AI-Driven Detection and Mitigation of Urban Heat Island Effects Using Vision-Language Models

Project ID: R25-002

Logbook

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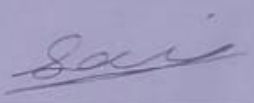
DECLARATION

I declare that this is my own work and this dissertation1 does not incorporate without acknowledgement any material previously submitted for a degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Also, I hereby grant to Sri Lanka Institute of Information Technology, the nonexclusive right to reproduce and distribute my dissertation, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

Name	Student ID	Signature
Ayeshmantha S. K. S.	IT21219320	

The supervisor/s should certify the LogBook with the following declaration.

The above candidate has carried out research for the bachelor's degree Dissertation under my supervision.

.....

Mr. Vishan Jayasinghearachchi
Supervisor

31/10/2023

.....

Date

1. Work Progress

Week	Progress
November– 2024	
Week 1	• Began brainstorming possible research areas. • Discussed ideas such as coral-reef protection, IoT-based deforestation detection, and travel-planning systems. • Focused on identifying a project with both innovation and social impact.
Week 2	• Continued reviewing different domains and evaluating feasibility. • Compared environmental, social, and technical relevance of shortlisted topics. • Supervisor guided us to align ideas with sustainability and real-world application areas.
Week 3	• Shifted focus toward **urban heating problems** and the **Urban Heat Island (UHI) effect**. • Supervisor mentioned a colleague from **University of Lincoln (UK)** researching this field. • Learned how AI + IoT can help analyze and mitigate heat retention in cities.
Week 4	• Finalized **UHI detection and mitigation** as our main research topic. • Supervisor proposed collaborating with his Lincoln colleague as **external supervisor** and **Ms. Kaushalya Rajapakse** as **co-supervisor**. • Outlined research objectives and drafted the initial problem statement. • Prepared early documentation for proposal submission.
December – 2024	
Week 1	• Began preparing the **TAF (Topic Assessment Form)** document. • Collected background details, objectives, and expected outcomes for inclusion.
Week 2	• Held a meeting to plan our research schedule. • Decided to **meet with supervisors every other week starting from January 2025** for progress reviews. • Began early reading on AI-based environmental analysis to prepare for proposal writing.
January – 2025	

Week 1	• Started creating Charter and proposal. • Met with the supervisor and co supervisor to obtain the signature for the charter document.
Week 2	• Completed creating the proposal presentation
Week 3	• Had our physical meeting to present the proposal presentation as trial run
Week 4	• Did a proposal presentation. • Submitted proposal report (final) to the CDAP cloud
February	
Week 1	• Conducted a group meeting to discuss the proposal result. • With a team meeting discussed how to begin the development.
Week 2	• Gathered information on how I can develop my system and faced some difficulties.
Week 3	• Discussed the issues with supervisors and identified solutions together
Week 4	• Started looking into what kind of hardware I needed to build the iot device • Searched for cheaper alternatives for expensive ones
March	
Week 1	• Showed my findings to supervisors and they suggested me with some cheaper alternatives for ones which I couldn't find
Week 2	• Started working on coding and testing individual hardware components.
Week 3	• Showed my progress and get feedback on how to improve the code and make the process better
Week 4	• Continue developing the IoT device. • Created a housing out of scrap cardboard for demonstration
April	
Week 1	• Prepared PowerPoint slides for Progress Presentation 1.
Week 2	• Did the progress presentation 1.
Week 3	• Conducted a group meeting to discuss the progress presentation result.
Week 4	• Started searching for more hardware components to allow the IoT to navigate autonomously • External supervisor suggested a pretrained model that allowed to match images
May	

Week 1	• Started looking for options for strong and sturdy replacement for the cardboard housing
Week 2	• Discussed with supervisor about the IoT device housing issue and 3d printing was suggested. • Participated in a "How to Write a Research Paper" discussion.
Week 3	• Started frontend design and development to manually control the IoT device before automating
Week 4	• Created 3d model of housing for 3d printing. • Requested quotations for printing from multiple shops.
June	
Week 1	• Continued the design and development of the web app frontend.
Week 2	• Started working on the python backend and integrated the superglue model suggested by external supervisor
Week 3	• Got the requested quotations from the different stores and the price to print was too high
Week 4	• Discussed the cost issue with supervisors and they suggested acrylic sheet as an alternative
July	
Week 1	• Purchased acrylic sheet. • Searched for laser printing shops to get it cut
Week 2	• Began writing our research paper. • Reviewed existing research papers related to our component to support the writing of our research paper
Week 3	• Sent our written research paper to the supervisor for checking.
Week 4	• Revised the research paper based on the supervisor's feedback.
August	
Week 1	• The supervisor confirmed our research paper for submission to the ICAC conference.
Week 2	• Started writing the individual final report. • Submitted our research paper to the ICAC conference.
Week 3	• Had a team meeting and discussed the PP2 and individual components. • Organized a team meeting to plan the final report.
Week 4	• Met with the supervisor to obtain the signature for the final report. • Completed individual final report and submitted to the CDAP. • Final report was sent for proofreading.
September	

Week 1	• Had a team meeting and discussed the PP2 • Developed an algorithm for automatic navigation • Started creating the PP2 slides. •
Week 2	• Checked that 90% of the HeatScape app is working correctly. • Presented the 90% progress to the panel at PP2
Week 3	• Shared the panel comments with the supervisors • Demonstrated how the algorithm worked to the supervisors • Continued some integration work between the frontend and backend.
Week 4	• Started creating the project website. • Looked into deployment strategies for the models
October	
Week 1	• Did validation testing around the campus • Found heat island in tennis court
Week 2	• A research paper status mail was received from ICAC. • Attending research discussion.
Week 3	• Deployed system to AWS. • Prepared final presentation • Created UI/UX Demo video • Applied to WSA Competition
Week 4	• Presented the final presentation

2. Supervisor Meeting Logs

Date	**Platform / Location**	**Remarks**
Nov 21, 2024 (Thu)	Microsoft Teams	Initial meeting after topic selection; discussed TAF preparation and upcoming proposal schedule.
Dec 5, 2024 (Thu)	Microsoft Teams	Reviewed draft TAF; supervisor feedback on objectives and feasibility.
Dec 18, 2024 (Wed)	Microsoft Teams	Progress check on proposal drafting; clarified scope of components.
Dec 19, 2024 (Thu)	Microsoft Teams	Finalized TAF submission and confirmed biweekly meetings from January.
Jan 2, 2025 (Thu)	Microsoft Teams	Discussed proposal structure and responsibilities for Charter document.
Jan 9, 2025 (Thu)	6th Floor, Main Building	Signed Charter; supervisor advised improvements for proposal presentation.
Jan 16, 2025 (Thu)	Microsoft Teams	Reviewed draft proposal slides; minor adjustments recommended.
Jan 23, 2025 (Thu)	6th Floor, Main	Trial run of proposal presentation; feedback on flow and clarity.

