



**EGE205  
CONNECT SYSTEM DESIGN PROJECT**

**EMA Smart Home System**

**PROJECT REPORT  
(GROUP 1)**

Braven Chiam, Benjamin Lee, Ong Zheng Xian, Tan Yong Rui,  
Joycelyn Wong  
242350F, 232350A, 242452R, 242509G, 241872D

## Part 1: Data Collection

Instruction:

- Identify targeted user group and design questionnaires for data collection.

### Targeted User Group

Note: Paste the image of your filled User Group Decision Matrix Table here.

	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	
CRITERIA DESCRIPTION	Reachable	Sizeable	Affordability to the user	Receptive to technology change	Perceptible user problems or needs	
	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	WEIGHTED SCORE
WEIGHT	10	10	10	10	10	50
PREFERRED USER GROUPS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
Team member 1: Zheng Xian Visually impaired individuals struggling to navigate public spaces independently.	4	5	5	4	8	260
Team member 2: Braven Households looking to enhance their quality of life and need support in managing their energy usage	9	9	8	8	8	420
Team member 3: Yong Rui Elderly individuals living alone with limited mobility and no caregiver, struggling with basic daily tasks at home.	6	7	6	3	9	310
Team member 4: Joycelyn Delivery riders(E.g Grab) facing delays and inefficiencies when picking up orders at busy restaurants.	6	6	7	7	6	320
Team member 5: Benjamin New parents overwhelmed by tracking baby feeding, sleep, and medical appointments.	7	6	6	6	8	330

## **Questionnaires**

- 1) What type of housing do you live in?
- 2) How many people live in your household?
- 3) What area of your home do you face the most challenges in (e.g., security, monitoring, energy usage, convenience, comfort), and could you kindly elaborate on the specific issues?
- 4) What is your average monthly utility bill (including electricity, water, gas)?
- 5) What are some challenges you face when trying to control your utility usage (e.g., checking bills, understanding usage)?
- 6) What challenges do you face in controlling or reducing your household's energy consumption?
- 7) If there is a simple system to help monitor and reduce your electricity usage, what features would you like to see included?
- 8) Do you currently use any smart home devices? If so, what are the devices?
- 9) If yes, what challenges have you faced when using these smart home devices?
- 10) What would motivate you to use a smart home system?

## Part 2: Data Management, Interpretation and Analysis

### Instruction:

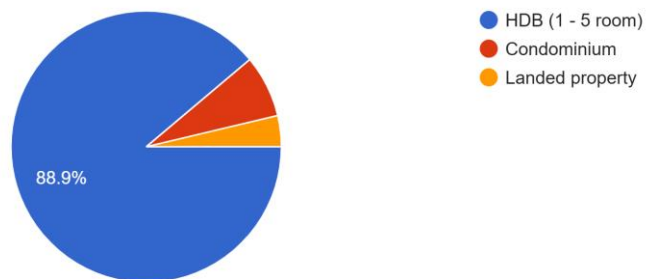
- Perform data management activities on collected data such as data integration, cleansing and transforming using graphical representation.
- Create a user persona by performing data analysis and interpretation on the collected data using either qualitative or quantitative methods or both.

### **Data Graphical Representation**

#### **Target user**

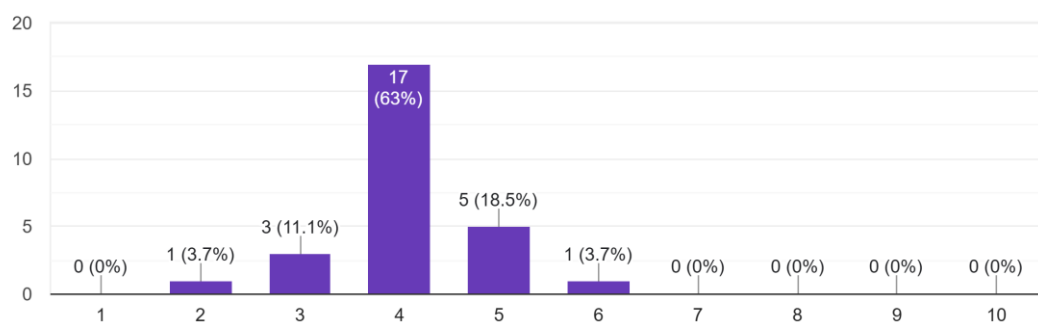
1) What type of housing do you live in?

