**Report on Innovative Teaching Learning method adopted: Introduction of real life experiment in Internet of Things Laboratory by Prof. Priya Deshpande**
**Sem VI, EXTC Subject: Internet of Things laboratory (EC305B), Academic Year: 2023-24**

## Introduction

This report details the implementation of real-life experiments in the IoT lab, aimed at enhancing students' practical skills and understanding of IoT systems. The experiments cover a range of applications, from basic GPIO interfacing to complex communication protocols, providing hands-on experience with IoT development boards and sensors.

## Experiment List and Outcomes

1. **Getting Started with IoT Development Boards**
    - **Experiment: ADC Implementation on ESP32 and RPi Pico W:** Students interfaced and programmed Analog-to-Digital Converters (ADC) on ESP32 and RPi Pico W development boards, displaying data using OLED screens. The use of LDR sensors allowed for the visualization of light intensity converted to voltage.
    - **Outcome:** Students gained practical skills in ADC programming, GPIO interfacing, and data visualization.
2. **IoT Sensor Integration**
    - **Experiment:** Designed and implemented an IoT system using the ESP32 board to integrate sensors (LM35 for temperature) and transmit data to the ThingSpeak platform via REST API.
    - **Outcome:** Students learned to collect and analyze sensor data wirelessly, and utilized cloud platforms for data visualization and remote monitoring.
3. **Weather Station Development**
    - **Experiment:** Students designed and implemented a weather station using the Raspberry Pi Pico W, integrating DHT11 and BMP280 sensors to monitor and display temperature, humidity, and atmospheric pressure on a mobile phone via WEBSOCKET API.
    - **Outcome:** Students acquired experience in building real-time monitoring systems and leveraging WebSocket APIs for data transmission.

4. **Communication Protocols**
    - **Experiment:** Implemented an IoT system with various communication protocols (MQTT, CoAP) on ESP32, including setting up a Mosquitto broker on a laptop for MQTT communication. Developed a Smart Sound Monitoring System (SSMS) to send sound levels from a sensor to the broker.
    - **Outcome:** Students developed skills in using communication protocols, setting up brokers, and creating IoT systems with real-time data transfer.
5. **Device-to-Device Communication**
    - **Experiment:** Designed an MQTT-based system using Mosquitto Broker to facilitate data transmission from one ESP device to another. Created a smart home security system with an IR sensor and actuator, communicating via MQTT.
    - **Outcome:** Students learned to implement device-to-device communication and integrate sensors with actuators using MQTT.
6. **SMTP Protocol Implementation**
    - **Experiment:** Implemented SMTP protocol on ESP devices to send data via email, creating a smart irrigation system that monitors soil moisture and sends email reports on soil conditions and watering activities.
    - **Outcome:** Students acquired skills in email communication via SMTP and developed an automated irrigation system for real-time monitoring and control.
7. **Blynk Protocol Implementation**
    - **Experiment:** Implemented Blynk protocol on ESP32 to create a smart water level control system, allowing remote monitoring and control via the Blynk app, with manual control options using a touch sensor.
    - **Outcome:** Students learned to use Blynk for remote IoT control and integrate sensors with mobile applications for user interaction.
8. **MQTT Communication between ESP32 Devices**
    - **Experiment:** Established MQTT communication between two ESP32 devices with a Raspberry Pi as the MQTT broker, and developed a system to monitor industrial equipment health by detecting vibrations and sending alerts via MQTT.
    - **Outcome:** Students developed expertise in MQTT communication between devices and created a system for monitoring and analyzing equipment health.

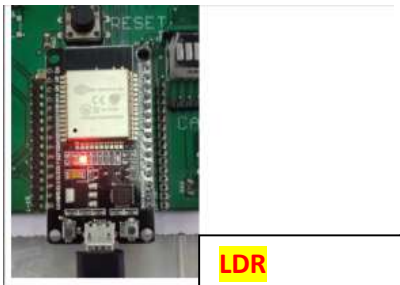
**Conclusion**

The addition of real-life experiments in the IoT lab has significantly enhanced students' practical skills and understanding of IoT technologies. By engaging in hands-on activities involving various sensors, communication protocols, and development boards, students have developed a deeper grasp of IoT systems and their real-world applications. The experiments have fostered critical thinking, problem-solving abilities, and proficiency in designing and implementing IoT solutions.