	Building	
Jan 30, 2025 (Thu)	Microsoft Teams	Proposal preparation review; confirmed submission readiness.
Feb 6, 2025 (Thu)	6th Floor, Main Building	Discussed proposal results; planned system development schedule.
Feb 13, 2025 (Thu)	Microsoft Teams	Shared early IoT component research; discussed hardware sourcing.
Feb 20, 2025 (Thu)	6th Floor, Main Building	Supervisor feedback on hardware feasibility; advised cheaper alternatives.
Feb 27, 2025 (Thu)	Microsoft Teams	Follow-up on hardware procurement and coding progress.
Mar 6, 2025 (Thu)	6th Floor, Main Building	Reviewed IoT coding progress; discussed testing plan.
Mar 13, 2025 (Thu)	Microsoft Teams	Discussed initial prototype issues; planned next testing cycle.
Mar 20, 2025 (Thu)	6th Floor, Main Building	Supervisor review on IoT prototype; improvement feedback.
Mar 27, 2025 (Thu)	Microsoft Teams	Prepared for Progress Presentation 1; checked slide content.
Apr 3, 2025 (Thu)	6th Floor, Main Building	Conducted mock PP1; feedback on presentation structure.
Apr 10, 2025 (Thu)	Microsoft Teams	Discussed PP1 results and suggested improvement areas.
Apr 17, 2025 (Thu)	6th Floor, Main Building	Planned hardware upgrades for autonomous navigation.
Apr 24, 2025 (Thu)	Microsoft Teams	Introduced pretrained model from external supervisor for matching images.
May 1, 2025 (Thu)	6th Floor, Main Building	Discussed IoT device housing; 3D printing suggested.
May 8, 2025 (Thu)	Microsoft Teams	Reviewed 3D model design and quotations for printing.
May 15, 2025 (Thu)	6th Floor, Main Building	Supervisor checked progress of frontend development.
May 22, 2025 (Thu)	Microsoft Teams	Discussed integration of backend model with frontend.
May 29, 2025 (Thu)	6th Floor, Main Building	Finalized acrylic sheet as IoT housing alternative.
Jun 5, 2025 (Thu)	Microsoft Teams	Supervisor reviewed Python backend and SuperGlue integration.
Jun 12, 2025 (Thu)	6th Floor, Main Building	Discussed research paper draft and experiment validation.
Jun 19, 2025 (Thu)	Microsoft Teams	Feedback on paper structure and data representation.
Jun 26, 2025 (Thu)	6th Floor, Main Building	Reviewed experiment results; finalized paper content.
Jul 10, 2025 (Thu)	6th Floor, Main Building	Supervisor checked final draft before submission.
Jul 24, 2025 (Thu)	6th Floor, Main Building	Reviewed ICAC submission and progress on final report.
Aug 7, 2025 (Thu)	6th Floor, Main Building	Feedback on final report writing and PP2 preparation.
Aug 21, 2025 (Thu)	6th Floor, Main Building	Reviewed final submission; confirmed proofreading stage.
Aug 21, 2025 (Thu)	Microsoft Teams	Final sync-up before submission; confirmed deadlines.
Sep 4, 2025 (Thu)	Microsoft Teams	Discussed PP2 presentation slides and algorithm demonstration.
Sep 4, 2025 (Thu)	6th Floor, Main Building	Conducted PP2 dry run and gathered feedback.
Sep 18, 2025 (Thu)	Microsoft Teams	Reviewed panel feedback and integration progress.
Oct 16, 2025 (Thu)	Microsoft Teams	Final presentation review; validation testing and WSA submission updates.

3. Meeting Notes

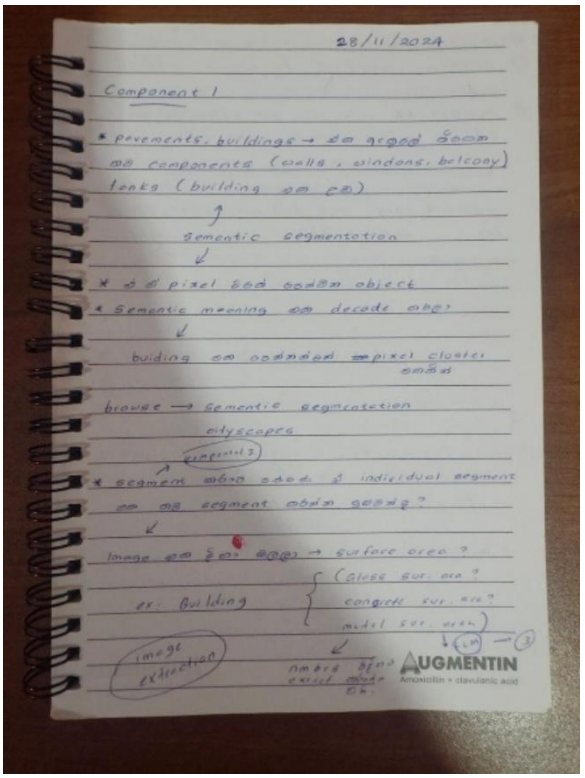
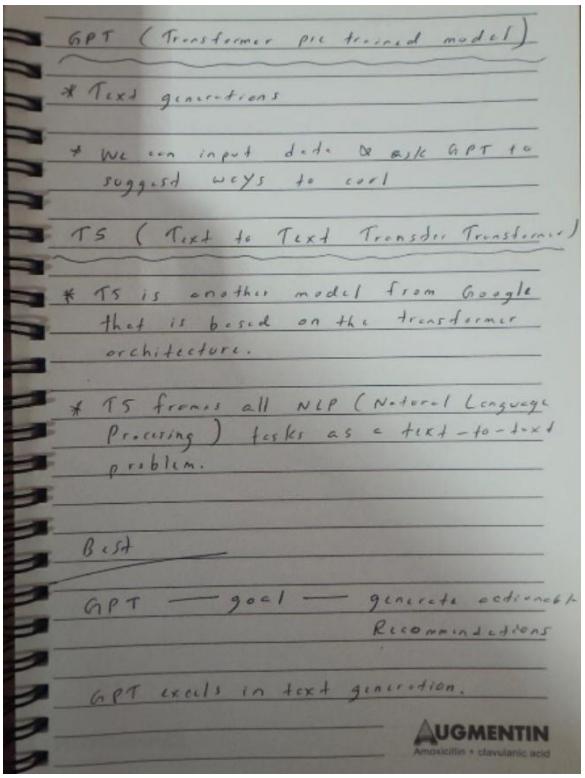


Figure 1: Note 1



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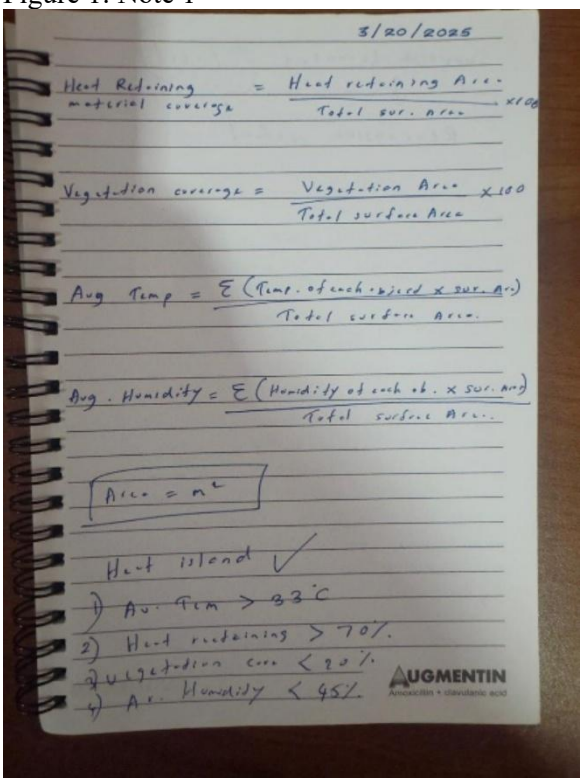

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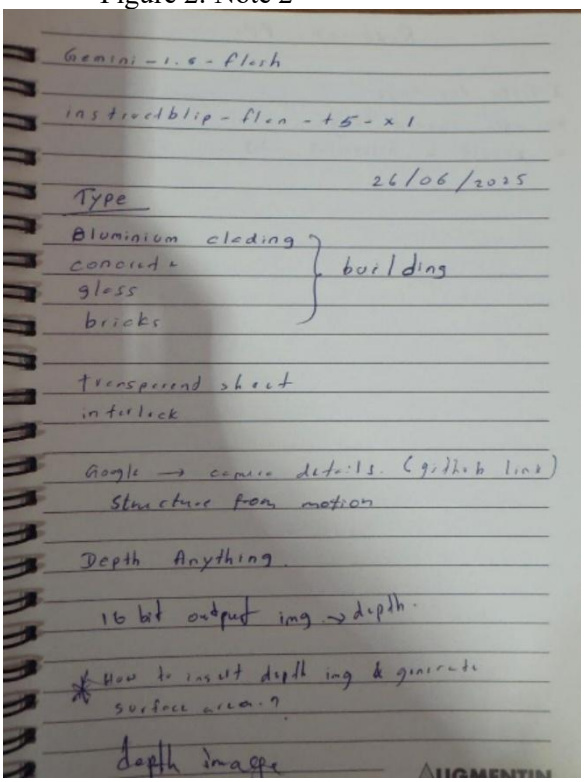