27 responses



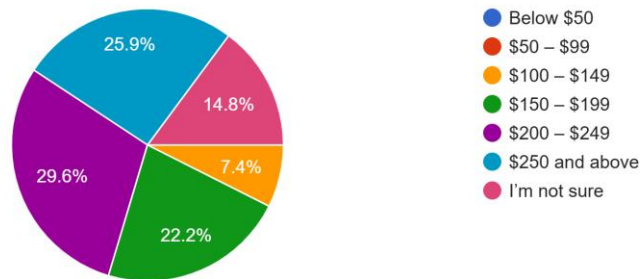
2) How many people live in your household?

27 responses



#### 4) What is your average monthly utility bill (including electricity, water, gas)?

27 responses



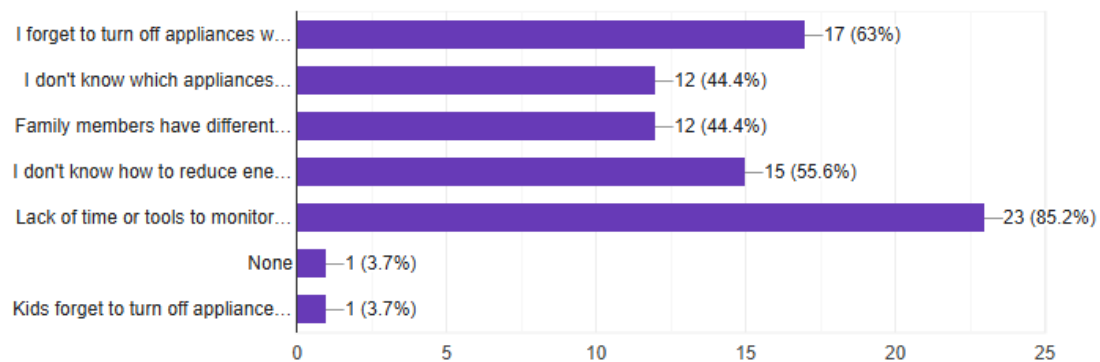
From the survey results, we filtered the data by focusing specifically on the average respondents who live in HDBs flats and have an average monthly bill of \$100 and higher. We also observed that majority of the respondents have around 4 people living in their household. This helps use better understand the utility consumption habits of a typical HDB household of medium size. By narrowing our data in this way, we ensure that our analysis reflects the most common living situations and provides more accurate insights into the average utility costs for the general population.

### Insights

 [Copy chart](#)

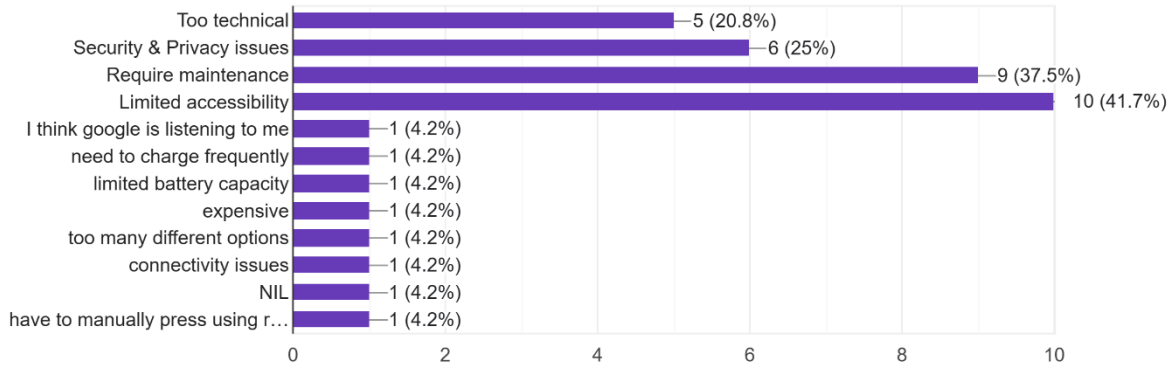
#### 6) What challenges do you face in controlling or reducing your household's energy consumption?

