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Faculty of Engineering
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EN2160 - Electronic Design Realization

Conceptual Design Report

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1. Introduction

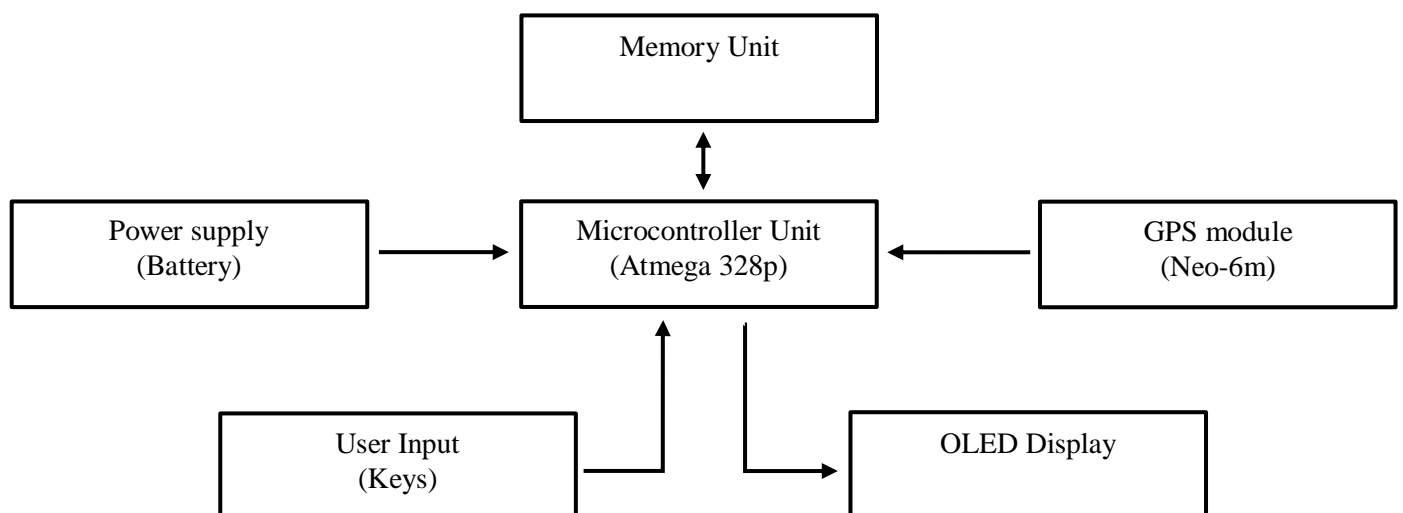
This report aims to provide a comprehensive and detailed overview of the conceptual design for a GPS tracker with additional features. The design includes three potential functional block diagrams and three enclosure designs, which will be evaluated and refined based on specific criteria. Additionally, a user survey was conducted to gather valuable insights on user preferences, which will be considered in the modified functional block diagram and enclosure design. The subsequent sections of this report will present the findings, evaluations, and selection process, taking into account a set of comprehensive evaluation criteria for both the functional block diagrams and enclosure designs. By following the systematic approach, the most suitable design that aligns with user requirements and addresses the functional objectives of the GPS tracker will be identified and recommended.

2. Functional Block Diagrams

Functional block diagrams illustrate the high-level functionality and interconnections of various components within a system. Here are three possible functional block diagrams for the GPS tracker, resulting from a brainstorming session.