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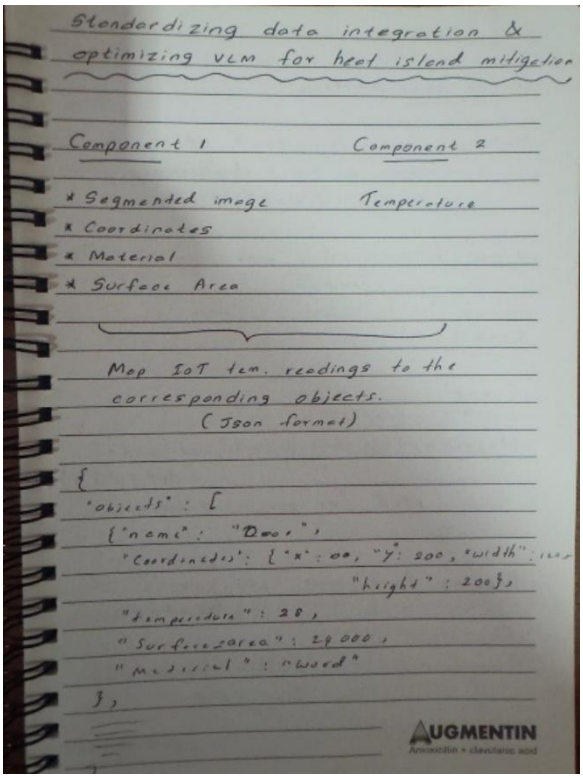

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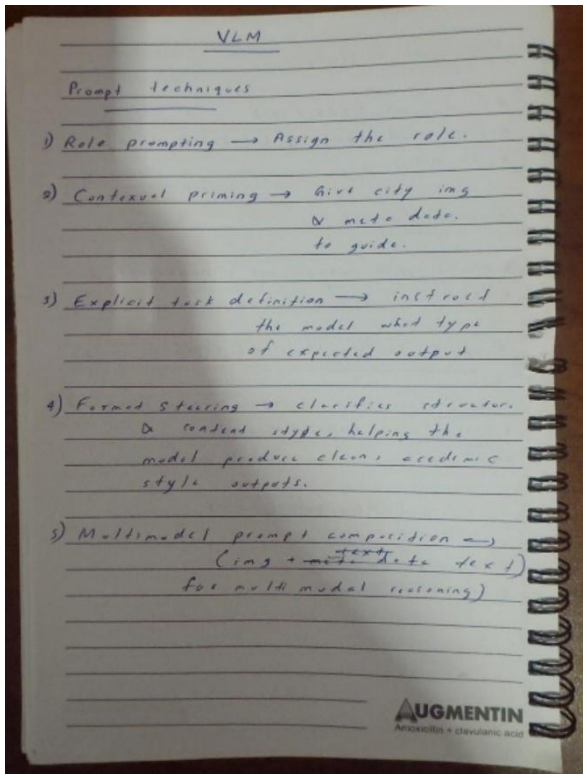

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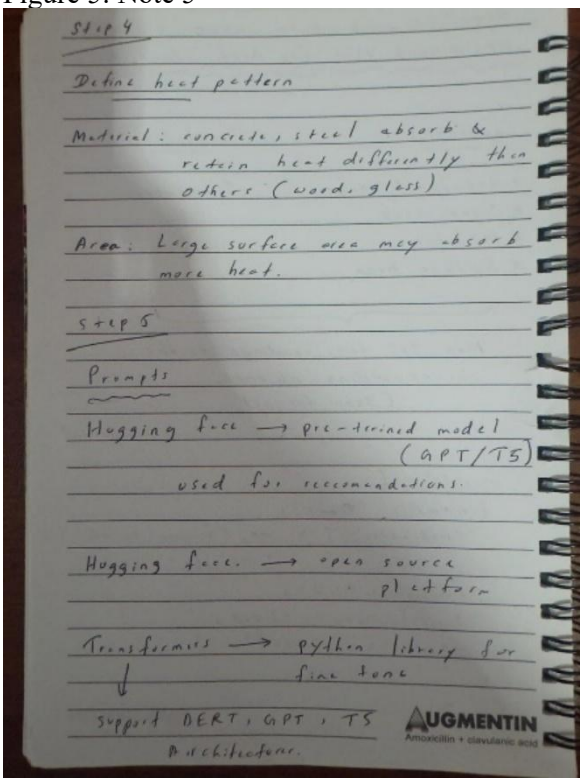

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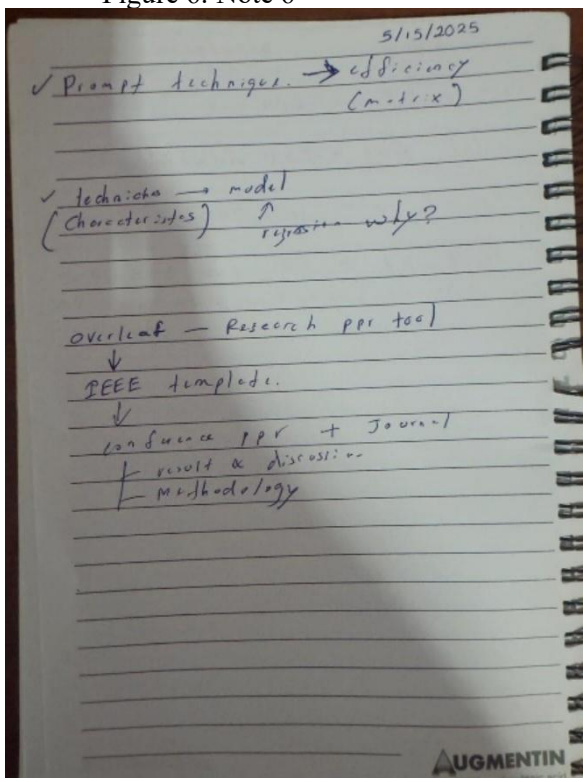

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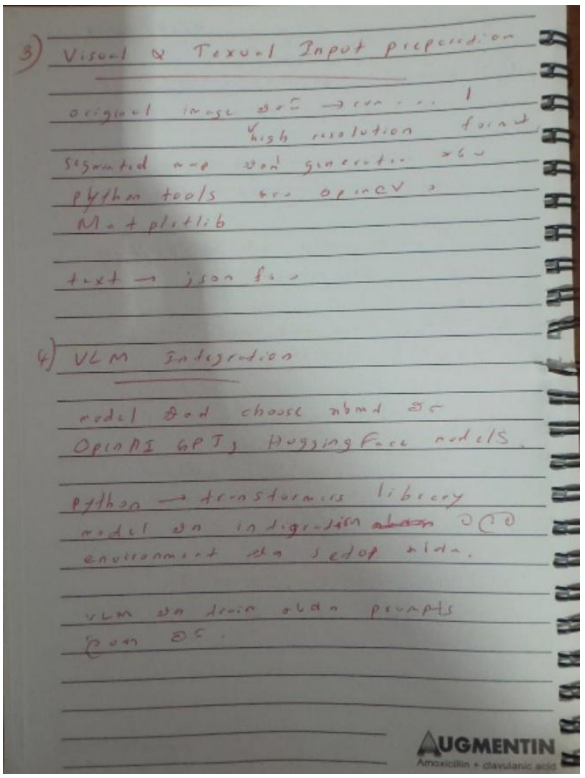