27 responses



9) If yes, what challenges have you faced when using these smart home devices?

24 responses

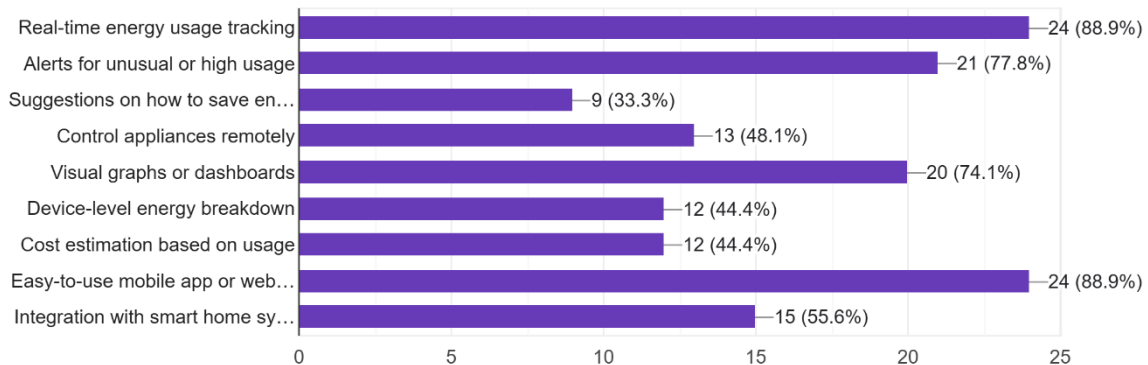


First, we aimed to identify users' pain points regarding energy consumption at home. Our findings revealed that the most common issues are forgetting to turn off appliances (63%) and lacking the time or tools to effectively monitor energy usage.(85.2%) We also explored the challenges users face with existing smart energy systems. The most frequently mentioned problems include limited accessibility (41.7%) and the need for regular maintenance (37.5%). Additionally, 25% of respondents expressed concerns about privacy and security, while 20.8% found smart home technology overly complex. These insights highlight the need for a user-friendly and accessible smart energy system that emphasizes simplicity, efficiency, and trustworthiness.

**Users' Desired Smart Home Features & Motivations:**

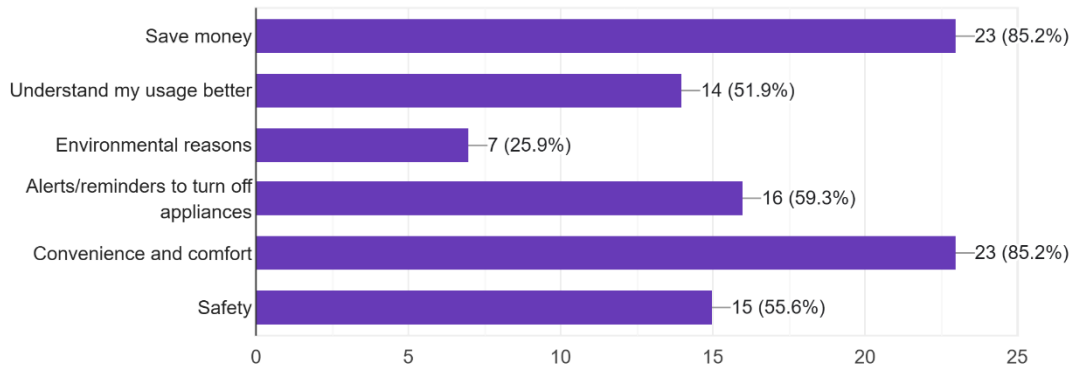
7) If there is a simple system to help monitor and reduce your electricity usage , what features would you like to see included?

