



**Research Project
(Comprehensive Design and Analysis Project) - IT4010
[2025/FEB]**

Logbook

**An Intelligent Electricity Management Unit: AI-Driven Power Forecasting and
Personalized Consumption Insights with Application Integration**

Group ID: R25-065

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**BSc (Hons) in Information Technology Specializing in Information Technology
Department of Information Technology**

Submitted to:

**Sri Lanka Institute of Information Technology
Sri Lanka**

-25 October 2025-

Date	Description	Remarks	Supervisor's Signature
16/10/2024 to 31/10/2024	1. Held meetings with supervisor & co-supervisor to discuss the research scope. 2. Discussed & finalized the research scope. 3. Studied research papers related to Home Energy Management. 4. Outlined the research methodology including the key components.	Figure 1 meeting with supervisor and co-supervisor	
1/11/2024 to 15/11/2024	1. Explored potential datasets; Started setting up IoT device (smart plug) for data collection. 2. Finalized literature review; Refined methodology; Configured smart plug and started initial data collection tests. 3. Group meeting; Presented methodology; Began systematic data collection for selected appliances (AC, fridge, laptop)		
16/11/2024 to 30/11/2024	1. Monitored data collection process; Started exploring data cleaning and pre-processing techniques in Python. 2. Addressed minor data collection issues; Continued daily data logging and backup		
01/12/2024 to 15/12/2024	1. Gathered feedback & refined forecasting objectives based on discussions. 2. Got supervisors' signatures after clarifying my component's role. 3. Clarified questions regarding TAF submission details for my section. 4. Submitted final TAF sections after approval.	Figure 2 meeting with co-supervisor	

16/12/2024 to 30/12/2024	<ol style="list-style-type: none"> 1. Received TAF evaluation results. 2. Met with supervisor & co-supervisor to plan initial steps for data processing and model selection. 	Figure 3 – meeting with teammates	
31/12/2024 to 14/01/2025	<ol style="list-style-type: none"> 1. Prepared project charter sections detailing forecasting & chatbot components. 2. Attended SLIIT research project meetings. 3. Drafted proposal report sections on time-series literature review and planned methodology. 	Feature 4 – meeting with teammates	
15/01/2025 to 31/01/2025	<ol style="list-style-type: none"> 1. Completed proposal report sections with clear problem definition, objectives & methodologies for my component. 2. Created presentation slides detailing the forecasting and chatbot approach. 3. Submitted final proposal report sections & participated in proposal presentation. 	Figure 5 – Meeting with teammates	
01/02/2025 to 14/02/2025	<ol style="list-style-type: none"> 1. Researched Python libraries for time-series analysis (Pandas, Statsmodels, XGBoost). 2. Met supervisor to outline steps for Progress Presentation 01 (data processing, initial model). 	Figure 6 – Meeting with teammates	
15/02/2025 to 28/02/2025	<ol style="list-style-type: none"> 1. Analyzed requirements for Flask backend API (endpoints for prediction, features, chat). 2. Studied React for frontend dashboard development. 3. Explored data visualization libraries (Chart.js) for forecast display. 	Figure 7 – Meeting with teammates	
01/03/2025 to 14/03/2025	<ol style="list-style-type: none"> 1. Read relevant research papers; identified gap in state-aware recursive forecasting for appliances. 2. Started developing Python scripts for data cleaning & pre-processing (handling 	Figure 8 – Meeting with teammates	

	<p>timestamps, nulls).</p> <p>3. Group meetings to discuss overall project progress and initial data format.</p>		
15/03/2025 to 31/03/2025	<p>1. Implemented data aggregation logic (5-sec to 1-min for AC, daily totals for monthly model).</p> <p>2. Trained initial baseline models (e.g., simple SARIMA for monthly).</p> <p>3. Created presentation slides for PP1 focusing on data pipeline and initial model results.</p>	Figure 9 – Meeting with supervisor	
01/04/2025 to 14/04/2025	<p>1. Completed data processing and baseline modeling required for PP1.</p> <p>2. Finalized PP1 presentation slides for my component.</p> <p>3. Delivered Progress Presentation 01 successfully.</p>	Figure 10 – Meeting with teammates to prepare for PP1	
15/04/2025 to 30/04/2025	<p>1. Began advanced feature engineering for the 1-min AC model (lags, rolling means).</p> <p>2. Met supervisor to discuss PP1 feedback and plan for XGBoost implementation.</p> <p>3. Met co-supervisor to confirm understanding of e_int vs e_tot for aggregations.</p>		
01/05/2025 to 14/05/2025	<p>1. Implemented XGBoost model training pipeline for the AC data.</p> <p>2. Evaluated initial XGBoost performance; identified recursive forecasting issues (flatlining).</p> <p>3. Integrated basic Chart.js components into React frontend placeholder.</p> <p>4. Met supervisor to discuss forecasting</p>		

	challenges and potential solutions (state features).		
15/05/2025 to 31/05/2025	<p>1. Developed and implemented cyclical (sin/cos) and state-based (time_since_on) features.</p> <p>2. Retrained XGBoost model with advanced features; validated significant accuracy improvement.</p> <p>3. Group meeting to discuss API integration plan between Flask and React.</p>	Figure 11- Meeting with supervisor	
01/06/2025 to 14/06/2025	<p>1. Developed the state-aware recursive forecasting loop in Python.</p> <p>2. Successfully generated stable multi-hour AC forecasts.</p> <p>3. Designed Flask API structure and defined endpoints (/predict, /info, /feature-importance).</p> <p>4. Met supervisor to review successful forecast results and API plan.</p>	Figure 12 – Meeting with supervisor	
15/06/2025 to 30/06/2025	<p>1. Implemented Flask backend API endpoints, including loading the saved AC model (.pkl).</p> <p>2. Developed React frontend components (ValidationChart, ForecastChart, ForecastTable).</p> <p>3. Implemented data fetching (Axios) in React to connect to Flask API.</p> <p>4. Internal testing session with group to ensure basic API-Frontend communication.</p>		