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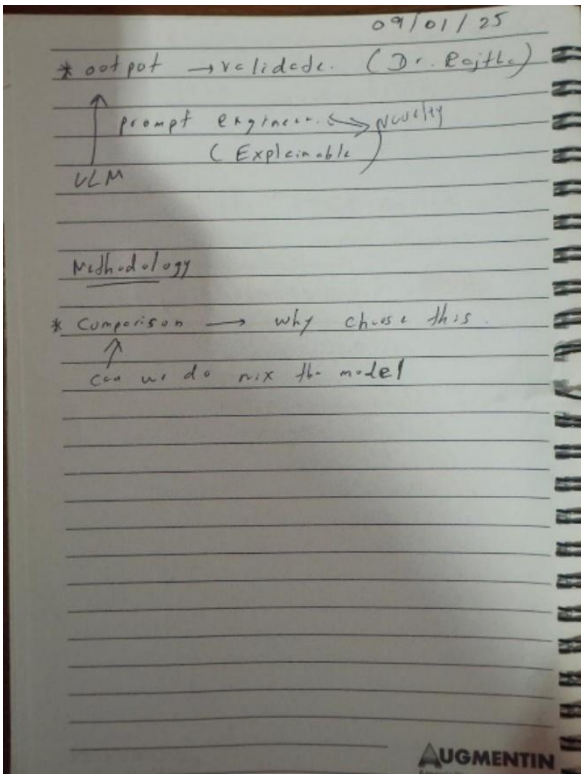

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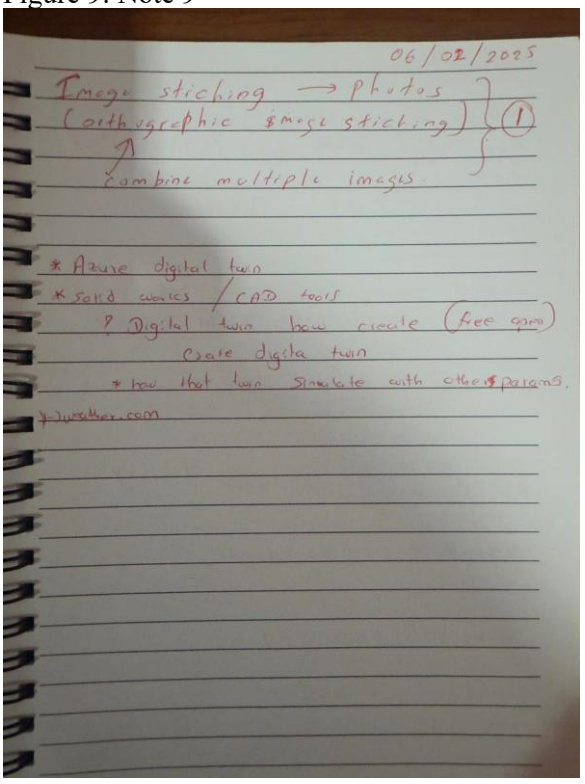

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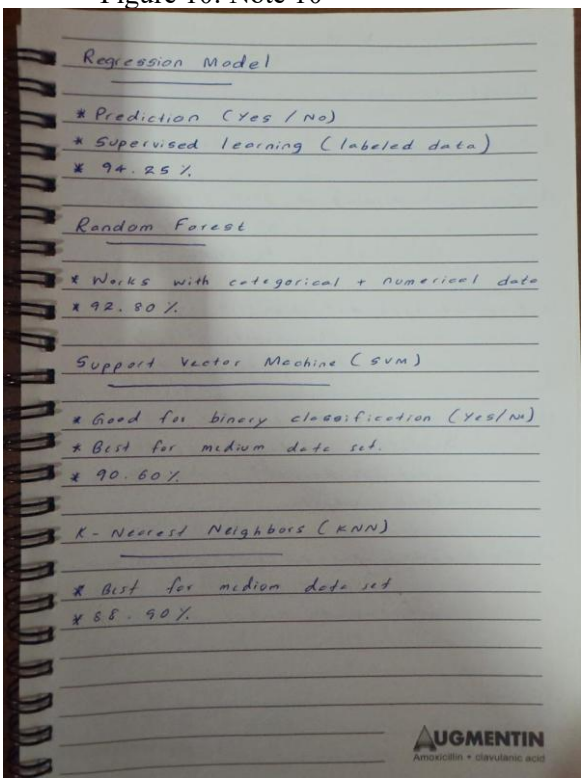

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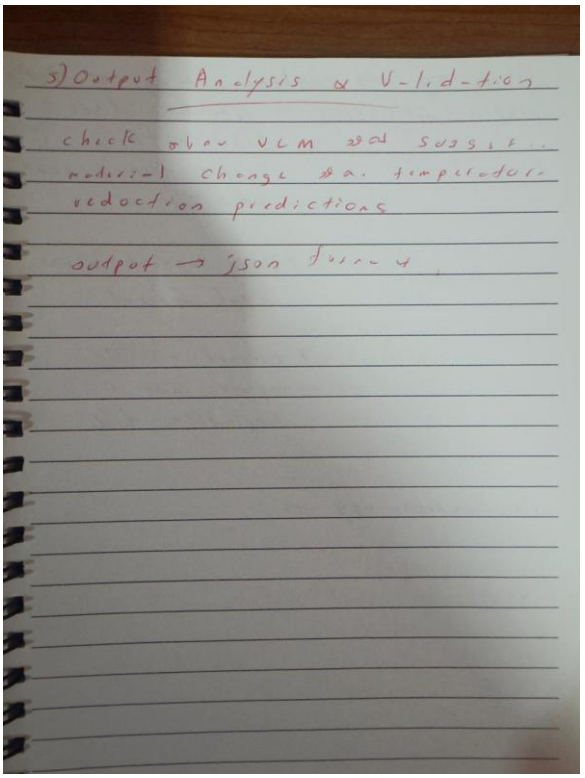

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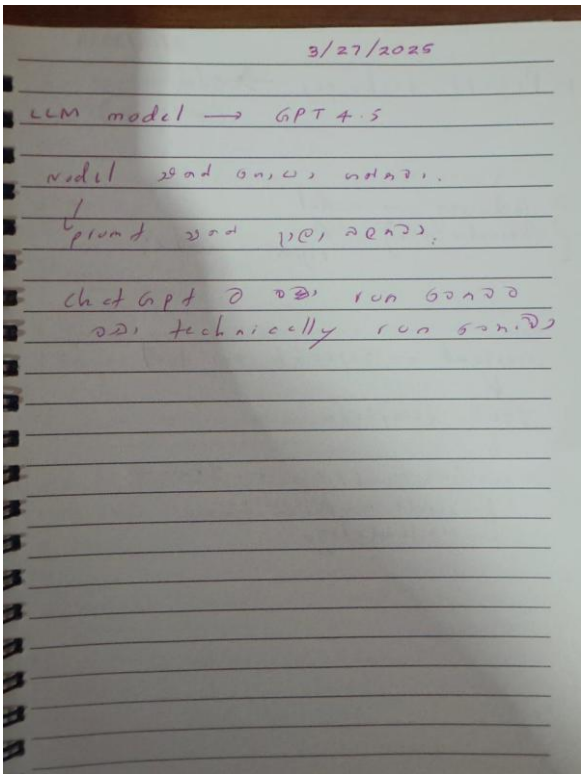