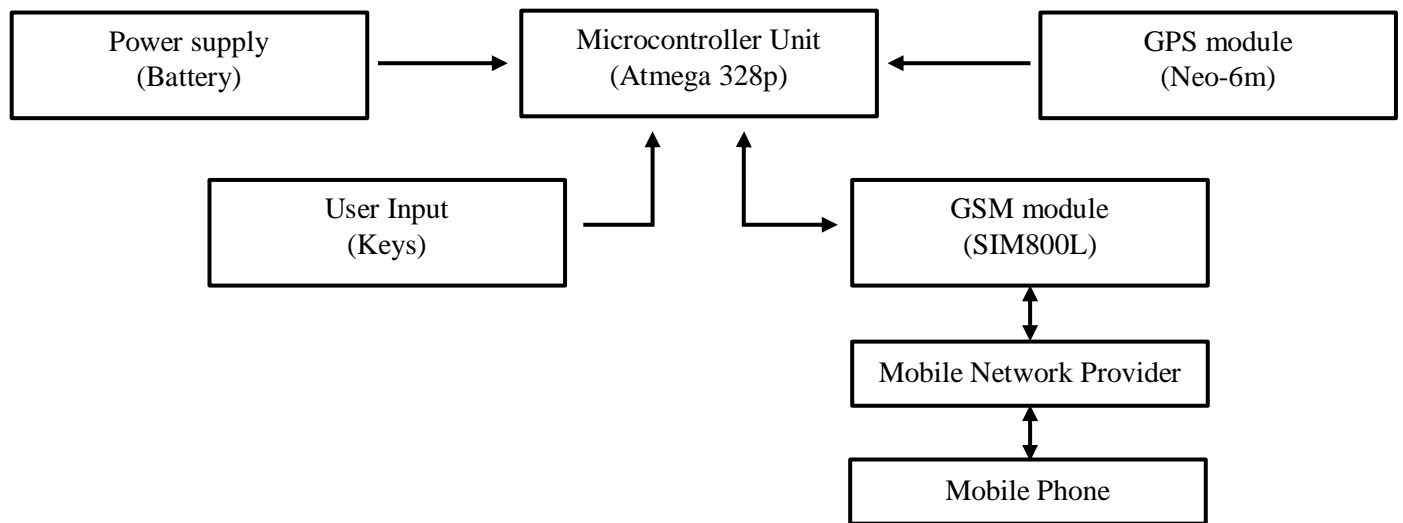
Design 1:

In this design, the GPS data received from the module will be sent to the Microcontroller Unit and the processed data will be stored in the memory. When prompted by the user, the data will be displayed in the OLED display. For portability, the device is equipped with battery power supply.



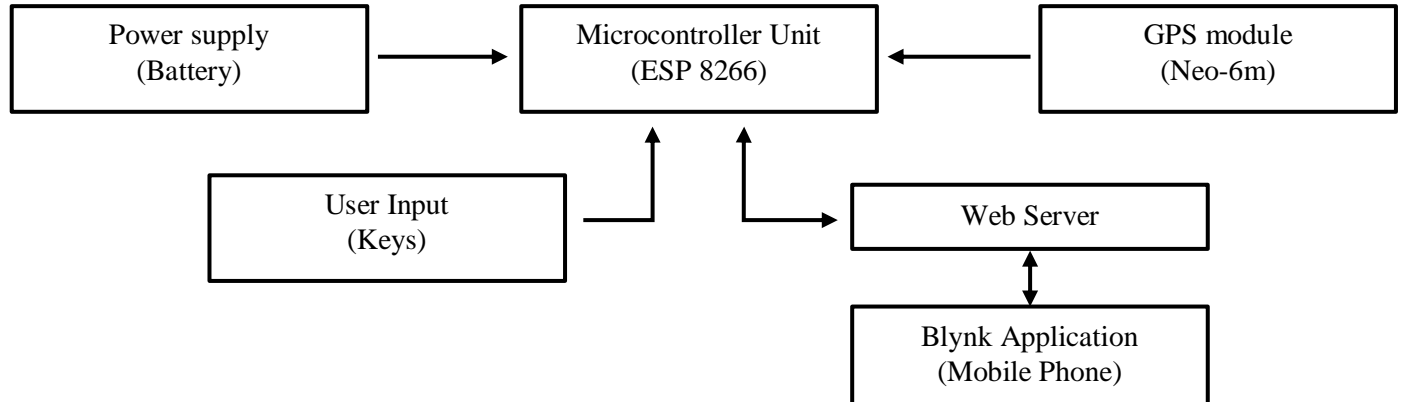
Design 2:

In this design the data received through the GPS module is sent to the Microcontroller Unit and the processed data is sent to the GSM module to transmit to the user through mobile network. SOS Alert button is implemented to allow the user to alert to a given mobile number. Device is powered by a battery.