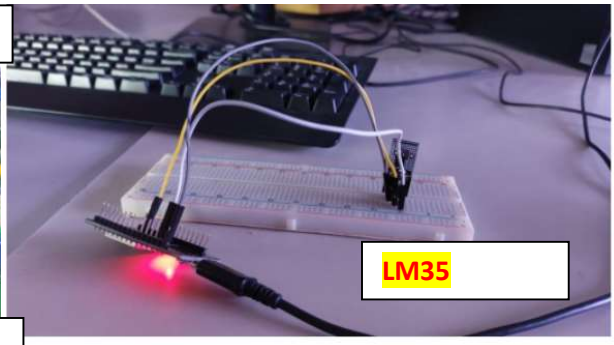
**Rubrics for Evaluation:**

| | | | |
|---|---|---|---|
| **Lab Ethics & Preparedness (PO8)** | Irregular in lab. late comer, absent mindness and copies the experiments from others<br>***0 points*** | Consistently regular but sometimes missed, Knows whats is going in the lab but unable to explain the concepts<br>***0.25 points*** | Punctuality in lab. Follows the procedure told by teacher and always gives answer of the questions sked<br>***0.5 points*** |
| **Documentation (PO10)** | Experiments not written in proper format and copies the experiments from friends<br>***0 points*** | Most of the lab report is in format but some of the formatting guidelines are missed<br>***0.25 points*** | Lab experiment is always writing in proper format for all experiments. (Experiment No, Date, Objective, Apparatus with specifications, software used if any)<br>***0.5 points*** |
| **Results and Conclusion** | Makes no attempts to relate data to theory. Unable to achieve the desired results.<br>***1 points*** | Apply appropriate theory to data when prompted to do so, but occasionally misinterpret physical significance of theory. Achieve the desired results.<br>***1.5 points*** | Analyses and interpret data carefully using appropriate theory. Tries to achieve the results from different viewpoints.<br>***2 points*** |

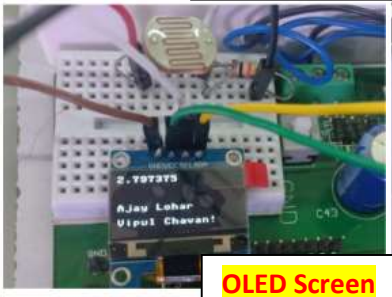
# IOT Lab Photos: Implementing different sensors in every lab experiment