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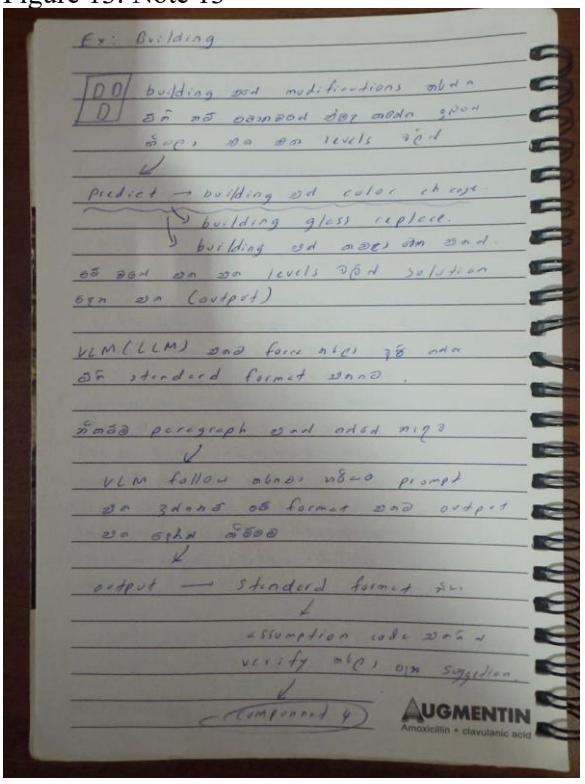

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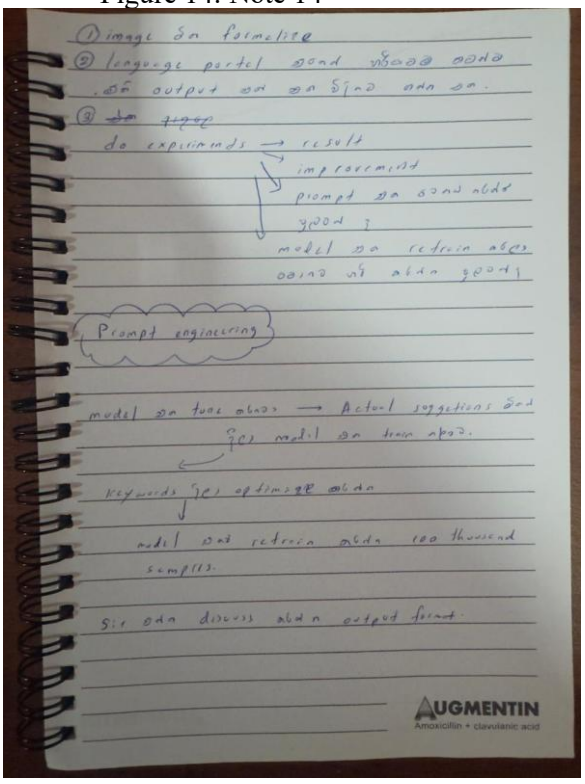

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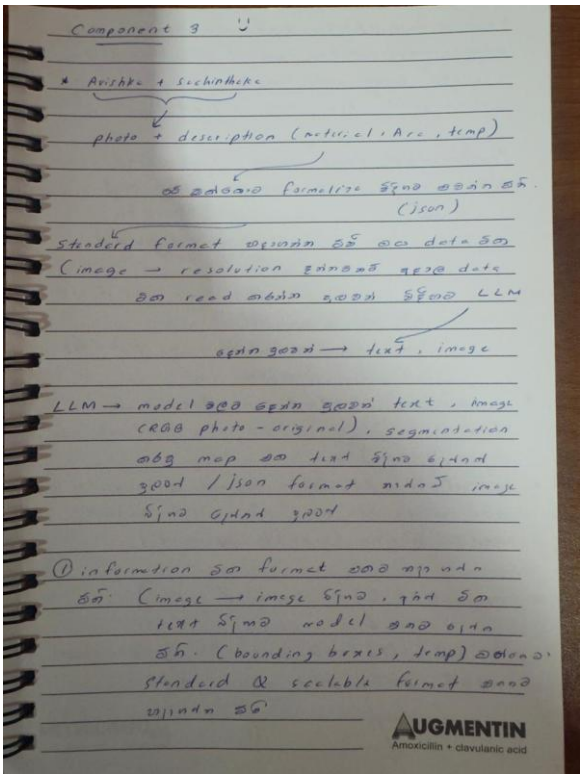

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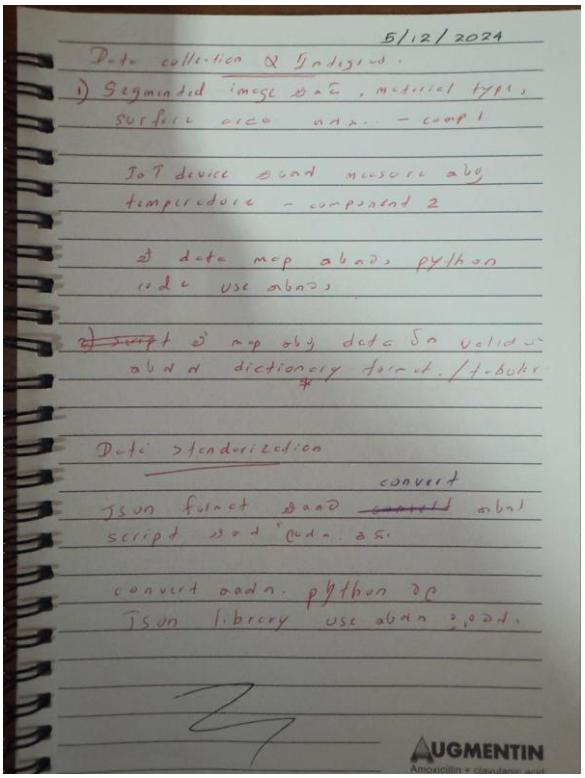
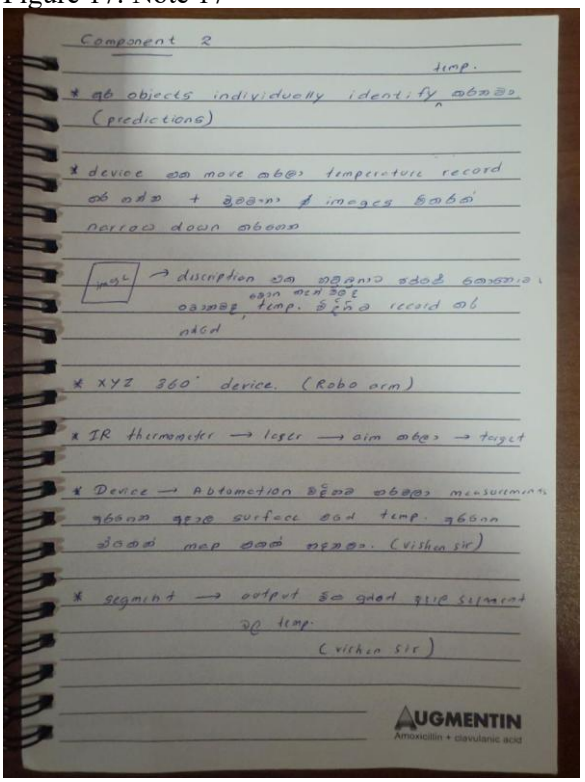