27 responses



### 10) What would motivate you to use a smart home system?

27 responses



We wanted to ensure that users felt their opinions truly mattered and had the opportunity to provide meaningful input. To achieve this, we offered a set of predefined options along with an open field where they could suggest additional features not included in our selections. The responses varied significantly from person to person, with no clear consensus emerging. Based on this, we prioritized features that we believe would deliver the greatest overall value to users. These include real-time energy usage tracking, an easy-to-use mobile web interface for appliance control, integration with existing smart home systems, device-level energy breakdown, and visual graphs or dashboards. To further understand what would drive users to adopt smart home systems, we asked about their motivations. The most common reasons were saving money and improving convenience and comfort, both selected by 85.2% of participants. Other strong motivators included receiving alerts or reminders to turn off appliances (59.3%), enhancing safety (55.6%), and gaining better insights into personal usage habits (51.9%).

## User Persona



### Biography

Jason, 44 years old from Singapore recently moved into a new HDB flat with his wife. He Works in tech and enjoys convenience and automation. Since both Jason and his wife work demanding jobs, they have little time to manage small household tasks and are therefore looking for smarter ways to maintain their home efficiently. He is also environmentally conscious and wants to play a part in reducing his carbon footprint as well as reducing his electrical bill.



### Personal Details

- Name: Jason Chiam Yong Lee
- Age: 44
- Gender: Male
- Nationality: Singaporean
- Marital Status: Married



### Personality & Motivations

- Tech savvy
- Practical
- Environmentally conscious
- Seeks convenience and automation
- Values safety & efficiency



### Goals & Interests

- Reduce electricity consumption
- Monitor household energy usage in real-time
- Maintain a safe and secure home
- Automate repetitive tasks
- Environmentally-friendly house



### Frustrations

- High electricity bill
- Devices left on when one is home
- Manual tracking of energy usage is time-consuming



### Likes

- Dashboard showing monthly energy consumption
- Automatic switching off devices when rooms are unoccupied
- Real-time home environment monitoring
- Smart security notifications
- Integration of all systems into one control panel

## Part 3: Idea Generation and Evaluation

### Instruction:

- Generate a list of ideas by applying ideas generation tools or techniques.
- Evaluate the list of ideas and select 1 idea to work on by using the decision matrix table.
- Design the system block diagram of the selected idea and indicate the team member responsible for each block.