01/07/2025 to 14/07/2025	<p>1. Developed Flask /chat endpoint and integrated Gemini API.</p> <p>2. Implemented prompt engineering, passing context (forecast, features, validation) to Gemini.</p> <p>3. Developed ChatInterface React component. 4. Refined chart display (connecting lines, axis formatting, table rounding).</p>		
15/07/2025 to 31/07/2025	<p>1. Met supervisor/co-supervisor to demonstrate the working dashboard prototype (charts, table, chatbot).</p> <p>2. Tested and refined chatbot responses for various user questions.</p> <p>3. Implemented forecast horizon validation (10-to-1 rule) in frontend and backend.</p>		
01/08/2025 to 14/08/2025	<p>1. Finalized frontend styling (App.css) for all components.</p> <p>2. Added timestamp display and refined UI elements based on testing.</p> <p>3. Began writing thesis sections related to my component's methodology.</p>		
15/08/2025 to 31/08/2025	<p>1. Completed methodology and implementation sections of the thesis.</p> <p>2. Optimized backend API code for clarity and efficiency.</p> <p>3. Prepared initial draft of research paper sections for my component.</p>		
01/09/2025 to 14/09/2025	<p>1. Visualized final model results (accuracy metrics, graphs) for thesis/presentation.</p> <p>2. Met supervisor to present final results and receive suggestions for PP2 slides.</p> <p>3. Prepared Progress Presentation 02 slides for my component.</p>	Figure 13 – meeting with teammates	

	4. Submitted relevant sections for conference paper draft.		
15/09/2025 to 30/09/2025	<p>1. Presented Progress Presentation 02 successfully; noted feedback.</p> <p>2. Wrote results and evaluation sections of the final thesis.</p> <p>3. Designed UI section for displaying predicted monthly cost (using teammate's function).</p> <p>4. Conducted final testing on AC model and monthly forecast model scripts.</p>		
01/10/2025 to 14/10/2025	<p>1. Finalized documentation for Flask API and React components.</p> <p>2. Conducted overall system integration testing (ensuring all parts work together).</p> <p>3. Prepared content and script for the final presentation and live demonstration.</p> <p>4. Met with supervisor to review final thesis draft and presentation plan.</p>		
15/10/2025 to 31/10/2025	<p>1. Finalized and formatted the final research report/thesis.</p> <p>2. Prepared and rehearsed the final presentation and demo with team members.</p> <p>3. (Current) Presented Final Presentation and Viva successfully.</p> <p>4. (Planned) Upload final project documents and presentation slides.</p>	Figure 14 – meeting with supervisor	

Figures (Screenshots)