Figure 18: Note 18



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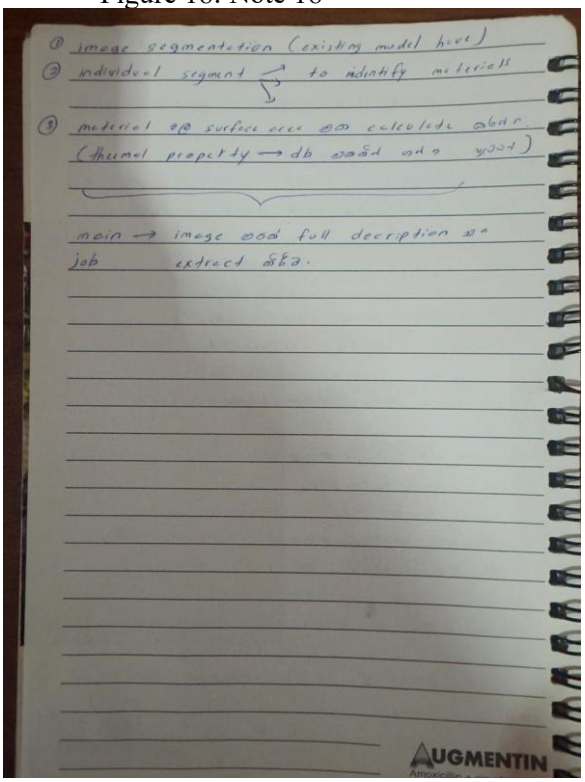
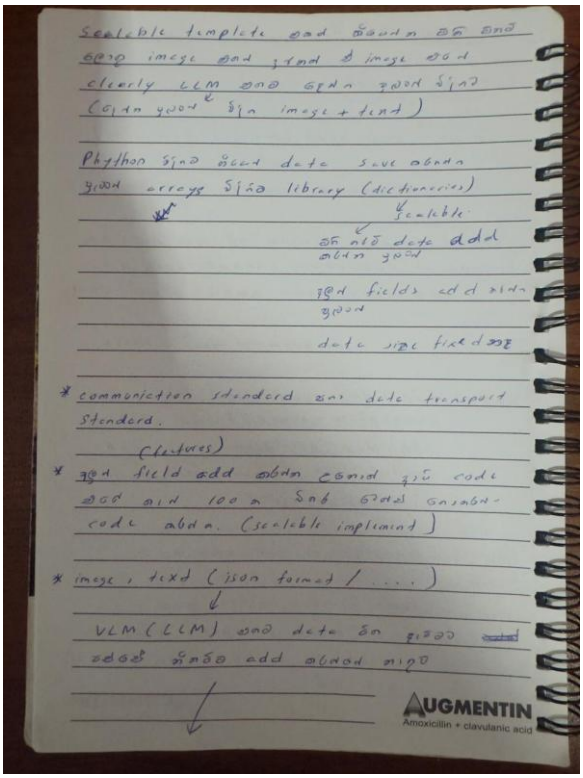


Figure 20: Note 20



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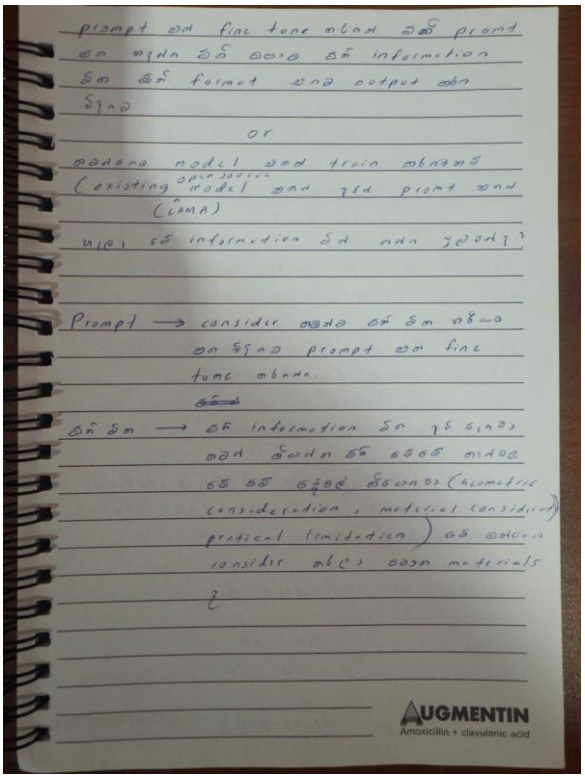

Figure 22: Note 22

4. Git Activity History

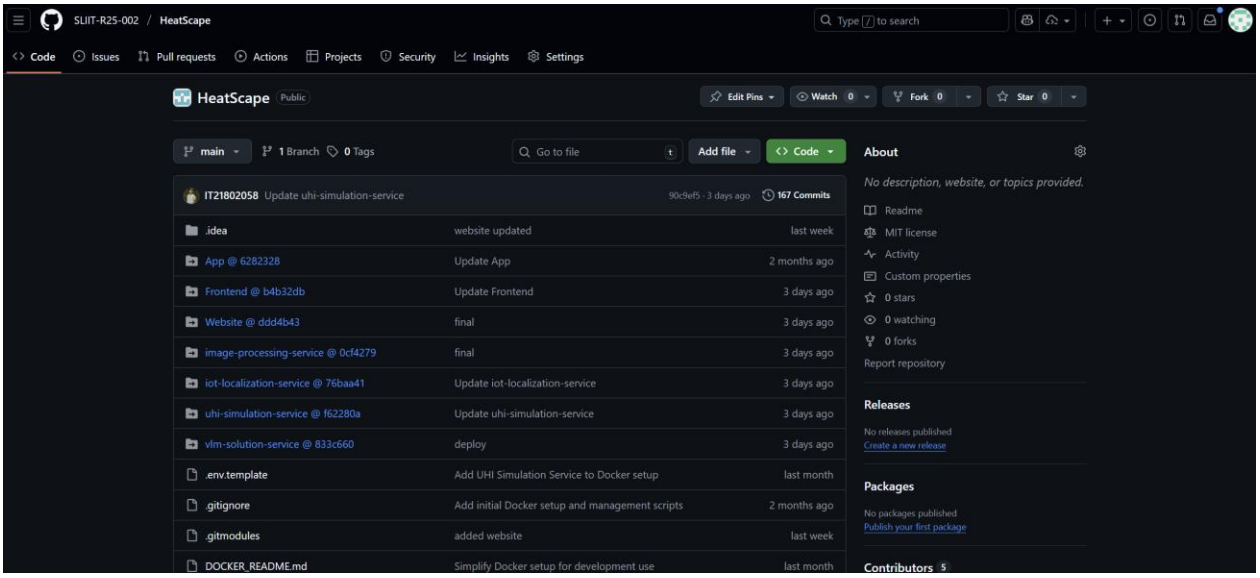

Figure 23: Git Repo

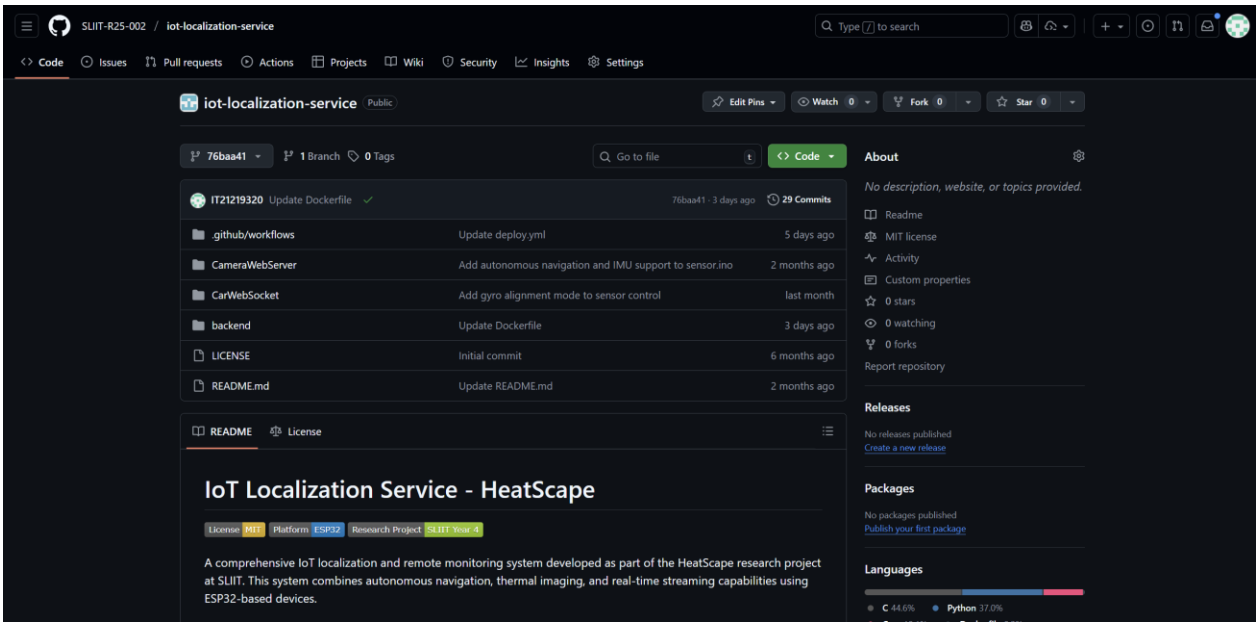

Figure 24: Git Repo (IoT Microservice)

