



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

Faculty of
Computing

REPORT: DESIGN THINKING PROJECT SMART WINDOW

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Introduction

Background

Design thinking is an approach to critical thinking that uses design, innovation, and teamwork to solve problems. Design thinking involves several stages, including empathy, definition, ideation, prototype, and testing. Each of these procedures contributes significantly to the result. Any remaining phases could have a negative effect and lead to issues.

Big data and artificial intelligence (AI) are closely connected, with big data providing the foundation for AI systems. Big data consists complex datasets created from sources like social media, online transactions and smart devices. AI uses this data to mimic human intelligence, allowing machines to learn, make decisions and solve problems.

Problem Statement

Traditional windows often fail to adapt to shifting environmental conditions and varying user preferences. By combining big data and AI to a window we can provide a solution, Smart Window: Winding Your Life Up that focuses on these shortcomings to create a better and safer environment.

Objective

The objective of this project is to create a smart window that implemented big data and artificial intelligence that adapts to environmental conditions and user preferences. Another key objective is to apply the design thinking methodology to thoroughly understand user needs, ideate creative solutions, and develop and test prototypes.

Design Thinking Process: Empathy

For the empathy process, we used three methods to gather information about window problems:

1. **Interviews:** We spoke with three students from Kolej Tun Dr Ismail who had expressed their concerns about the issues they faced. Below is the question and answers from the interview session:

Persona 1: Hudzaifah (19 years old)

Question: Do you have any problem that you facing lately with your window?

Answer: When I lived here, sometimes I was scared to open the window because when I opened the window for a while, I found out the monkey had entered my room and stolen all of my food.

Persona 2: Danish (19 years old)

Question: Do you have any problem that you facing lately with your window?

Answer: Actually, I rarely stay in my room and often forget to close the window before going outside. Sometimes the weather is unpredictable, especially on a rainy day, the rainwater enters my room and the floor becomes wet.

Person 3: Harith (19 years old)

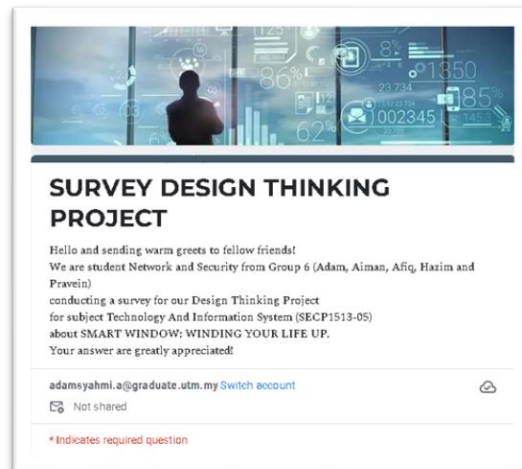
Question: Do you have any problem that you facing lately with your window?

Answer: I always open the window at night because my room is quite hot. When I tried to sleep, there must be a mosquito or insect that interrupts me. It makes me feel uncomfortable and unable to sleep.



2. **Surveys:** We created a survey with questions about window problems and to understand the challenges better. We distributed the survey among students in Universiti Teknologi Malaysia (UTM) from various colleges. We managed to collect 50 responses in one week. Below are the questions and answers that we got from the surveys.

(Link: <https://forms.gle/Xngg6vXkEoJozk278>)



3. **Observations:** We noticed that many areas in Malaysia face flooding issues. To help with this, we included a feature in our design to stop floodwater from getting into houses through the windows.

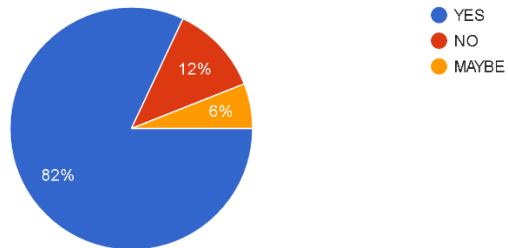
(sources: <https://www.malaymail.com/news/malaysia/2025/01/12/flood-crisis-deepens-in-johor-with-3449-victims-other-states-remain-unchanged/162910>)