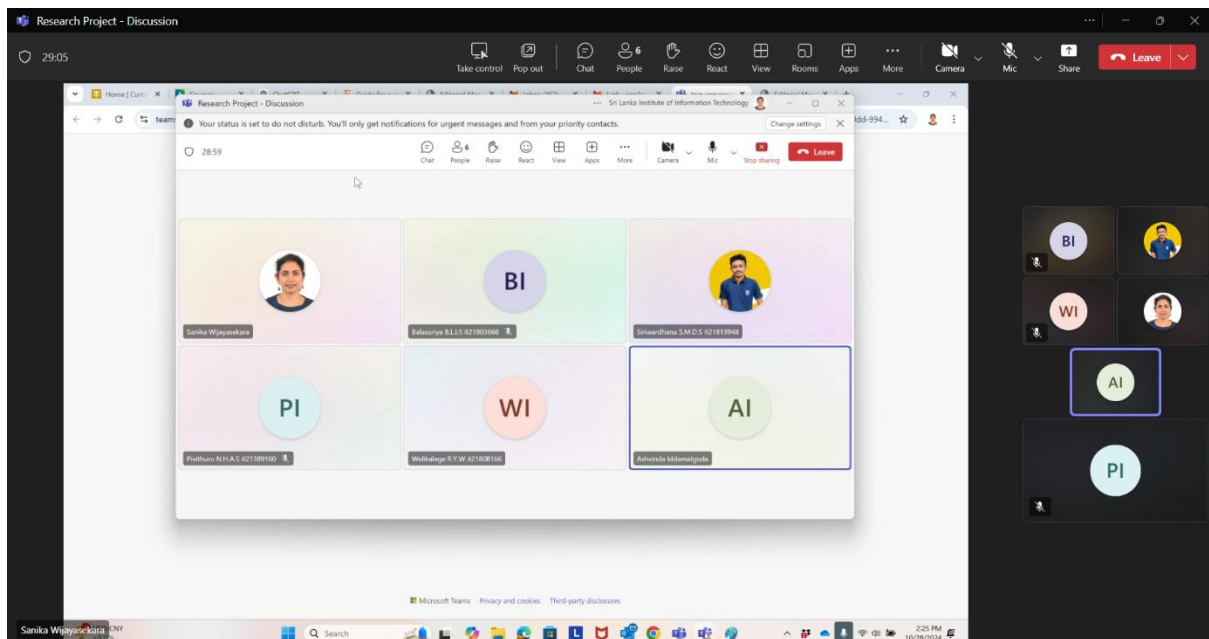


Figure 1 - Meeting with Supervisor and Co – Supervisor

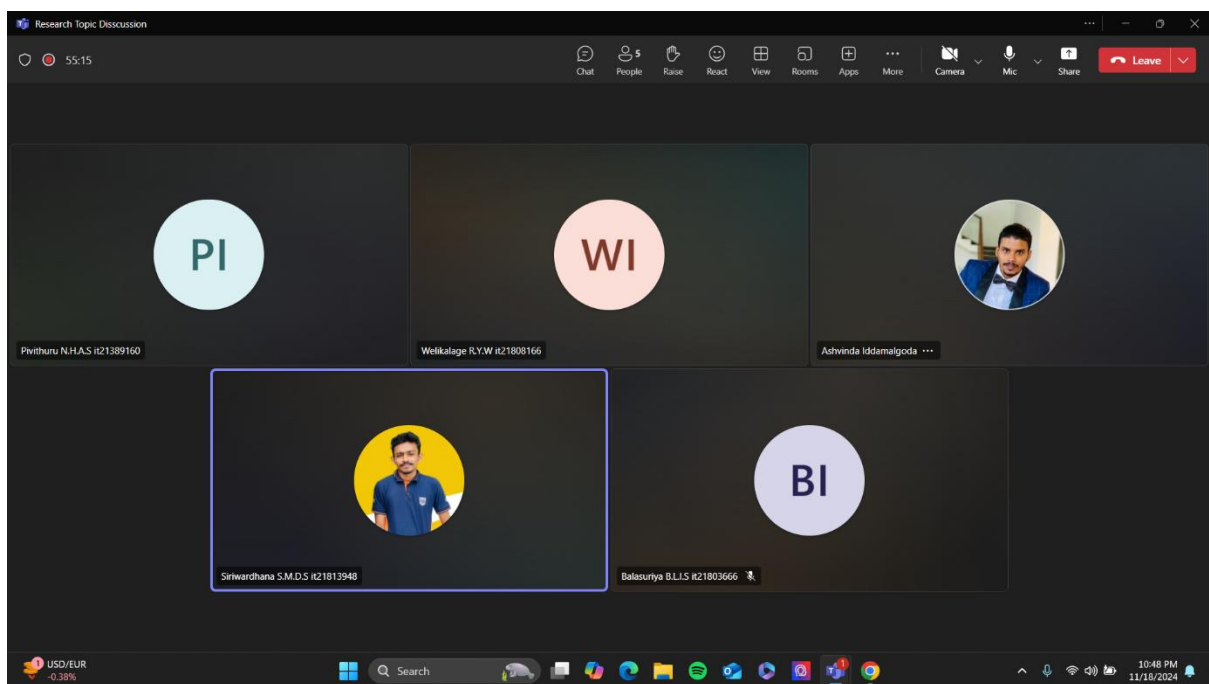


Figure 2 - Meeting with Co – supervisor