Design 3:

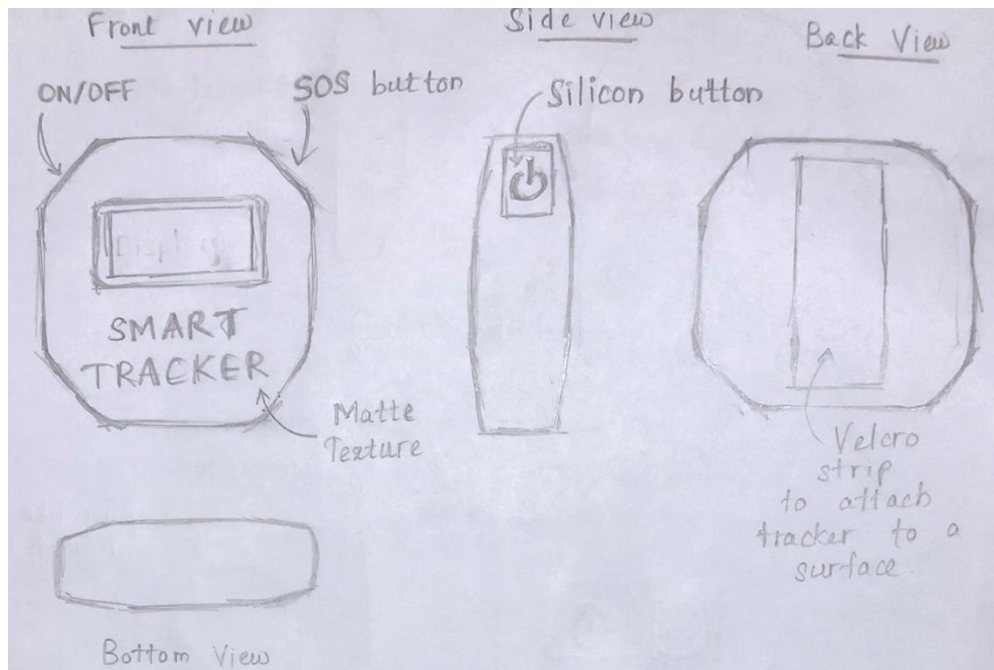
In this design the data received through the GPS module is sent to the Microcontroller Unit and the processed data is sent to the Web server which then transmits it to the Blynk application. The application can be then downloaded by the user on the Mobile phone to view the GPS location. The device is powered by a battery to facilitate portability.