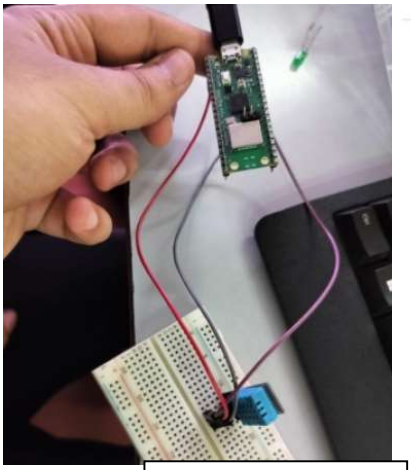
LDR



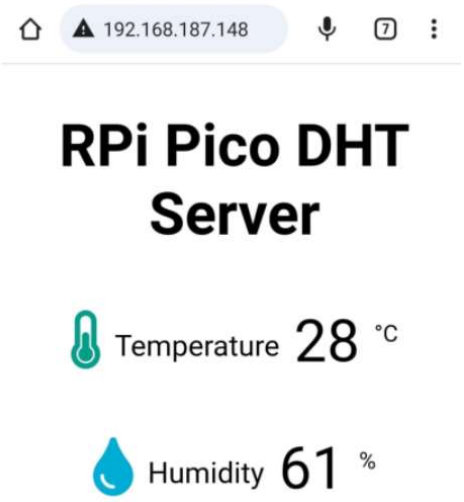
LM35



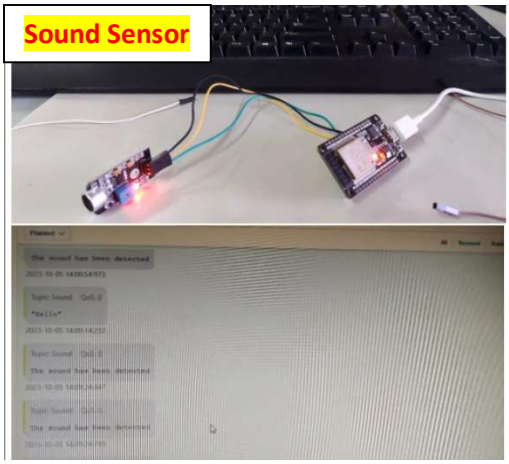

OLED Screen

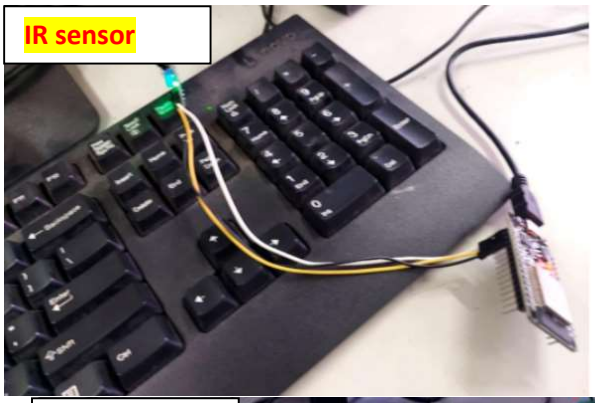
DHT11 Sensor



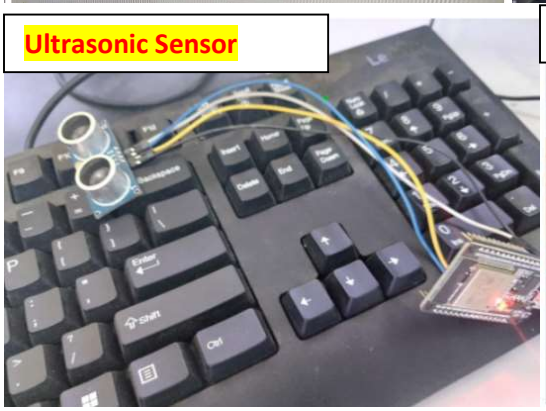
Sound Sensor



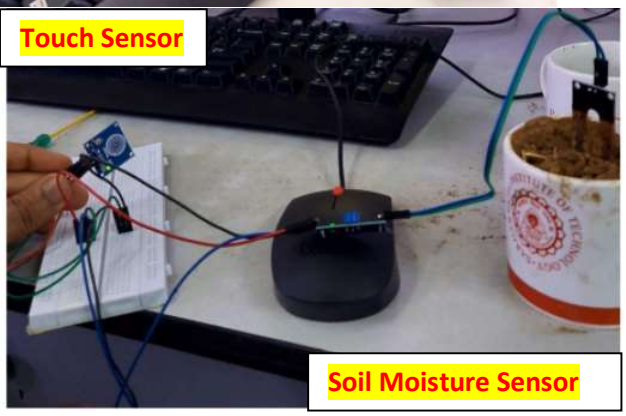
IR sensor



Ultrasonic Sensor

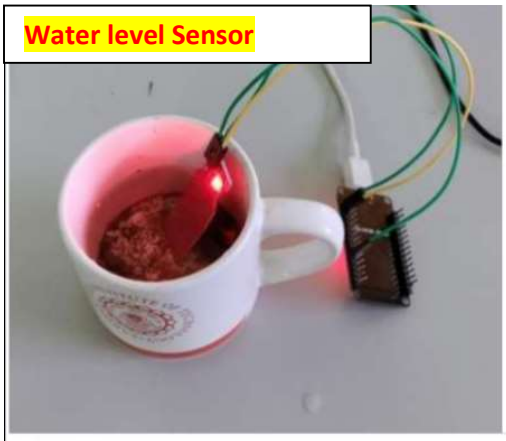


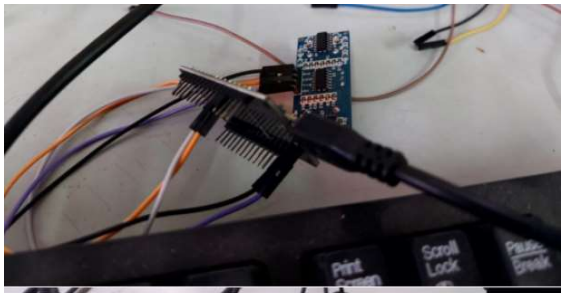
Touch Sensor



Soil Moisture Sensor

Water level Sensor



Kahoot Quiz For Students: Every student has to given quiz on every lab experiment after completion of the experiement

Kahoot! is an interactive quiz platform that promotes several key benefits among students:

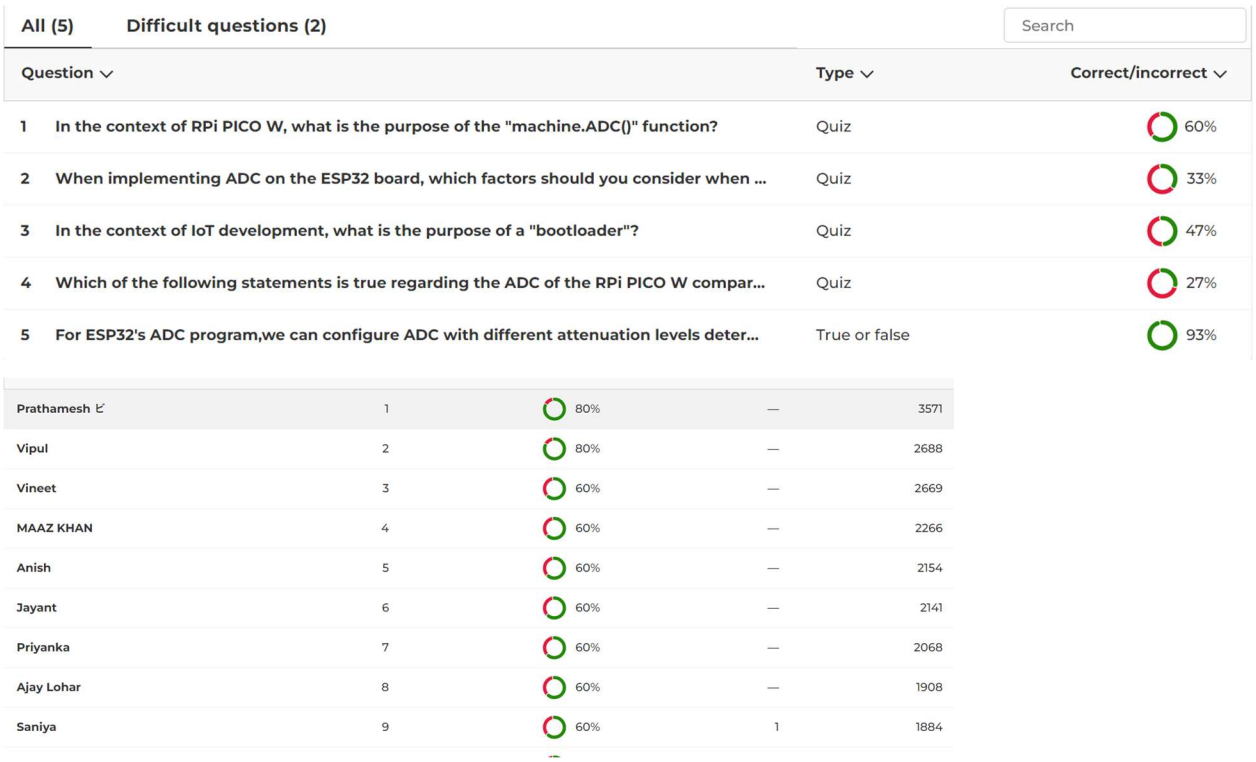
**1. Engagement and Motivation:**

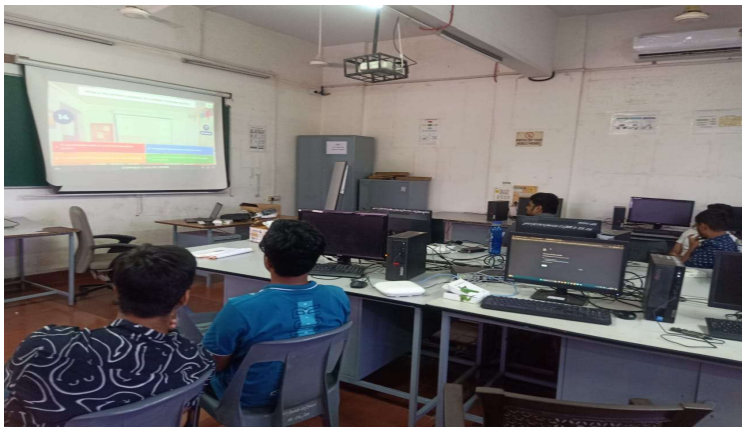
- **Interactive Learning:** Kahoot! uses game-like elements to make learning fun and engaging, increasing student motivation and participation.
- **Competition and Collaboration:** The competitive nature of Kahoot! quizzes, where students earn points for correct answers and speed, fosters a sense of excitement and healthy competition. Team modes also encourage collaboration.

**2. Immediate Feedback:**

- **Real-Time Results:** Students receive instant feedback on their answers, helping them quickly identify areas of strength and areas needing improvement.
- **Performance Insights:** Teachers can provide immediate feedback and adjust instruction based on quiz results.

**Example Kahoot:**





**Feedback from the Students:**

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|---|
| I would like to add in iot machine learning and artificial intelligence concept other wise course and experiments whatever you have given mam all are massive thank you mam for giving knowledge🙏🙏 |
| Learning IoT concepts for first time was a great experience. |
| A mini project should be alloted/ given information about at the start of course. |
| No it's good |
| Excellent course |
| Instructions given were clear daily quizzes helped , easy to understand |
| It should be a whole subject like adc and Cs |
| Na |
| Give some iot related projects and also organised iot exhibition |