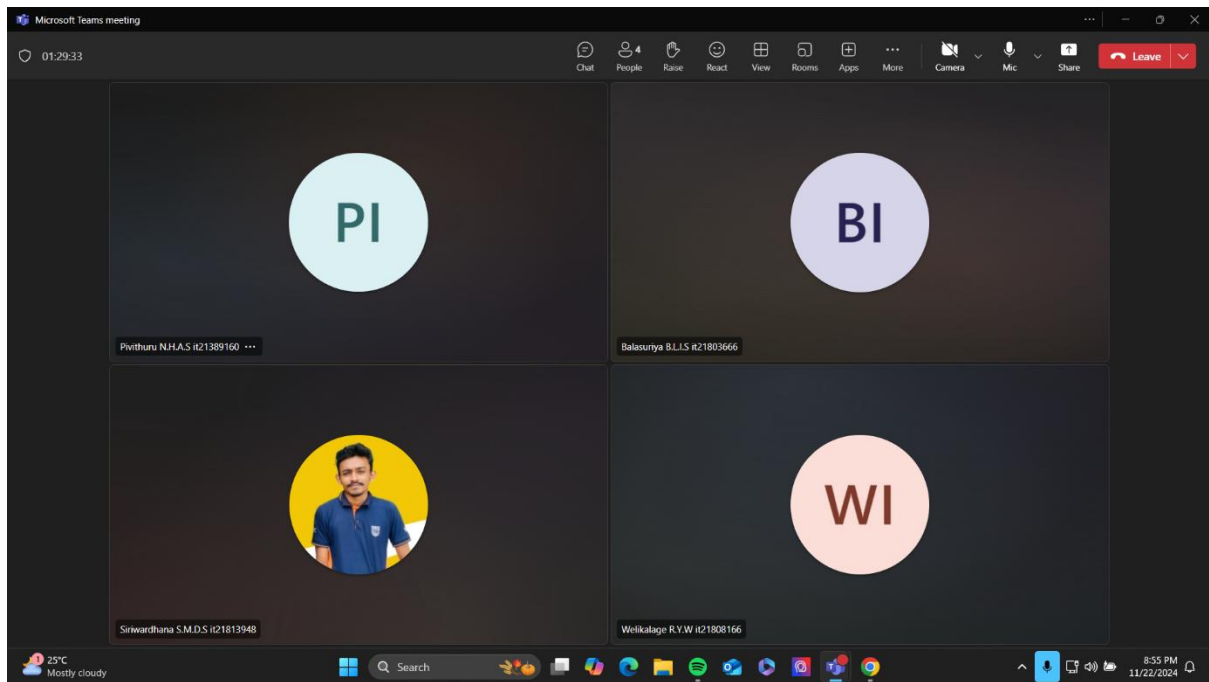


Figure 3 - Meeting with Teammates

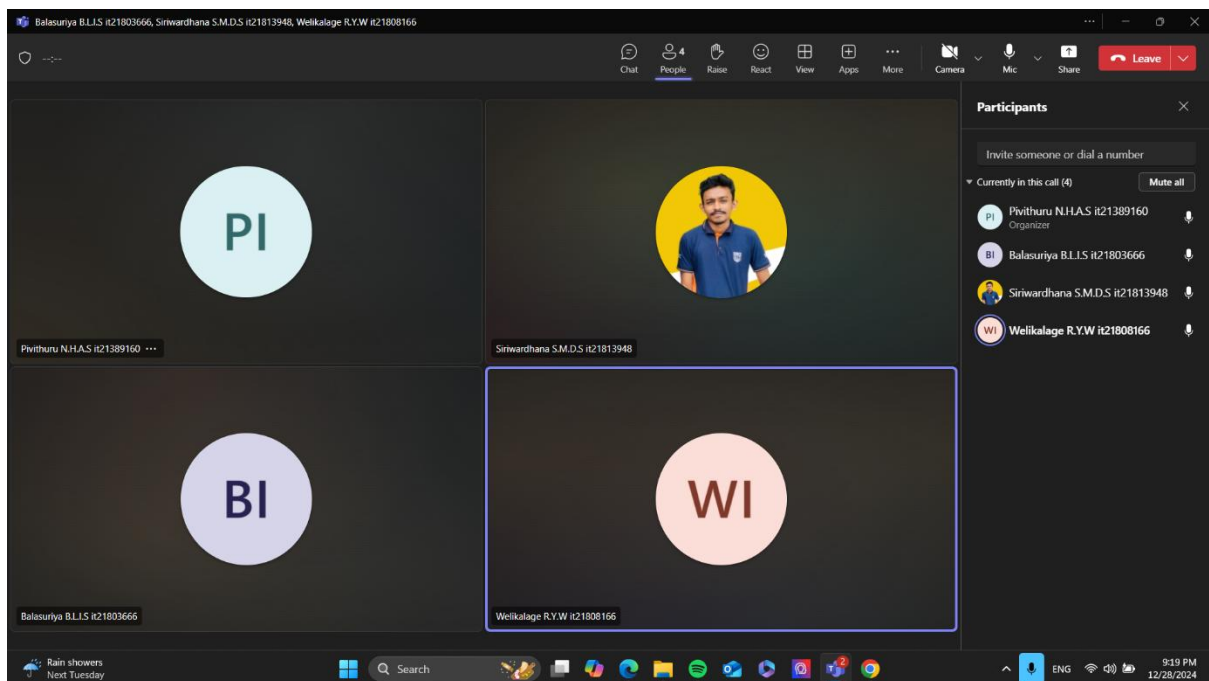


Figure 4 - Meeting with Teammates

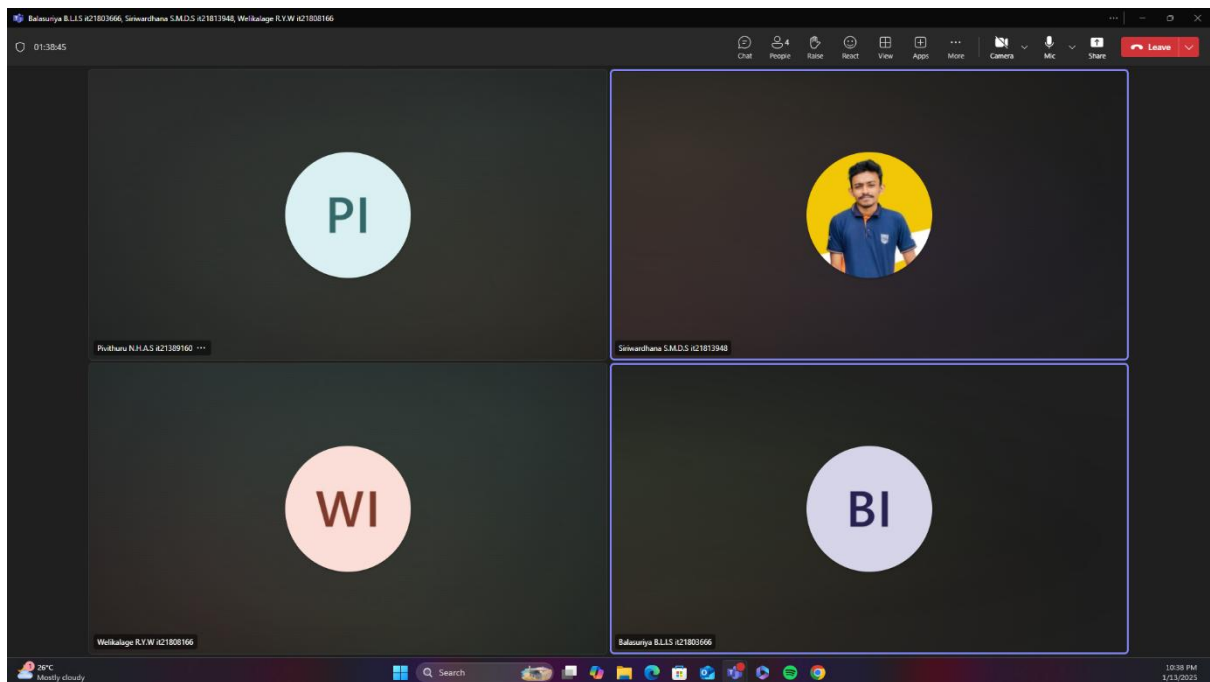