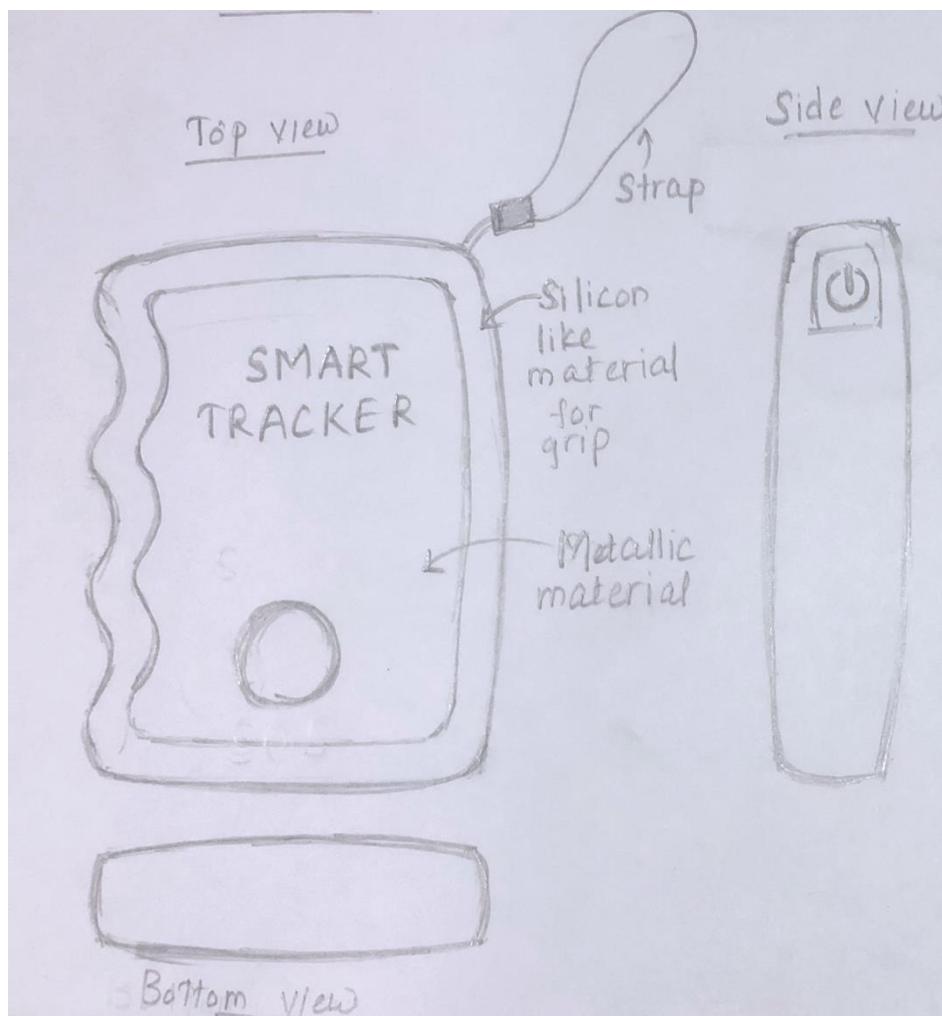
3. Enclosure Designs

Enclosure designs determine the physical appearance and packaging of the GPS tracker. Following are three possible enclosure designs, resulted from the brainstorming session.

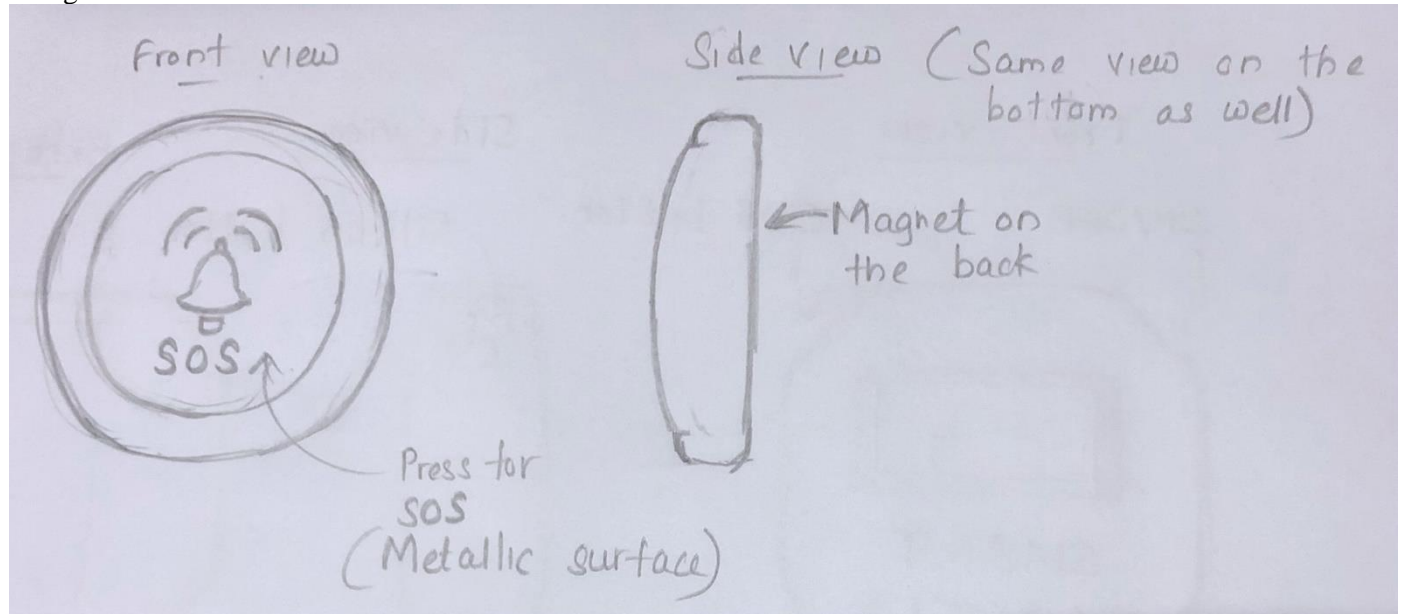
Design 1:



Design 2:



Design 3:



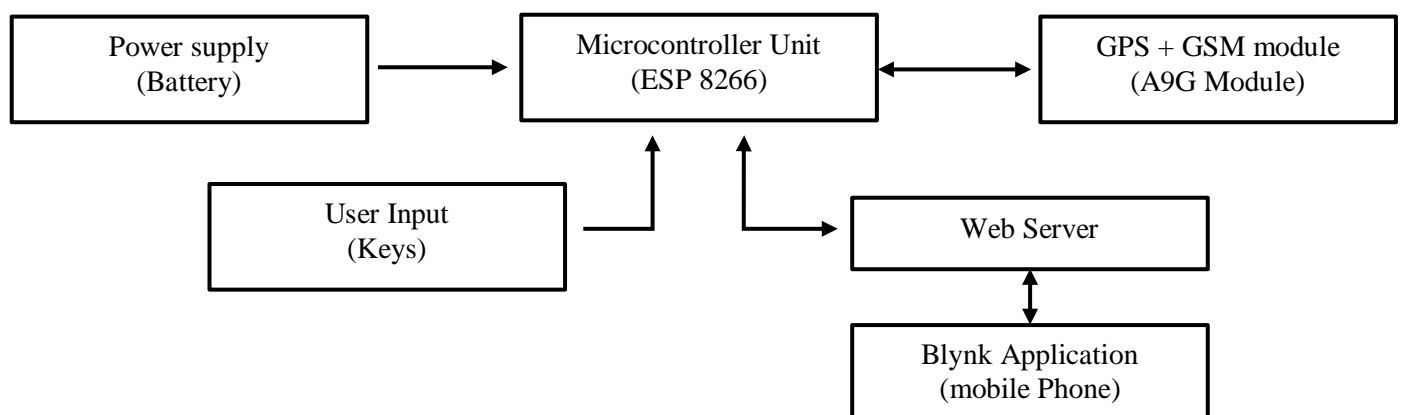
4. User Survey

A user survey was conducted to gather feedback on user preferences for the GPS tracker design. The survey included questions about design aesthetics, usability, durability, display preferences, and additional features. A sample of 7 users within the University premises participated in the survey. The survey questions and the answers are attached as Appendix.

Based on the user survey results, a modified functional block diagram and enclosure design were developed to better align with user preferences.

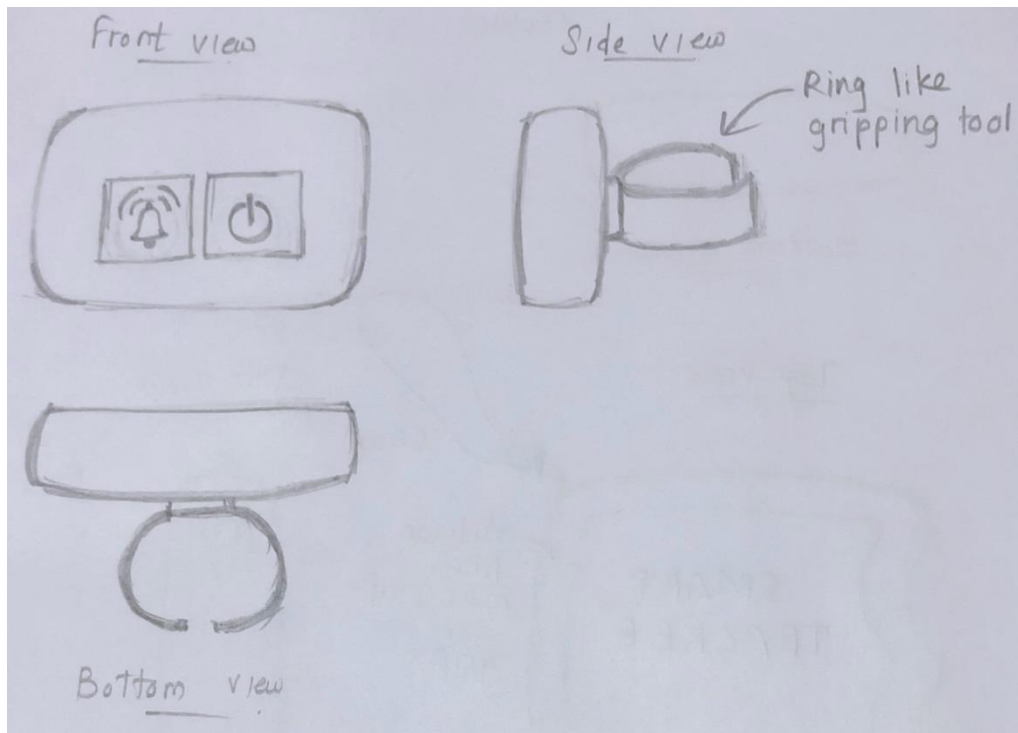
Modified Functional Block Diagram (Design 4):

The modified functional block diagram includes GPS and GSM modules combined to make the design more compact in align with the user feedback. The Microcontroller allows communication through Web server by Wi-fi connection which allows the user to view the GPS location through the Blynk application along with getting SMS notifications and Call alerts in the case of any emergency which was mentioned in the feedback received from the User Need survey. SOS button is used in the case of an emergency. The device is powered by rechargeable batteries to accommodate the user needs.