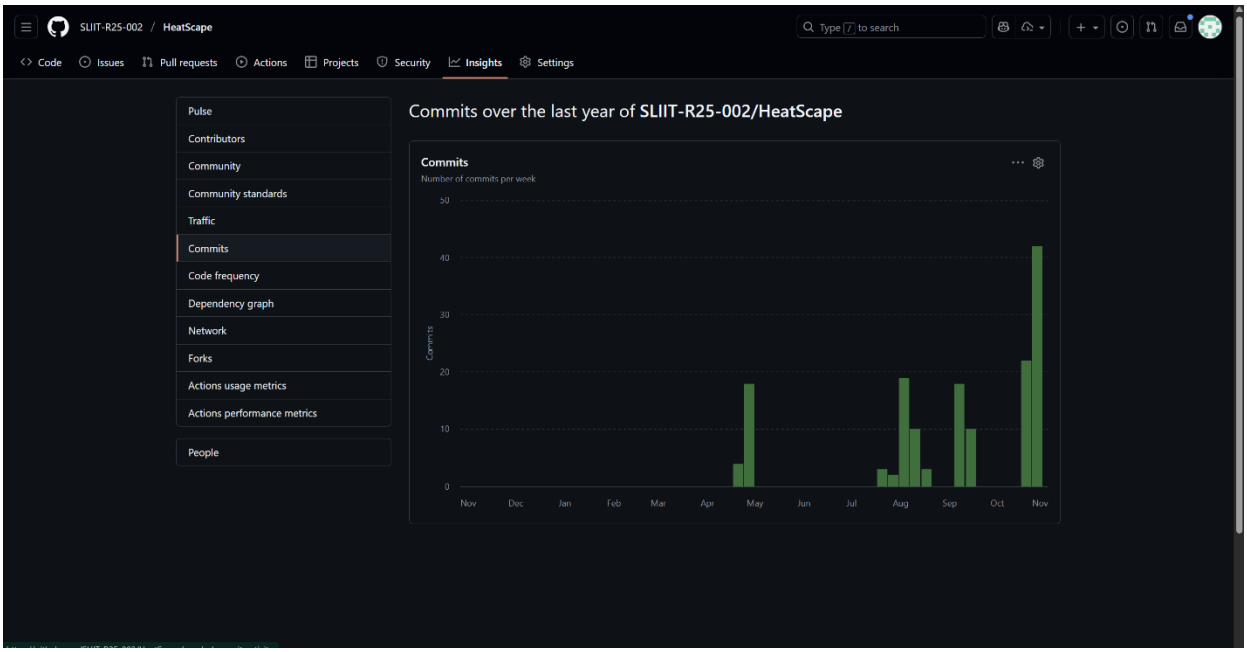

Figure 25: Git Code Commits (Main Repo)

Figure 26: Git Code Commits (IoT Microservice)

