.

SESSION 2

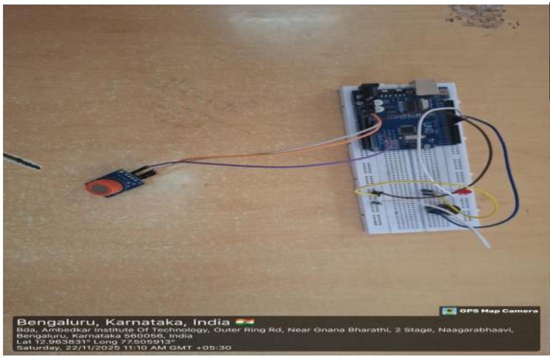
The second session of the day began with a hands-on experiment using the **MQ2 smoke and gas sensor**. We learned how the MQ2 sensor detects smoke, LPG, methane, and other combustible gases. The faculty explained its significance in industries for fire safety, leakage detection, and early warning systems. Understanding its necessity helped us connect the experiment to real-time industrial applications.

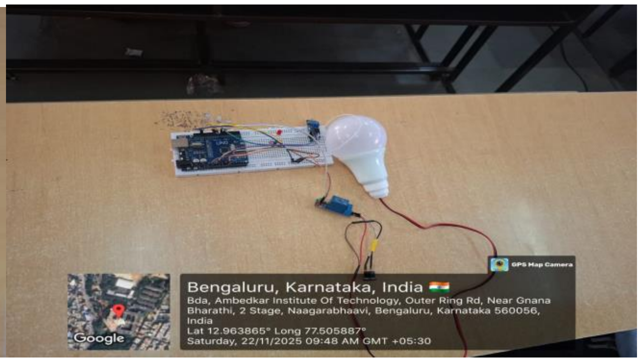
We then moved on to working with the **rain sensor**, which is used for raindrop detection. We studied the working principle of the sensor, performed the interfacing, and wrote the code to detect rainfall conditions. We also understood how automated systems—like car wipers and smart irrigation systems—use this sensor for decision-making. Learning the theory and coding for this module added another practical tool to our growing set of embedded system skills.

CONCLUSION

We ended the workshop with a detailed discussion summarizing everything we had learned over the three days—from sensors and microcontrollers to automation concepts and hands-on project building. A vote of thanks was delivered to appreciate the efforts of the faculty and organizers.

This workshop proved extremely helpful and enjoyable for all students. It offered the **hands-on experience needed to pursue future industry-oriented projects**, and it provided a strong foundation for upcoming academic and practical work in embedded systems, IoT, and automation.






GPS Map Camera
Google
Bengaluru, Karnataka, India
Bda, Ambedkar Institute Of Technology, Outer Ring Rd, Near Gnana
Bharathi, 2 Stage, Naagarabhaavi, Bengaluru, Karnataka 560056,
India
Lat 12.963842° Long 77.505885°
Saturday, 22/11/2025 11:42 AM GMT +05:30