Figure 5 - Meeting with Teammates

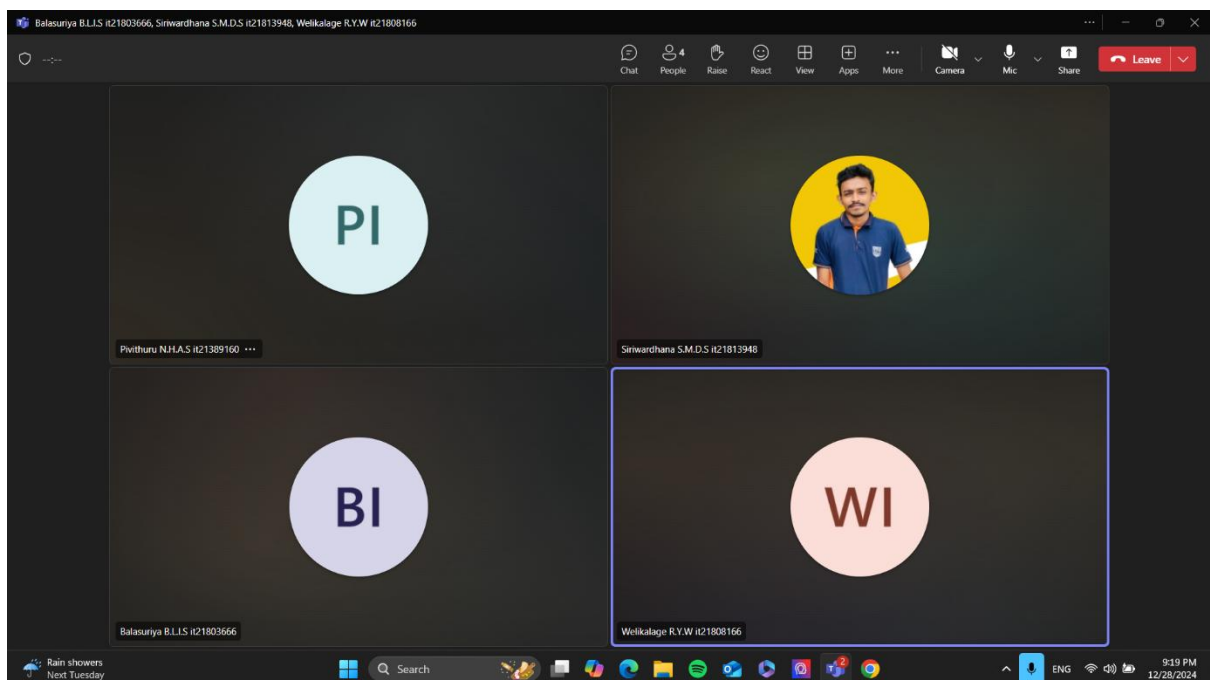


Figure 6 - Meeting with Teammates

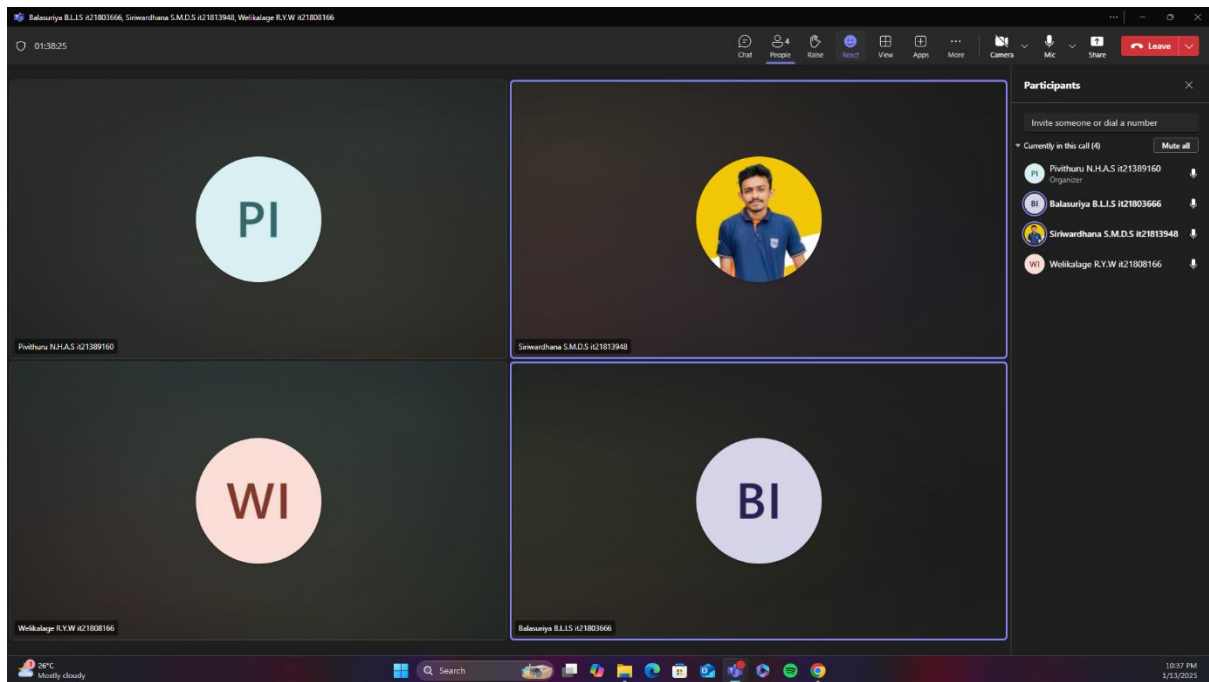


Figure 7 - Meeting with Teammates