The Question & Answers from The Survey

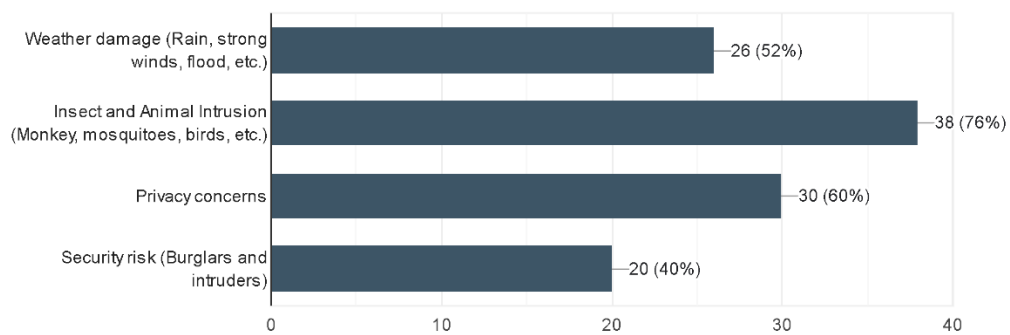
Do you have trouble with your window?

50 responses



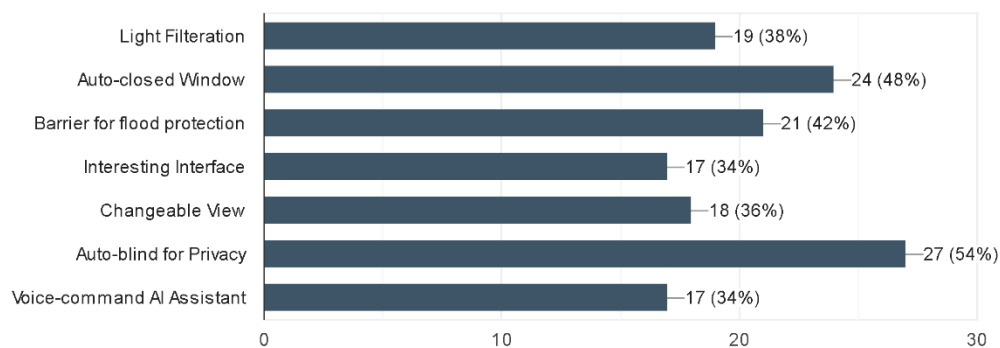
Do you face any of this problem? (You may tick more than one) //You can put another answer in other option!

50 responses



What kind of features you would like to have on your window? (Choose 2 only)

50 responses



Design Thinking Process: Define

Through the empathy phases, we can define the problems that we are going to solve. Below are the problems that we determined after we did the interview, surveys and observations:

1. Insects and Animal Intrusion

Dealing with insects and animals entering through windows is a common problem, especially in areas that expose to the wildlife. Small pests like mosquitoes and flies can be irritating, while animals like monkeys or birds can create a mess or cause damage. To address this, a solution is needed that keeps insects and animals out while still allowing fresh air and natural light to come in.

2. Security Risks (Intruders and Burglars)

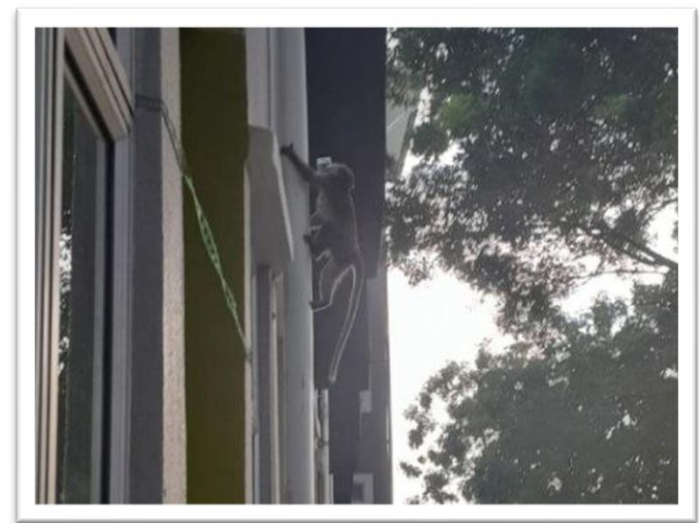
Traditional windows can make homes and building easy to break in by burglars and intruders. Weak locks or open windows can provide easy access, putting people and their belongings at risk. A more secure window design with added features like alarms or motion sensors can help protect against these threats and give peace of mind.

