Electronics Lab Project Report
Context Awareness System

Chauhan Sahil Nileshbhai, Abel B Aliyas, Saharsh S Hiremath
Yash Sultania, Gnan Ravi Gowda, Tharun M

November 20, 2025

1 Team Members

Name	Roll Number	Email ID
Chauhan Sahil Nileshbhai	IMT2024090	Sahil.Chauhan@iiitb.ac.in
Abel B Aliyas	BT2024244	Abel.Aliyas@iiitb.ac.in
Saharsh S Hiremath	IMT2024008	Saharsh.Hiremath@iiitb.ac.in
Yash Sultania	BT2024013	Yash.Sultania@iiitb.ac.in
Gnan Ravi Gowda	IMT2024074	Gnan.Gowda@iiitb.ac.in
Tharun M	IMT2024009	Tharun.M@iiitb.ac.in

2 Components Used:

1. Raspberry Pi 4
2. Raspberry Pi Camera
3. ESP32 Dev Module
4. NFC Sticker Tags
5. MFRC522 NFC Reader
6. ToF Distance Sensor (VL53L0X)
7. MLX90614 IR Temp Sensor
8. DHT11 Sensor
9. Wires and Breadboards

3 Schematics of our Overall System

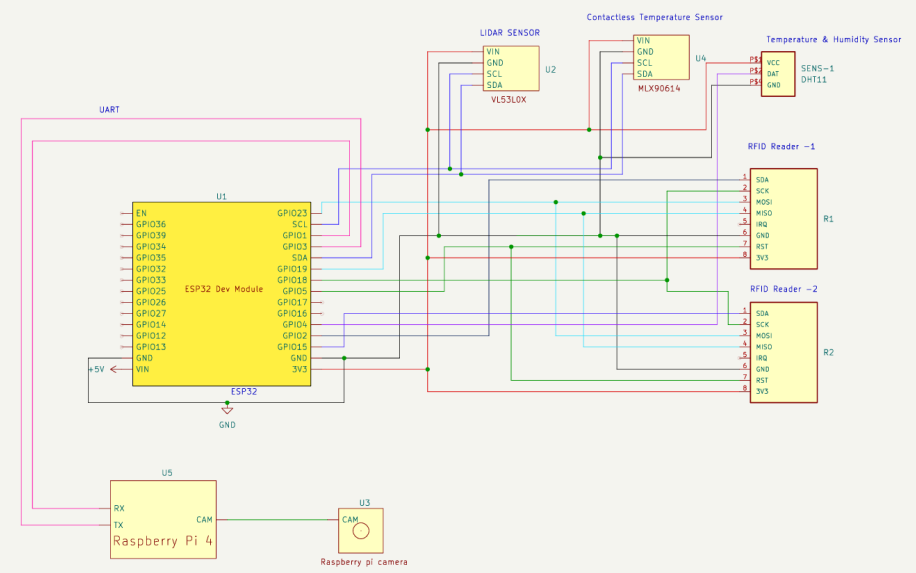

Figure 1: Schematic of our Overall System on KiCad

4 Demonstration Video Link

Context Awareness System Demonstration

5 Prerequisites

1. KDE Connect App must be installed on all devices you wish to use.
2. All devices including the Raspberry Pi must be on the same Wifi Network.

6 Project Description

Modern devices are powerful, but are "context blind", that is, they cannot sense when we are studying, relaxing, or working.
Our project solves this by creating a **Context-Aware Desk**, a smart surface that uses simple sensors to recognize objects, detect gestures and devices.
These gestures and recognized objects, allow us to control our devices and communicate between the registered devices too.

Dock 1: System Dock

It is like the central hub of the overall context awareness system which consists of the Raspberry Pi. The Raspberry Pi in the dock also runs the user interface, which tracks, displays, and logs all events and sensor readings.

The Raspberry Pi acts as the server and central orchestrator, managing device pairing and KDE Connect communication. The ESP32 functions as the sensor hub, handling RFID scanning, device registration, sensor operations, and serial communication with the Raspberry Pi.

When the user places a device near the RFID reader, the system activates the device or registers the device if it has not been added before. Hand gestures are mapped to device actions such as pause/play, next track, copying content to the shared clipboard. Placing objects like a pen, notebook, or beverage triggers mood recognition and initiates helpful modes such as muting notifications during study mode or playing relaxing music during relax mode.

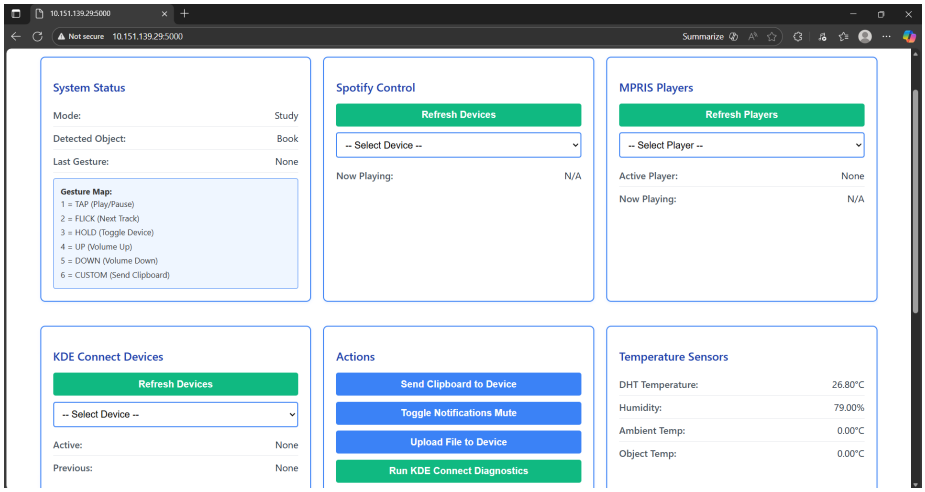

Figure 2: Image of Website used for Controlling Dock 1

Dock 2: Mood (Object) Detection Dock

This dock can detect 3 objects, a book, a pen and a mug (may be filled with hot or cold beverages). This in turn helps to deice the mood of the user.
After detection, this dock decides and activates one of the two modes – Study Mode or Relaxed Mode, based on the object detected.
The book and pen correspond to Study Mode, whereas the mug corresponds to Relaxed Mode.

How it detects:

- The object placed at the centre of the camera area is detected. Any object placed outside this bounding is treated as noise and goes undetected.
- The system also detects the object temperature and compares it with room temperature.
- Combining the parameters of shape and size, with the readings from the temperature sensors, an appropriate decision tree was formed for the detection of the 3 objects mentioned above – that symbolize the mood of the user.

Dock 3: Gesture Detection Dock

In this dock, we can use hand gestures to perform system actions on our laptop or phone. The following gestures are supported:

1. **Tap Gesture:** Used to pause/play songs and videos.
2. **Flick Gesture:** Used to skip to the next song/video.
3. **Volume Up Gesture:** Increases the system volume.
4. **Volume Down Gesture:** Decreases the system volume.
5. **Hold Gesture 1:** Used to copy the contents of the clipboard from the current active device to all other connected devices.
6. **Hold Gesture 2:** Used to toggle between the active devices.

7 Images of Setup:

Figure 3: Overall Context Awareness Desk

Figure 4: Breadboard wiring and other sensors