5. Screenshots of Meetings & Mails

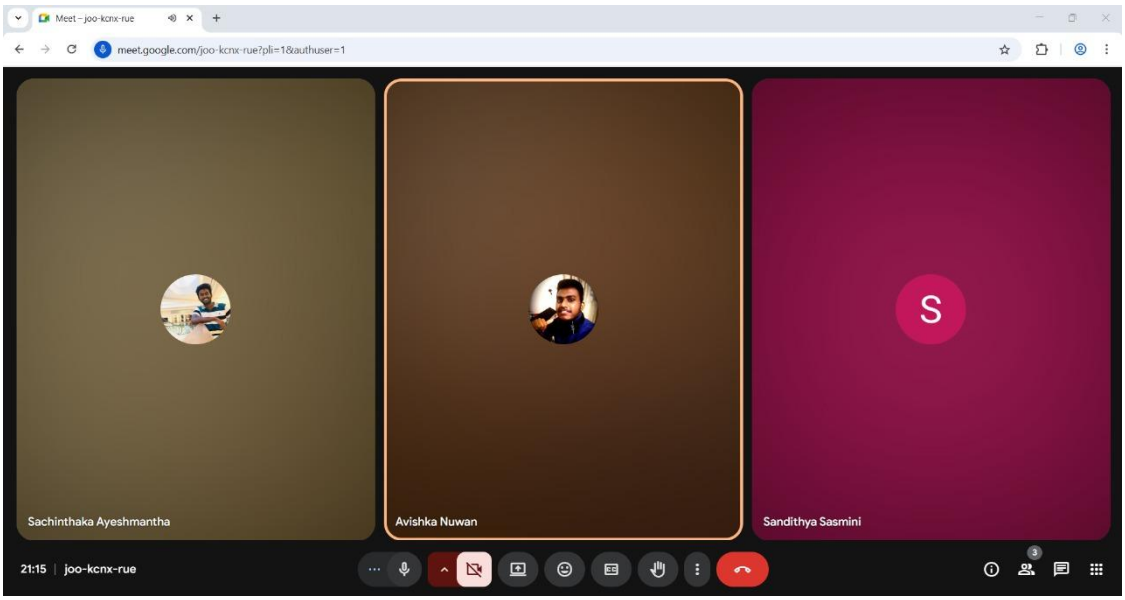

Figure 27 : Group Meeting

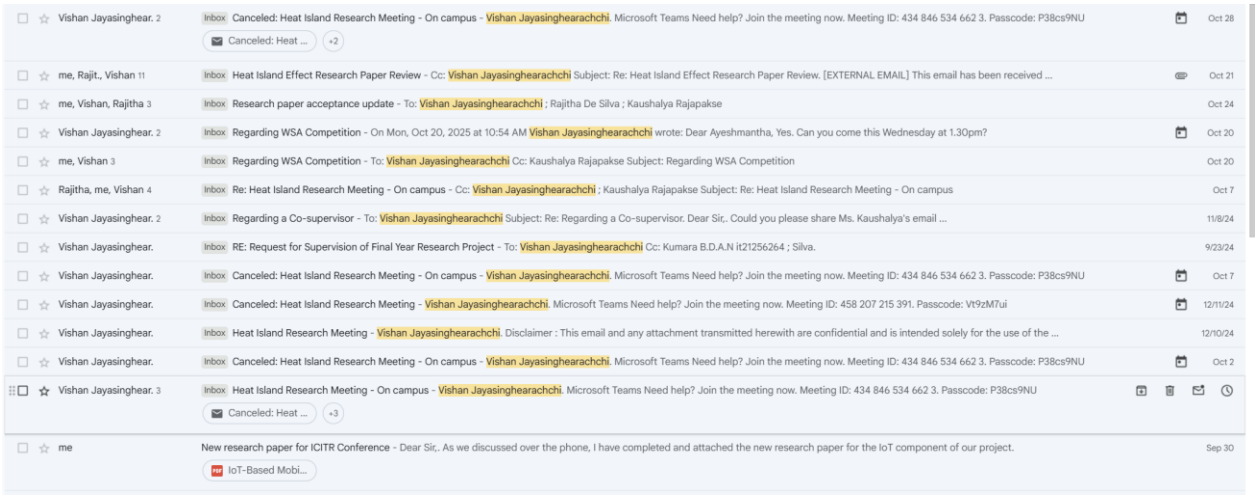

Figure 28: Emails 1

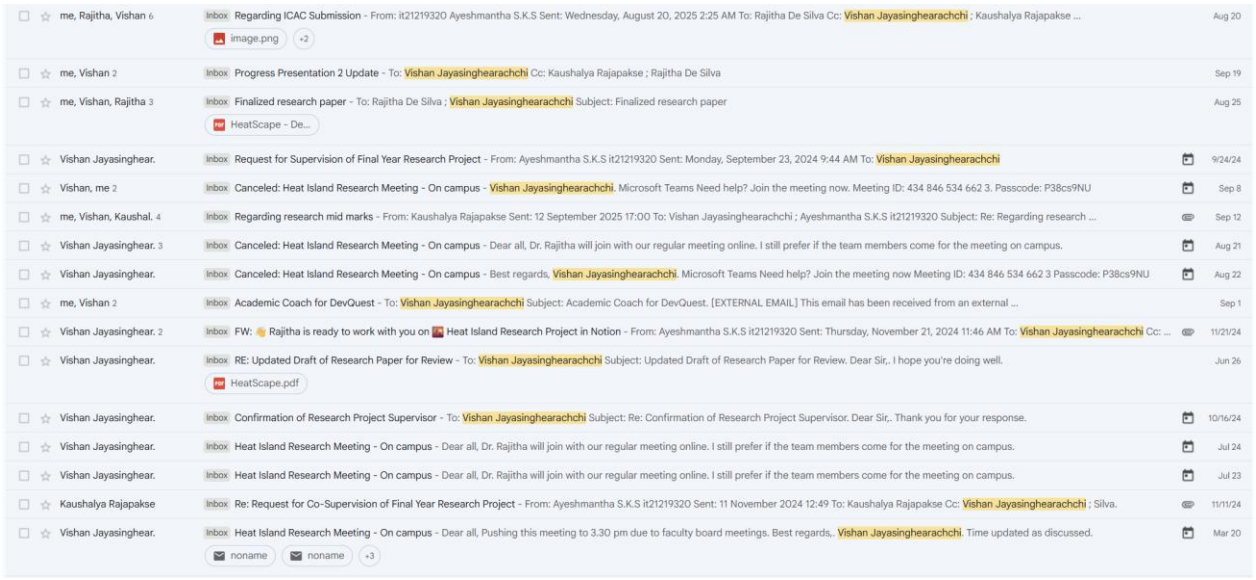

Figure 29: Emails 2

Figure 30: Emails 3

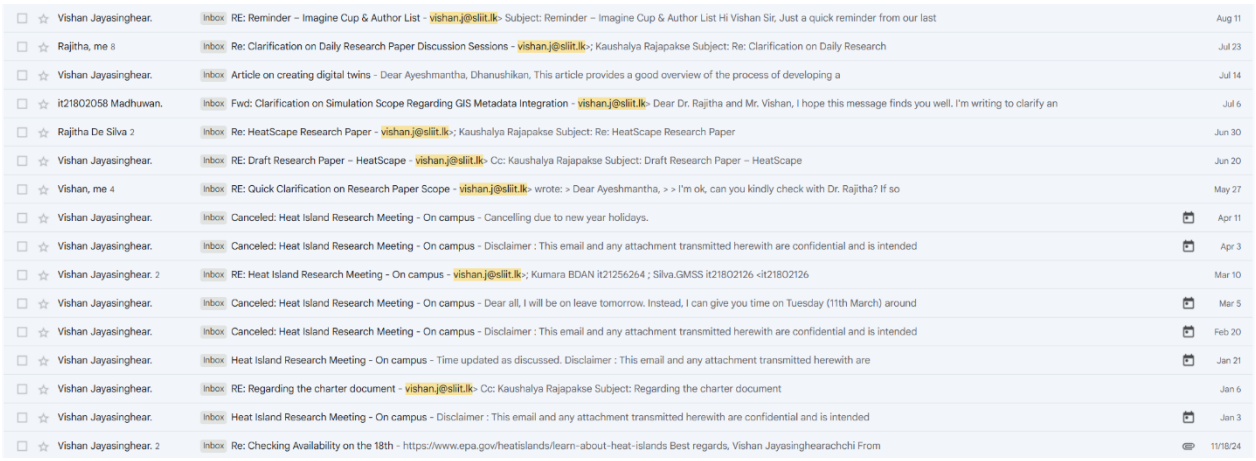

Figure 31: Emails 4

6. Gallery

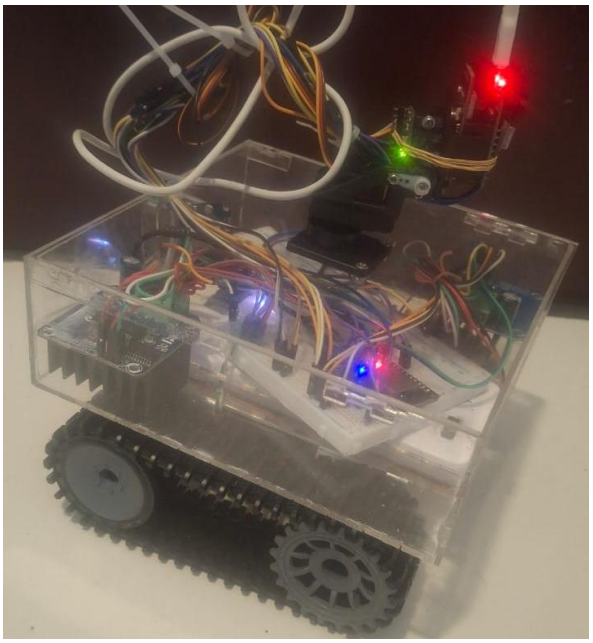

Figure 32: IoT Device (Side View)

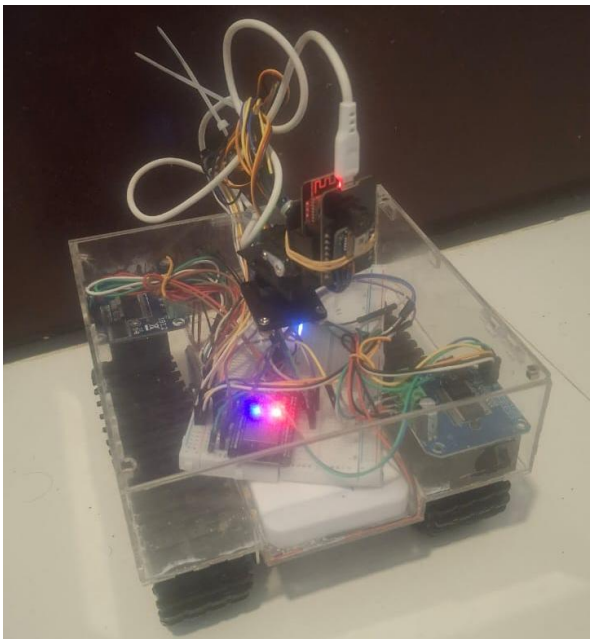

Figure 33: IoT Device (Front View)

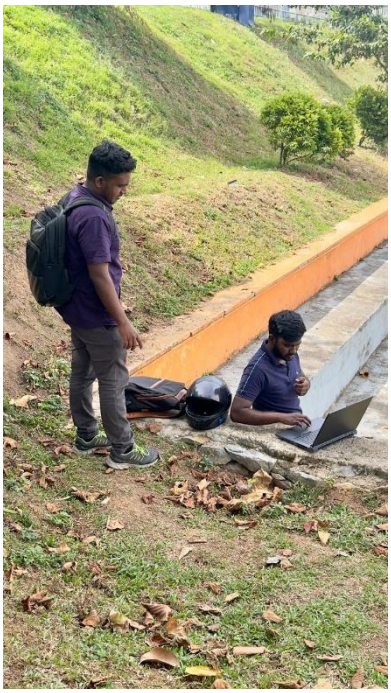

Figure 34: Validation Testing 1

Figure 35: Validation Testing 2

Figure 36: Validation Testing 3

Figure 37: Final Presentation Completed