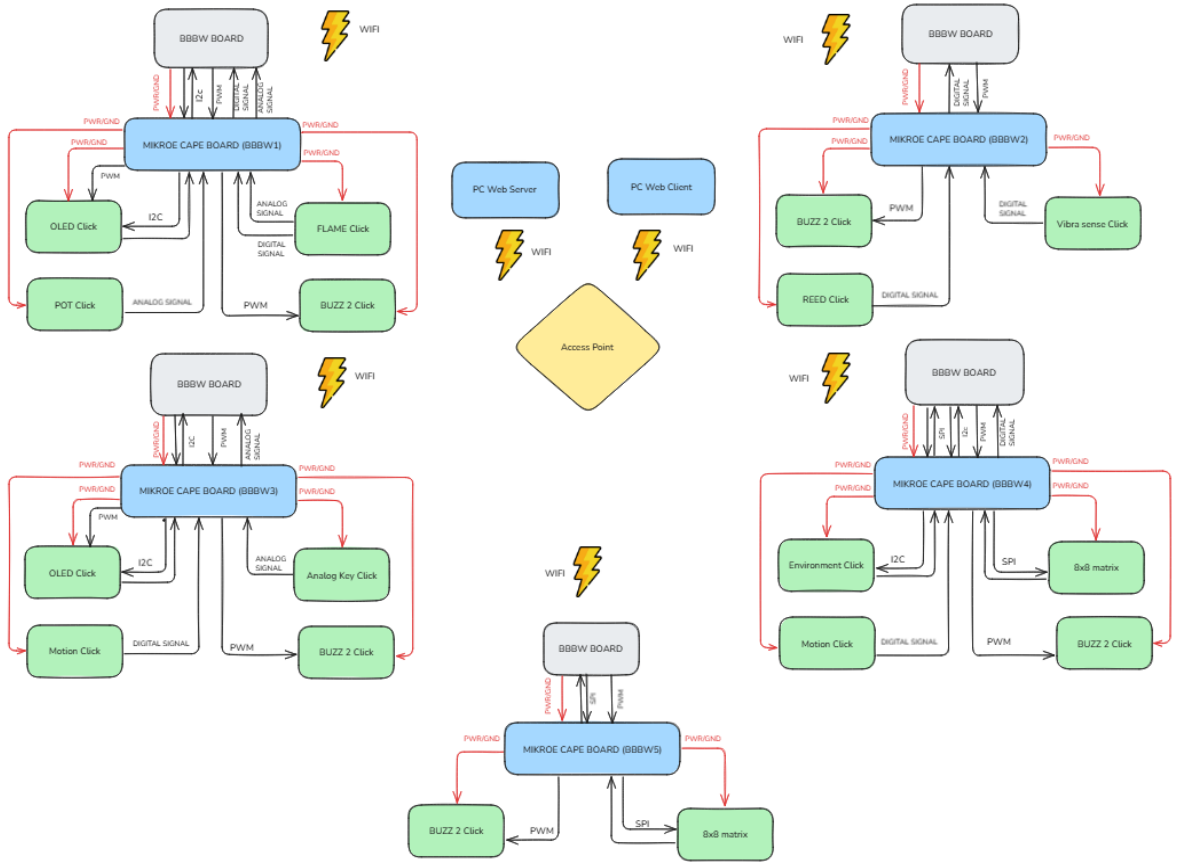
### **List of Ideas (Smart home)**

- Smart indoor climate control system
- Smart toilet with water-saving features
- Smart doorbell with live monitoring
- Ambient light adaptive system
- Mobile app for push notifications
- Energy scheduling & tracking dashboard
- Water usage monitoring & shower timer
- Intruder detection & fire safety system
- Automated appliance disconnection
- Smart shower timer system
- Occupancy-based energy management
- AI-driven energy coaching assistant

## Evaluated and Selected Idea

	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	
CRITERIA DESCRIPTION	Realistic	Ease of Implementation	Relevant to target user	Affordable	Scalability	
	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	WEIGHTED SCORE
WBGHT	4	4	5	4	3	20
PREFERRED USER GROUPS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
Team member 1: Zheng Xian A smart system that automates indoor climate control while simultaneously monitoring and optimizing energy usage based on real-time conditions and user preferences.	5	5	5	3	5	92
Team member 2: Yong Rui A lighting system that uses ambient light sensors to detect the level of natural sunlight entering the room and automatically adjusts the brightness of indoor lights accordingly	5	4	4	4	2	78
Team member 3: Braven A mobile app that sends scheduled push notifications to remind users to turn off lights, unplug chargers, or switch off appliances.	5	4	5	4	4	89
Team member 4: Joycelyn A basic wall-mounted device or mobile app that allows users to set timers for appliance of choice, choosing start and end times, and duration of use then displays usage data on a simple dashboard for management	5	5	3	4	3	80
Team member 5: Benjamin Intruder detection system to tackle security issues and Fire detection sytem for safety around the house	5	4	3	3	2	69

# System Block Diagram



csdp4

## Part 4: Project Development Plan

### Instruction:

✓ Formulate a project development plan by using Action Plan and Gantt Chart.

#### **Project Title:**

Energy Smart Connected Homes

#### **Project Description:**

This project aims to create a smart connected home system that reduces energy wastage while improving the quality of life for homeowners. With Singapore striving toward net-zero carbon emissions by 2050, households are increasingly facing the challenge of managing their energy needs effectively. This system addresses that challenge by lowering household energy demand, reducing dependence on fossil fuels, and promoting a more sustainable way of living, all while helping homeowners enhance their comfort and gain better control over their energy usage without compromising convenience.