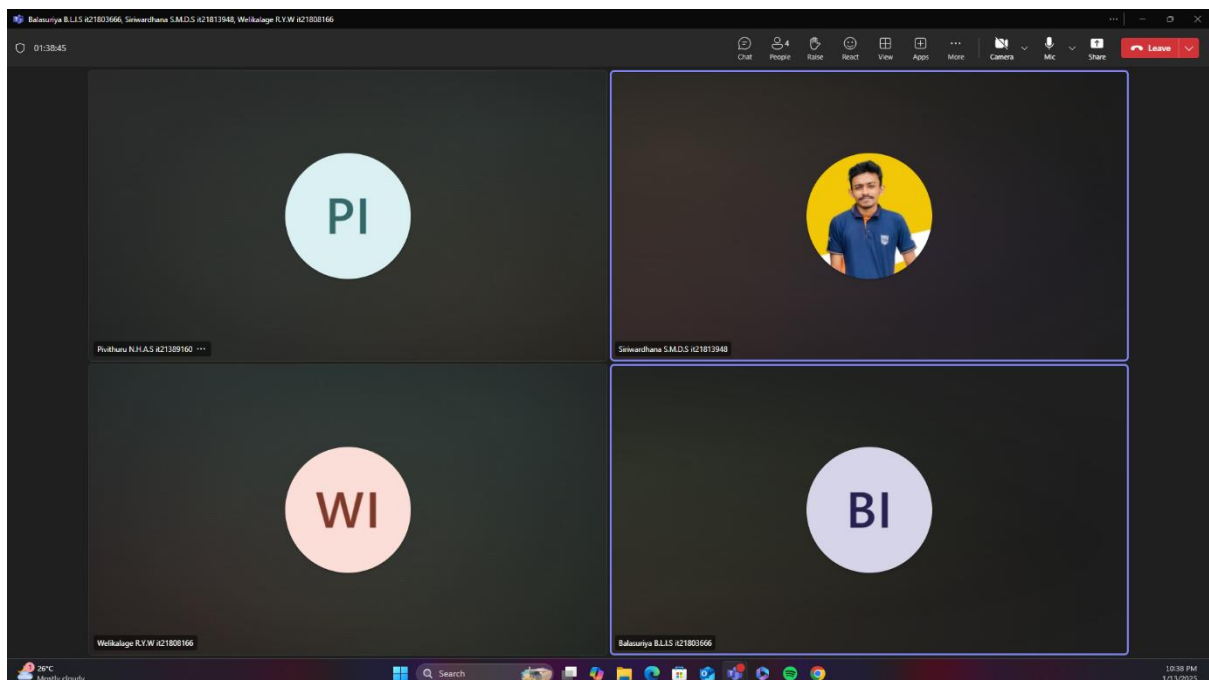


Figure 8 - Meeting with Teammates

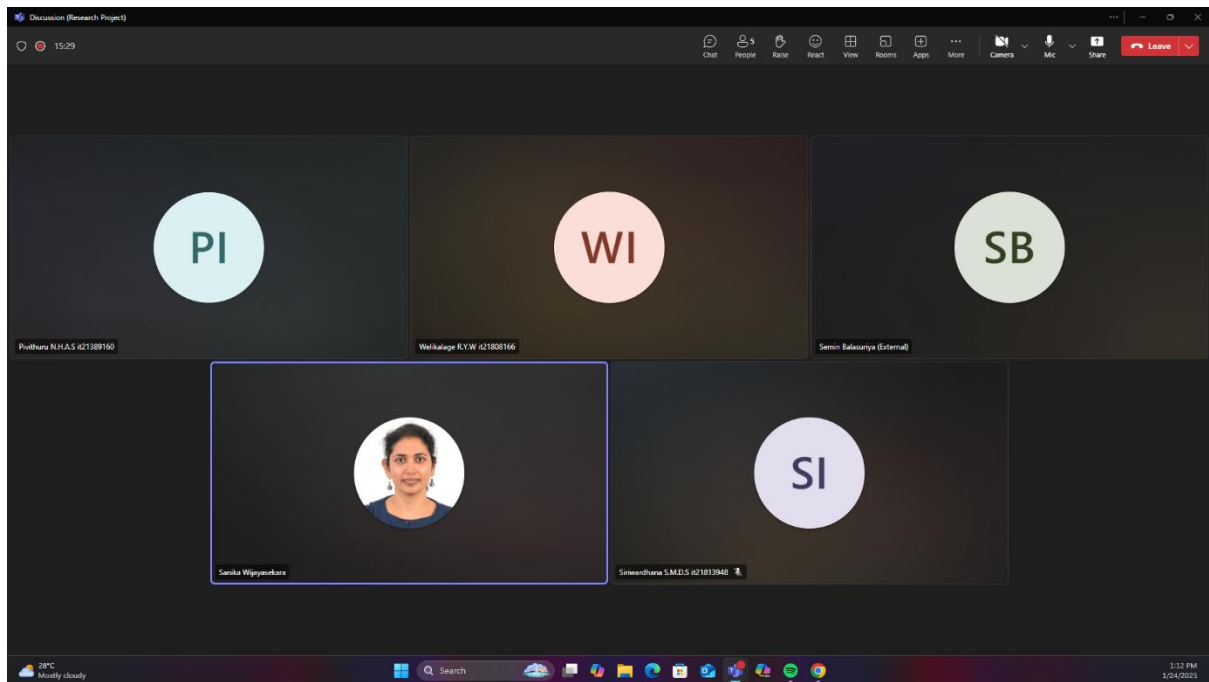


Figure 9 - Meeting with Supervisor

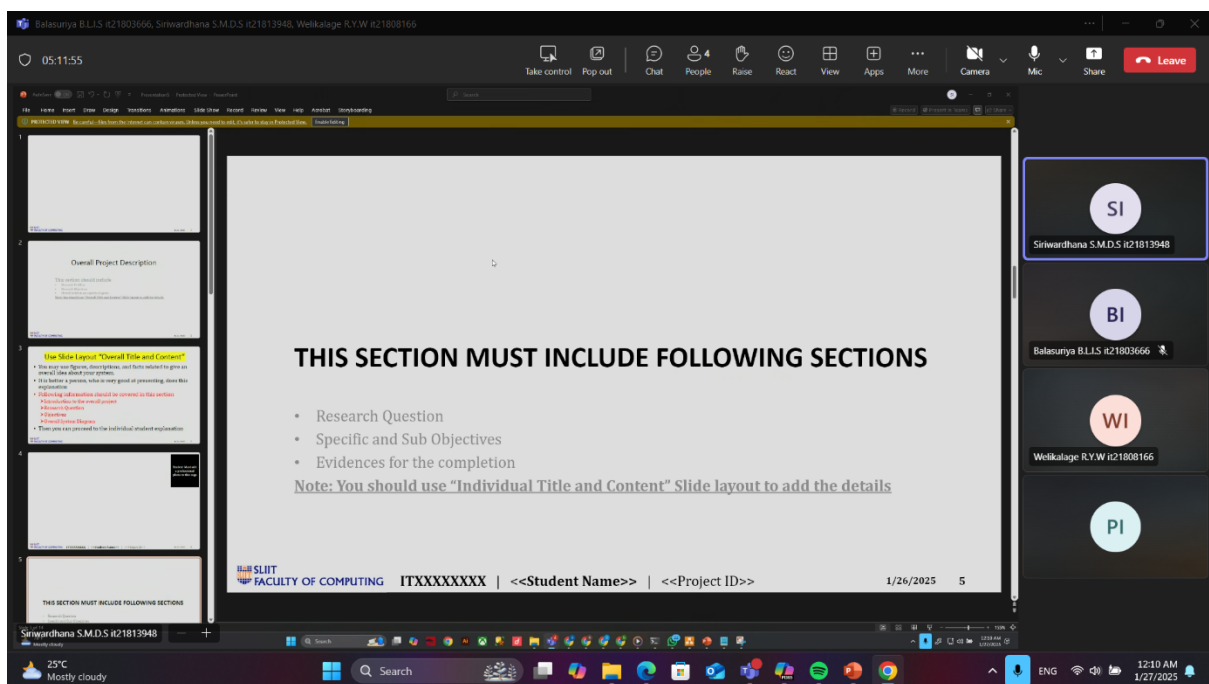