Modified Enclosure Design (Design 4):

Enclosure was designed in a compact manner with user friendly buttons for power and SOS alert. A gripping tool is added to accommodate the need raised for attaching the tracker onto a bicycle



5. Evaluation Criteria

To select the most suitable design, evaluation criteria were established for both the functional block diagram and the enclosure design. The criteria for each aspect are as follows:

Functional Block Diagram Criteria:

1. Accuracy: How accurately does the GPS tracker determine location?
2. Connectivity: How effectively does the tracker communicate with external devices?
3. Data Processing: How efficiently does the tracker process and analyze data?
4. Scalability: How well does the design accommodate future expansion or integration of new functionalities?
5. User Interface: How intuitive and user-friendly is the interface for interaction?
6. Power Efficiency: How effectively does the tracker manage power consumption?
7. Modularity: To what extent does the design allow for easy replacement or upgrade of individual components?

Enclosure Design Criteria:

1. Aesthetics: How visually appealing is the enclosure design?
2. Durability: How well does the design withstand impacts and environmental conditions?
3. Weight and Portability: How lightweight and portable is the design for convenient carrying and transportation?
4. User Safety: How well does the design address safety concerns, such as avoiding sharp edges or potential electrical hazards?
5. Ergonomics: How well does the design fit in the user's hand and allow easy interaction?
6. Attachment Options: How versatile are the attachment options for different use cases?
7. Manufacturing Cost: How economically viable is the design for mass production?

6. Design Evaluation and Selection

Functionality Design Selection Matrix:

	Design 1	Design 2	Design 3	Design 4
Criteria 1	7	7	7	9
Criteria 2	0	5	8	9
Criteria 3	8	8	8	8
Criteria 4	3	5	8	10
Criteria 5	9	5	5	6
Criteria 6	6	5	6	8
Criteria 7	5	6	5	5
Total	38	41	47	55

Enclosure Design Selection Matrix:

	Design 1	Design 2	Design 3	Design 4
Criteria 1	5	8	10	7
Criteria 2	7	7	6	7
Criteria 3	9	9	10	9
Criteria 4	10	10	10	9
Criteria 5	7	9	5	5
Criteria 6	3	7	6	7
Criteria 7	7	5	4	6
Total	48	55	51	50

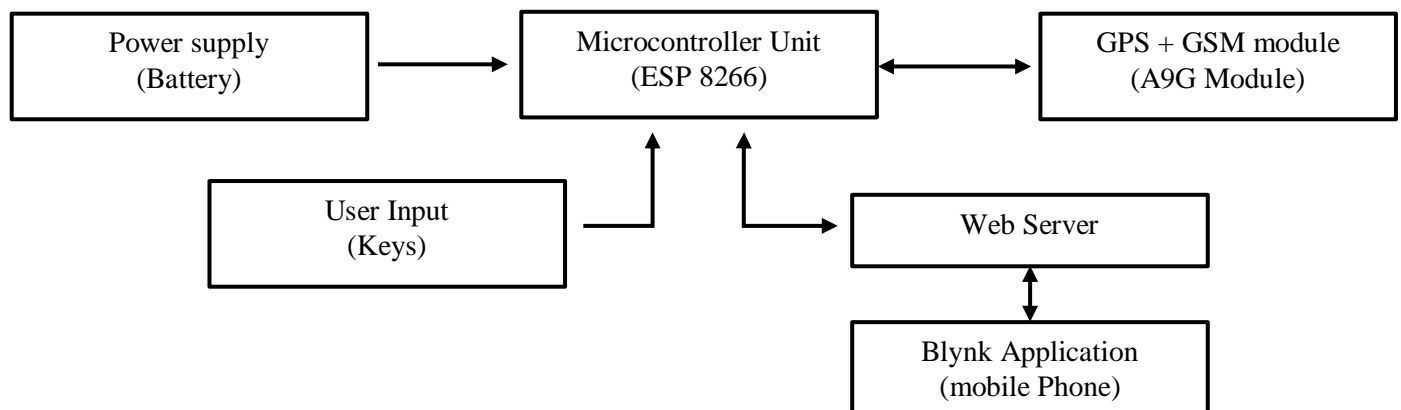
Design 4 for the functional block diagram and **Design 2 for the enclosure design** were selected as the most suitable options based on evaluation criteria.