At the core of our solution is the Energy Monitoring and Actioning (EMA) system, a platform designed to monitor and control energy usage across different household appliances. This system connects multiple smart devices to automate various tasks while providing homeowners with real-time information and control. Through a centralized dashboard, users can view live data such as their rate and total energy consumption in kilowatt-hours, as well as environmental conditions within their home. The dashboard also allows users to control devices remotely and customize actions, such as setting alerts when energy use exceeds a certain threshold or even cutting power to appliances automatically.

The system is designed to optimize energy use in several ways. It monitors energy consumption in real time and sends alerts when usage exceeds predefined limits. Motion sensors detect human presence, turning off lights and fans when rooms are left empty for too long. In the bathroom, a shower time management feature lets users set a time limit, displaying a countdown on an OLED screen and automatically turning off the water heater when the time is up, reducing unnecessary energy use. In addition to energy optimization, the system includes several safety and security features. A vibration sensor detects knocks at the main door, acting as an alert to notify the user if someone is at the door, for instance, if there is a delivery and the user did not hear the doorbell or knock, while a reed sensor monitors entry points to detect potential intrusions, triggering alarms and sending alerts to the homeowner. A flame sensor in the kitchen provides early fire detection, sounding alarms across all nodes and notifying the user through the dashboard.

The EMA system's modular design allows for easy installation and future upgrades by swapping sensors instead of replacing entire boards, ensuring long-term usability and minimizing electronic waste. Overall, this smart home system provides a practical solution for reducing household energy use, improving safety, and enhancing daily living, helping homeowners take an active role in creating a more sustainable future.