3. Privacy Concerns

In crowded neighborhoods, lack of privacy is a major concern. Regular windows don't always block the view from outside, which can make people feel uncomfortable in their own homes. A window that can switch between transparent and full blind offers privacy features is important to ensure personal comfort while letting the light in.

4. Weather Damage (Rain and Flood)

Heavy rain and floods can cause water to get through windows, damaging property and creating inconvenience. This is especially common during storms or in areas that high-risk for flood. A window system that includes barriers to block water can help prevent such damage and keep homes safe during bad weather.



Design Thinking Process: Ideate

We gathered in groups and brainstormed lots of great idea to produce our prototype during this ideate phase. The materials used to create the smart window prototype were chosen with sustainability and accessibility in mind, as most of them are recycled or easily available. Below are the functions and the materials for the smart window:

Functions and Features

1. Privacy Mode

The smart window is designed with an adjustable shade feature, allowing users to switch between transparent and full pitch black. This ensures complete privacy when needed, whether for personal activities or preventing outsiders from looking in.

2. Smart Sensors

Equipped with advanced sensors, the window monitors environmental factors such as temperature, humidity, light intensity, and air quality. A standout feature is its heat imaging sensor, capable of distinguishing between humans and animals, which is particularly useful for preventing false alarms or unauthorized access.

3. Solar Power Integration

The smart window includes embedded solar panels that collect sunlight to generate renewable energy. This energy powers the window's smart features, reducing usage of electrical power sources and contributing to energy efficiency.

4. Customizable View

Users can personalize the window's appearance by changing its view to suit their preferences, such as displaying calming landscapes or vibrant cityscapes. This feature allows for a more dynamic and enjoyable experience, particularly for rooms with unappealing or obstructed views.

5. **Automatic Flood Barrier**

During floods, the smart window activates a built-in barrier system to prevent water from entering the house. This feature is especially useful in areas that high-risk with flood, offering homeowners peace of mind and reducing potential property damage.

6. **Light Filtration**

The window intelligently adjusts its tint and transparency based on the time of day and the amount of light and heat entering the room. This not only enhances comfort but also reduces glare and minimizes energy consumption for cooling.

7. **Interactive Interface**

The window features a digital display that shows useful information such as notifications, the current time, and weather updates. This eliminates the need for additional gadgets or devices, as the window itself becomes a functional interface.

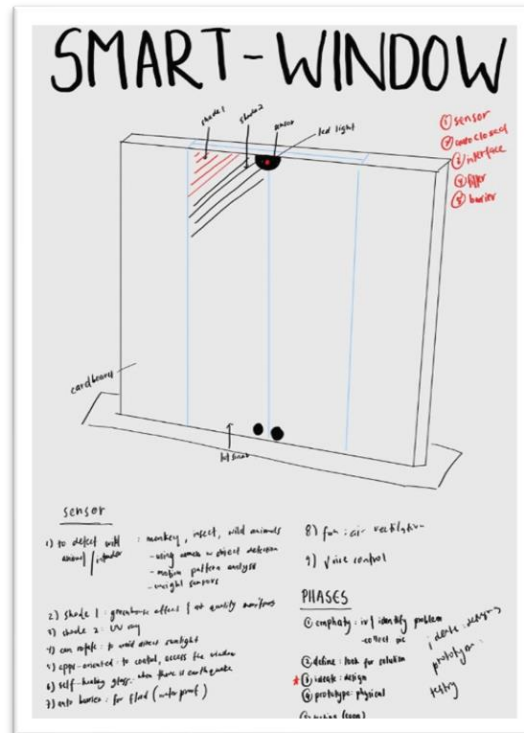
8. **Voice-Controlled AI Assistant**

The smart window includes a built-in AI assistant that allows users to control its features with voice commands. Tasks like adjusting shade, changing views, or checking weather updates can be performed hands-free, making the window highly convenient.