7. Selected Design

According to the results of the selection matrices, the following designs were selected for the Functional block diagram and the Enclosure design to be implemented for the Preliminary design.

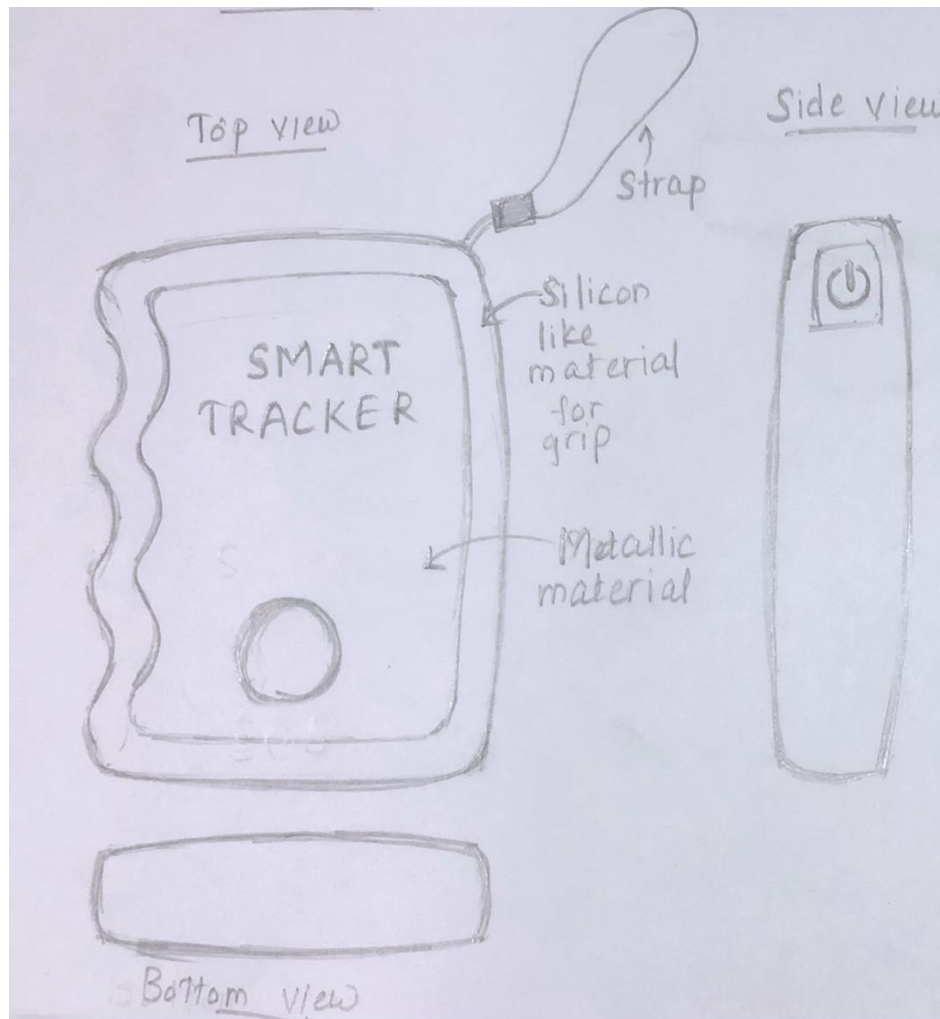
Functional Block Diagram

Design 4 received the highest scores across accuracy, connectivity, data processing, scalability, user interface, power efficiency, and modularity.



Enclosure Design

Design 2 received the highest scores in aesthetics, durability, weight and portability, user safety, ergonomics, attachment options, and manufacturing cost. It demonstrated a balanced approach, combining visual appeal, and user comfort.



8. Acknowledgment

The following is a list of the names and corresponding index numbers of my team members who made valuable contributions to the conceptual design during the brainstorming session.