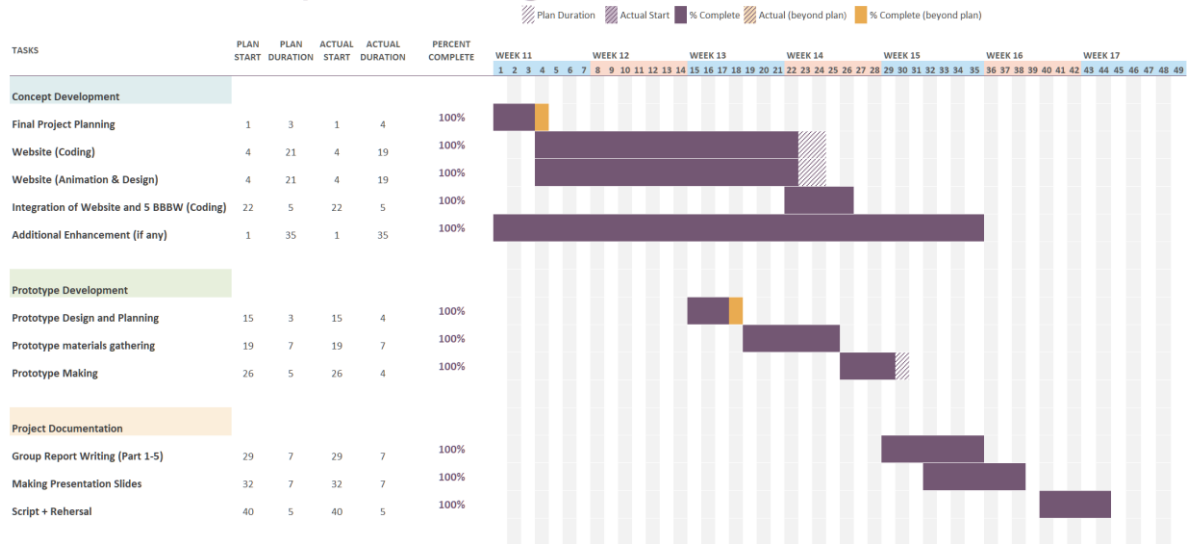
#### **Action Plan**

Task Description	Estimated Duration	Required Resources	Responsible by
Group Report (Part 1-5)	1 week	Canva, MS Word	Zheng Xian, Joycelyn, Yong Rui
Website (Coding)	3 weeks	VScode(HTML, CSS, Javascript)	Braven
Website (Animation & Design)	3 weeks	VScode(HTML, CSS, Javascript)	Braven
Integration of Website and 5 BBBW (Coding)	1 week	5 Beagle boards, Clickboards, Cloud9, Python	Joycelyn
Prototyping (Design & Planning)	2 days	OnShape	Zheng Xian & Yong Rui
Prototyping (Materials & Development)	2 weeks	3D Printer, Duct tape, Blu tack	Zheng Xian & Yong Rui
Additional Enhancement (if any)	The whole project duration (6 weeks)		All members
Making Presentation Slides	1 week	Canva, Power point	All members
Script + Rehearsal	4 days	Power point, Zoom	All members

# Gantt Chart

Note: Paste the image of your filled Gantt Chart here.

## Gantt Chart (1 July 2024 - 17 Aug 2025)

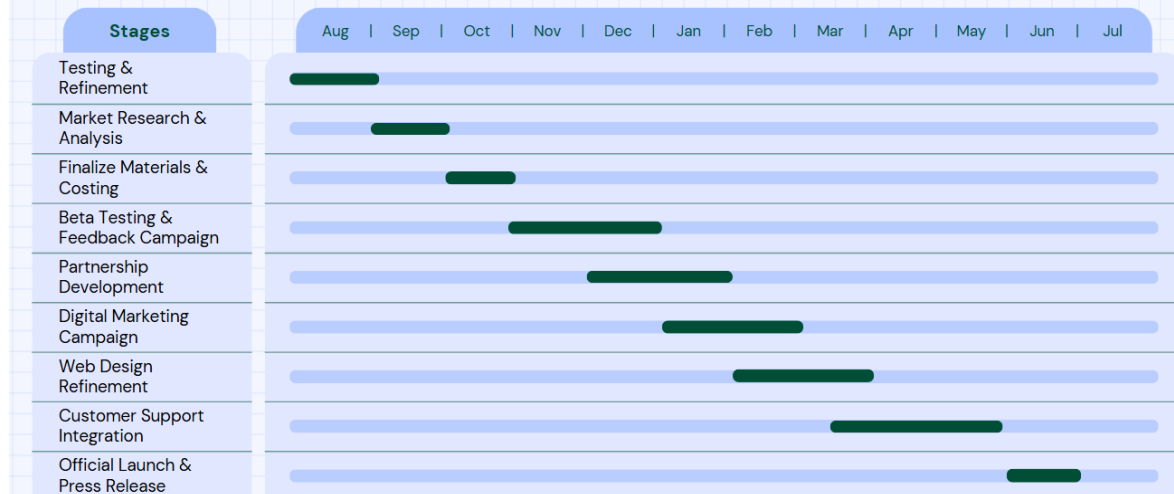


## Part 5: Project Deployment Plan

### Instruction:

✓ Formulate a project deployment plan with key milestones by considering the availability of the resources needed.

# Product Launching Plan



### 1. Testing & Refinement

Conduct comprehensive testing on all system components, including sensor accuracy, wireless communication reliability, and the dashboard interface. This phase ensures the energy automation logic functions as intended and refines the user experience before wider deployment.

### 2. Market Research & Analysis

Study market trends and analyse consumer behaviour to identify primary user group, such as eco-conscious homeowners, tech-savvy individuals, and families concerned about safety and utility costs. These insights will inform marketing strategies and feature prioritization.

### 3. Finalise Materials & Costing

Based on testing results, finalize the selection of materials and hardware components to ensure durability, performance, and affordability. Calculate production costs, refine the pricing strategy, and confirm the bill of materials for scalable manufacturing.

### 4. Beta Testing & Feedback Campaign

Deploy the system to a group of beta users across different home environments. Collect feedback through structured surveys, interviews, and performance data to identify usability issues, unexpected bugs, or hardware weaknesses for final improvements.

### 5. Partnership Development

Engage with e-commerce platforms (like Amazon, Lazada, Shopee), local retail chains, and smart home service providers. Explore collaboration opportunities for bundling, installation services, or platform integration to extend market reach.