Figure 10 - Meeting with Teammates to prepare for PP1

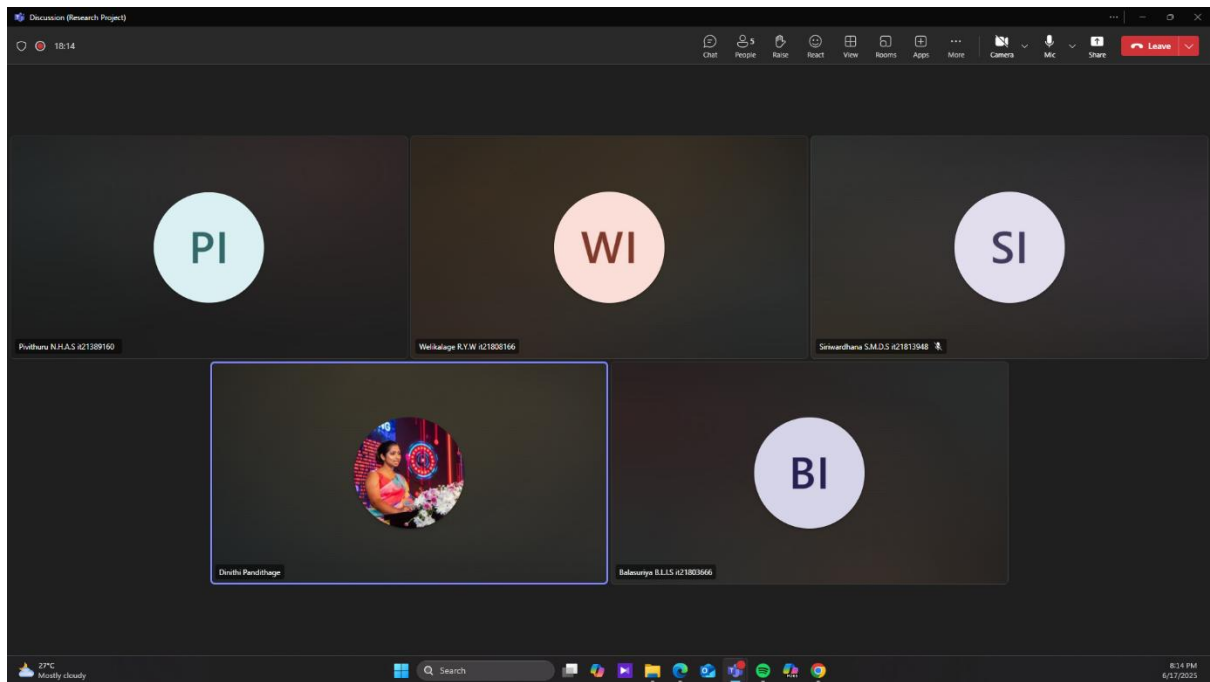


Figure 11 - Meeting with Supervisor

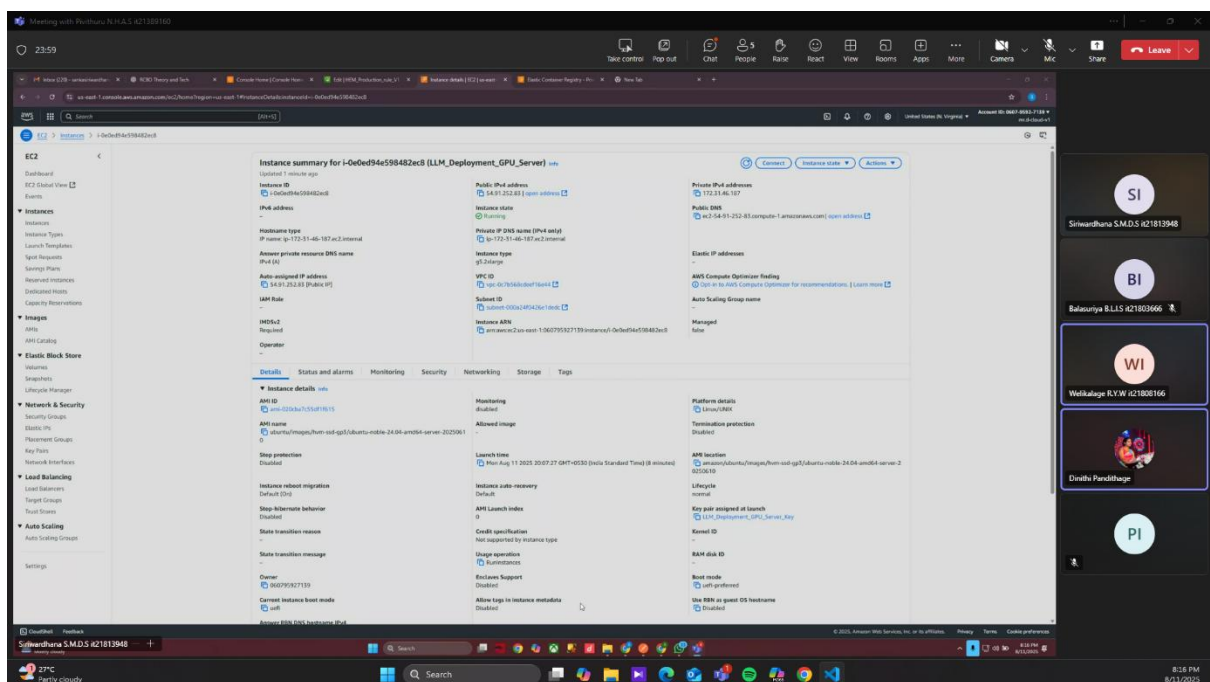


Figure 12 - Meeting with Supervisor