Wikramanayaka R.S.D	200709K
Samaraweera D.T	200564J
Wanigathunga W.A.S.S	200693D
Wijerathna K.D	200722T
Mithushan K.	200398D
Kowrisaan S.	200312L
Wijesekara W.M.E.P.B.B.	200725F

9. Appendix

Survey Questions:

1. How often do you find yourself in situations where you need to track your location or the location of your belongings?
2. What specific activities or scenarios would you typically use a GPS tracker for?
3. What are the most important features or functionalities you look for in a GPS tracker?
4. Do you prefer a standalone GPS tracker device or a mobile app-based solution?

- How important is real-time tracking capability for you in a GPS tracker?
- What is your preferred method of accessing GPS tracking data (e.g., smartphone, web portal, SMS alerts)?
- Are there any specific environmental or terrain conditions that your GPS tracker needs to be able to handle effectively?
- How long would you expect the battery of a GPS tracker to last on a single charge?
- Are there any specific size or weight considerations for the GPS tracker that would be ideal for your needs?
- What is the price range that is affordable to you for a GPS tracker that provides your specified needs?

Answers:

① Name: Kaveeshwara Dayanath
Dep: EMTc

- Not that often
- There were couple of times when I switched my bag with brothers so if I can put a gps tracker it'll be easy to find
- Accurate location, battery life, real time tracking.
- Standalone
- It is essential
- web portal and sms data.
- Yes, Rain and it should work inside my bag
- At least 2 days or 3
- It should be small and not light
- Around 3000-4000

② Name: Rishi Zeen
Background: FD

- Sometimes
- To track my belongings, to track my location.
- Accuracy,
- Both, if I need to see my location
- Very important
- Smartphone, sms alerts, web portal, App
- Yes, fast travelling vehicles like uber when I travel to home.
- 1-2 days
- Yes it needs to be small and light.
- Rs 2000 around that

① Bijitha Liyanage
Department: CSE

- Somewhat often
- I like to hike and sometimes I find myself lost in rural areas. For that I would like if I can know my location
- Location should be accurate and signal strength should be pretty high.
- Standalone GPS tracker would be better since I can use it for when the phone is dead or mobile signal is not available.
- Very important.
- Smartphone or SMS alerts would be fine.
- Forests like environments should be included.
- 4-5 days
- Better if it was ^{less than} the size of a ~~hand~~ a mobile phone with a strap.
- About 5000.

② Name: Santhosh
Department: Mechanical.

- Pretty often
- I want to track my bike's location when I park it inside the campus.
- Accuracy, signal strength, Portable, Alerts if someone tries to move the bike.
- Mobile based so I can track using my phone.
- Not that important as long as I can track when I want to.
- SMS alerts or calls.
- Inside ground parking lots.
- 2-3 days
- About 200g and should be attachable to the bike
- About 2000-3000

Name: Sanjana Kaputkawa
Dept: Emtc.

- Somewhat often
- ~~At boarding~~ Track the my location by a friend when I'm going to my boarding place at night times.
- Alerts and SOS system. Accurate location.
- Mobile based solution
- Very important since my friend can track my location real time.
- SMS alerts, SOS button with a alert call.
- No.
- 1-2 days would be fine.
- About the size of a small portable with router.
- ~~2000-3000~~ 2000-3000

Name: Snuka Ampavila

Background: CCE

1. I think it's important, often.
2. ~~to~~ I'll keep a tracker in my laptop bag. My friend lost his bag in a bus. And it had his wallet, laptop, ~~and~~ a tablet and a person has taken it. Therefore, it's important to have one in our bags.
3. Real time tracking, accuracy, small enough to not be found.
4. Standalone
5. ~~is~~ highly
6. Smartphone and SMS, a app.
7. Nothing specific
8. At least 3 days
9. It should be small and light weight and should be able to fit into a bag.
10. Around 2000-3000

1. Often I need to track my bag and belongings.
2. Track location of Laptop when I leave it in library for some works.
Track my bag and belongs when I kept at counter area or common area.
3. Accurate. real time location track.
Compact.
Long battery life,
Secure and encrypted comm. channel for security.
4. mobile app based solution
5. It is very important.
6. Having a dedicated smartphone app is better to me.
7. It should be - handle both indoor & outdoor environment.
should provide accurate tracking even in - low signal areas in building and library.
8. 2 to 3 days
9. Should be light weight and portable & compact
It should designed to attach with laptop.
without adding bulk. weight.
10. 3000/- to 5000/-