### 6. Digital Marketing Campaign

Launch a promotional campaign focusing on the system's energy-saving features, safety functions, and ease of use. Leverage social media, content marketing, influencer outreach, and teaser videos to build awareness and interest before the launch.

## 7. Web Design Refinement

Refine the interface and user journey on both the website and mobile/web apps. Integrate helpful features like video tutorials, FAQs, system status indicators, and onboarding guides to support users and enhance usability.

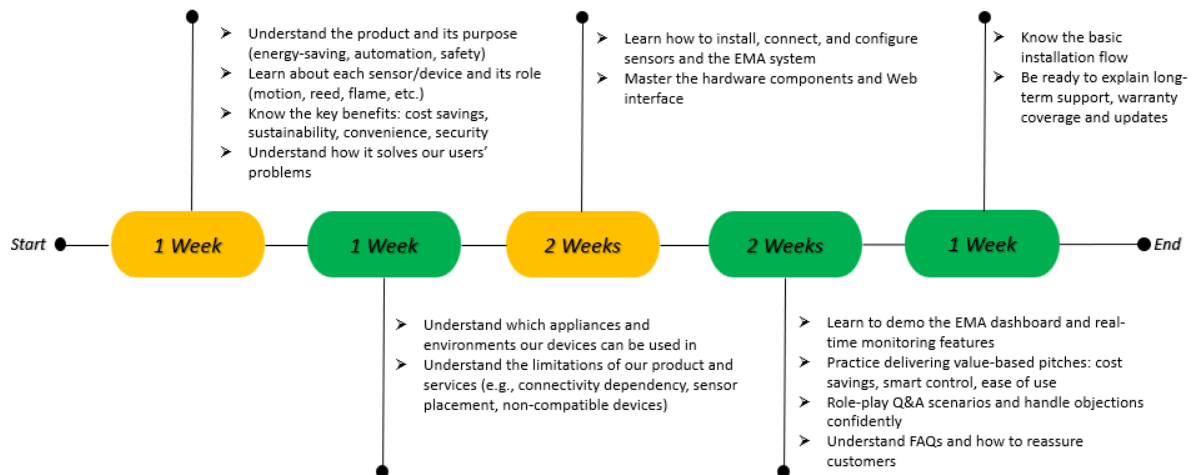
## 8. Customer Support Integration

Develop a scalable customer service system including live chat, email support, chatbot help, and a firmware update delivery mechanism. Establish protocols for issue tracking, warranty handling, and collecting user feedback post-launch.

## 9. Official Launch & Press Release

Kick off the full product launch with mass production, a formal press release, and coordinated marketing. Make the product available on major platforms and through strategic partners, supported by media coverage and promotional offers to boost visibility and adoption.

### Product Knowledge Training Plan



### Product Maintenance & Support Plan

- ✓ Warranty coverage: 3 Years for all core IoT devices and sensors
- ✓ System-related issues:
  - Dispatch technician for on-site diagnosis and basic resolution
  - If unresolved, device is sent back for evaluation
  - If confirmed faulty due to wear/defect, provide 1-to-1 replacement
- ✓ Network/dashboard issues:
  - 24/7 remote support via system dashboard
  - If hardware fault is identified, refer to maintenance workflow
- ✓ Firmware & app support:
  - Provide updates via OTA (Over-the-Air) system
  - Update notes and support guides published on web/app interface

### **Marketing Plan**

To launch the Smart Connected Home System, we will partner with green-tech initiatives and energy agencies. The campaign will feature the theme "Smart Living, Greener Future", encouraging users to take charge of their household energy use.

Key campaign elements:

- Home Energy Challenge: Participants receive a weekly task (e.g., reduce 10% energy use, set motion-based automation)
- Gamified Rewards: Completing tasks unlocks rewards like smart plug add-ons, vouchers, or sustainable home goods
- Social Sharing: Users can share energy savings on social media with a campaign hashtag to boost reach
- Workshops & Demos: Pop-up booths in malls or tech fairs to showcase real-time EMA system functionality

[Video Demonstration Link](#)