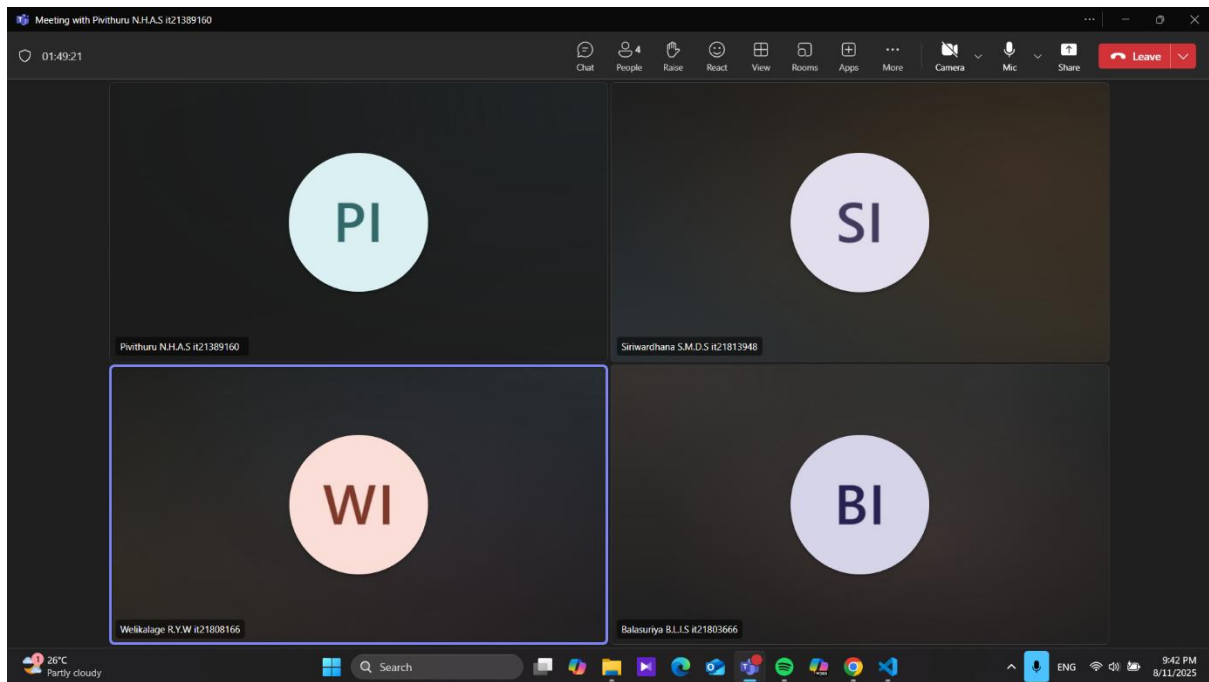


Figure 13 - Meeting with Teammates

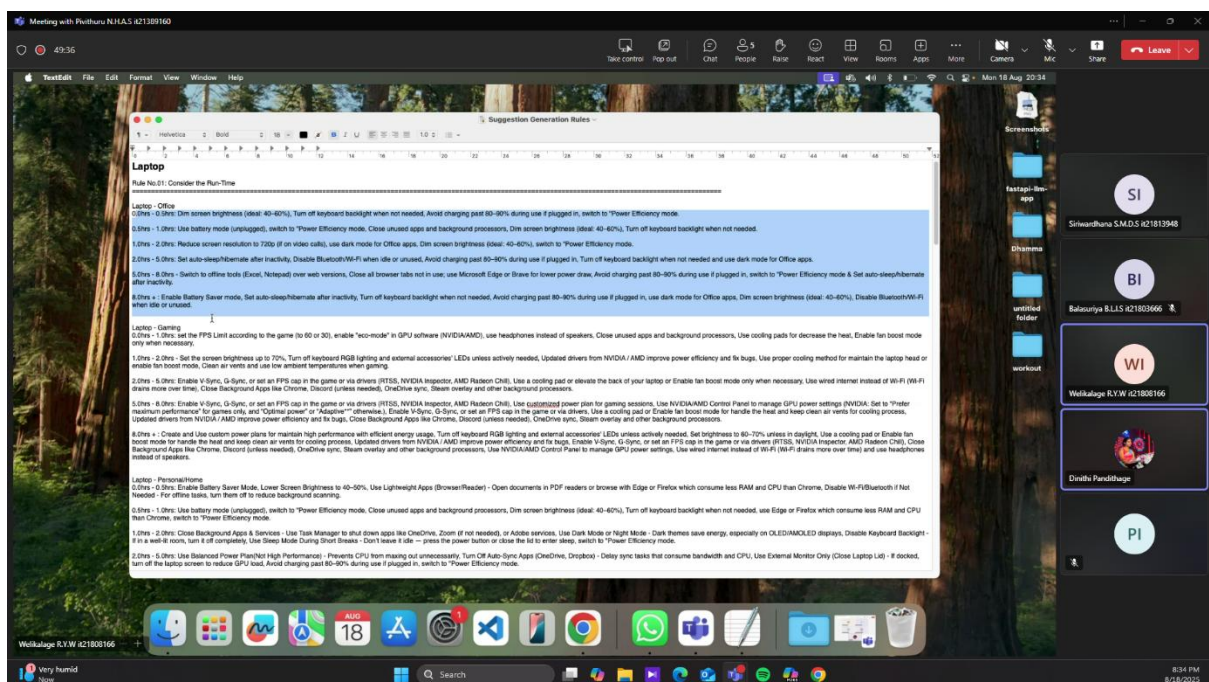


Figure 14 - Meeting with Supervisor for Final Adjustments