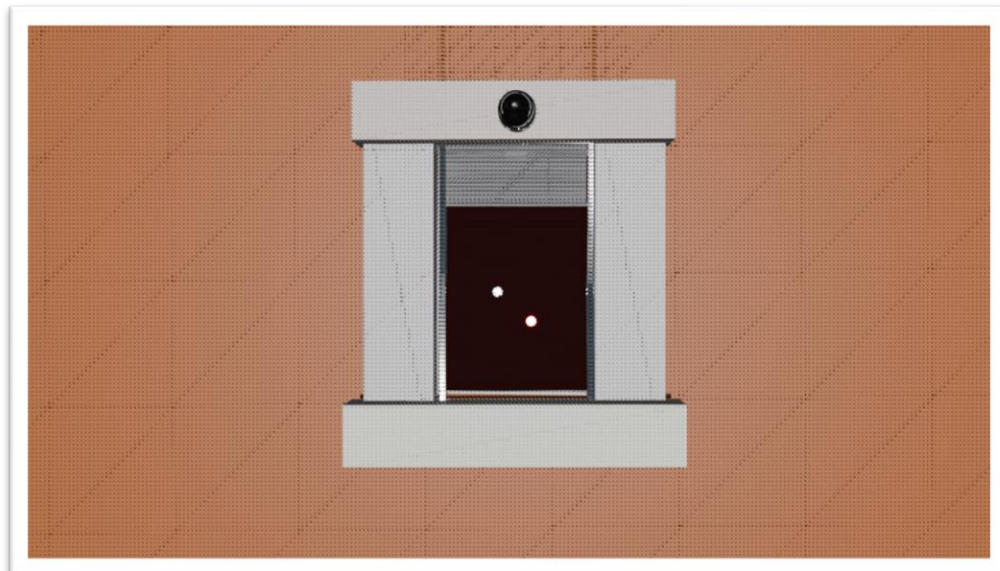
Materials

1. Cardboard
2. Paper
3. Scissor
4. Hot Glue Gun
5. Tennis ball
6. Velcro Tape
7. Magnet
8. Marker Pen
9. Cutter

First Draft



3D Blender



Design Thinking Process: Prototype

After brainstorming and collecting information, we produce our own Smart Window prototype alongside with an app to enhance user experience as below:



Interesting Interface



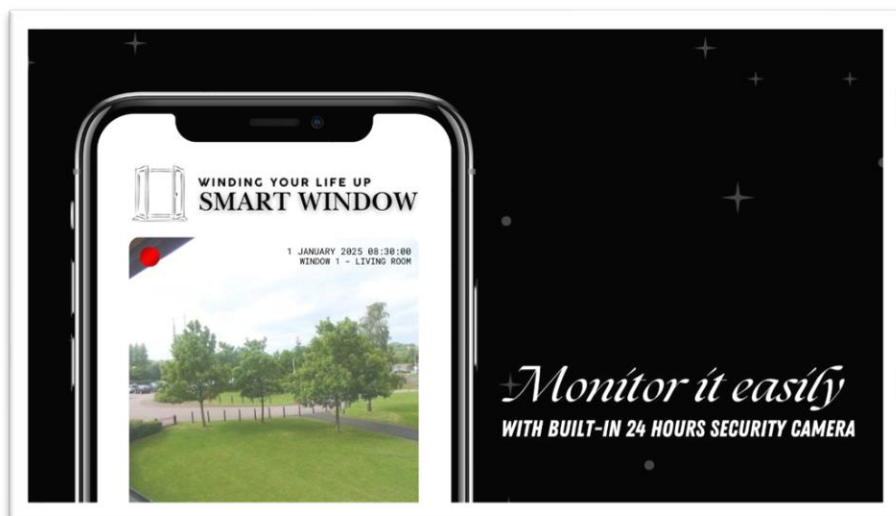
Adjustable Shade

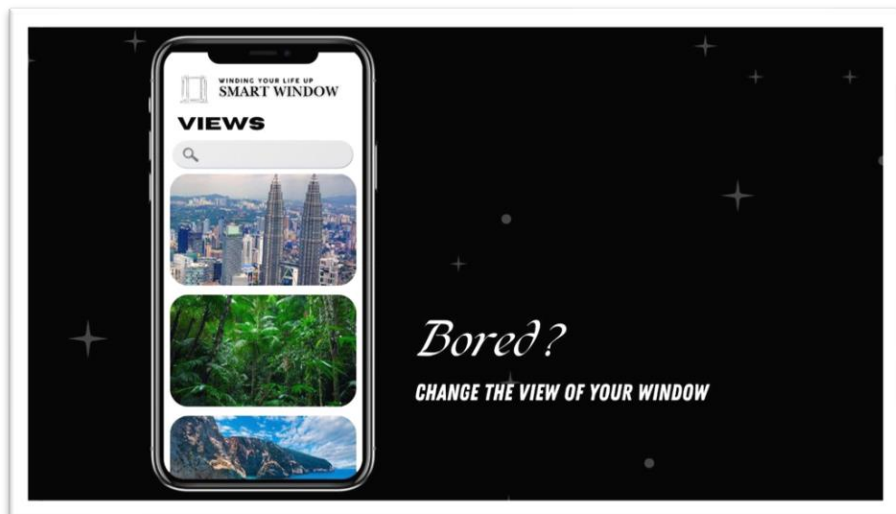


Auto Closed Window



Automatic Flood Barrier





Design Thinking Process: Test

For the last process in design thinking, we ask the students that we interviewed in empathy phases to test our prototype and gather their helpful feedback.

“With its cutting-edge technology and multiple sophisticated functions, the smart window is a wonderful product. The auto-close feature, which keeps monkeys out of my room, is my favourite feature! I would rate this product a 5/5 overall because it is flawless and fixes almost all issues.”

Hudzaifah, 19 years old.

“This product is very incredible! I adore the app feature, which is useful for someone like me who is constantly out of the room. In comparison to the traditional window used in our home, this product has a lot more functions, so I give it an overall rating of 4.8 out of 5. However, it would be excellent if lighter materials were used to lessen the weight.”

Danish, 19 years old.

“This product is amazing! I firmly believe that this product should be installed in every home since it can deal with a wide range of issues that individuals encounter. The hydraulic barrier, which can be useful during floods, is my favourite feature! I give it a five out of five because it is impeccable in every way.”

Harith, 19 years old.

Reflection

What is your goal/dream regarding your course/program?

- Adam : My dream is to achieve required knowledge about network and security to become a skilled cybersecurity, capable of safeguarding networks with ease and efficiency.
- Afiq : My goal is to become a skilled cybersecurity professional, effectively solving problems and ensuring the protection of networks, systems, and data with precision and efficiency.
- Aiman : I aim to establish myself as a top cybersecurity professional, skilled in countering cyber threats and staying ahead of cybercriminals by developing innovative solutions.
- Hazim : My goal is to pursue a career in cybersecurity because I am fascinated by how it works and the challenges of protecting systems and networks.
- Pravein : My goal in this program is to acquire the knowledge and abilities that will be needed in the field of computer science in the future, as well as to improve my social skills.

How does this design thinking impact on your goal/dream regarding your program?

- Adam : This design thinking process enhances my problem-solving skills and creativity, which are essential for a career in cybersecurity. By applying these techniques, I can anticipate security threats and design effective, user-centered solutions.
- Afiq : The smart windows we developed integrate the Internet of Things (IoT), which has significant implications for network security. By studying these devices, I can identify common vulnerabilities in IoT, understand their functionality, and gain hands-on experience in securing similar devices.
- Aiman : This project focuses on how AI is used on the Internet of Things (IoT), a technology that is becoming more important. In cybersecurity, it's important to keep learning about new technologies like AI to help prevent cybercrimes.
- Hazim : This design thinking process helps me imagine how the world might change in the future. It also shows me what things I'll need to protect as technology develops.
- Pravein : Design thinking helps me develop creativity and gain the knowledge needed to create a product. It also allows me to learn through each stage, improve my social skills, and gain valuable experience for future work.

What is the action/improvement/plan necessary for you to improve your potential in the industry?

Adam : I plan to enhance my cybersecurity knowledge and stay updated on emerging threats. I will also gain practical experience and build a professional network.

Afiq : I plan to focus on mastering networking basics, which are essential for identifying and fixing security issues. I will also stay updated on new cyber threats, as they constantly evolve, to protect networks effectively.

Aiman : I plan to expand my cybersecurity knowledge by studying relevant topics and staying updated on trends. I will also follow tech news on social media and websites to stay informed about emerging challenges.

Hazim : I aim to deepen my cybersecurity knowledge by studying advanced topics and practicing coding. I also plan to apply my skills in real-world scenarios through internships or job experience.

Pravein : I plan to improve my knowledge of network security and practice with cyber ranges and CTF events. Additionally, I will strengthen my programming skills, especially in Python, for automation and penetration testing.

Team Roles and Responsibilities

Member's Name	Task
Adam	Write the project report and make sure it matches the goals.
	Lead the ideate phase, guiding the team to come up with creative ideas.
	Lead the prototype phase, making sure the prototype is developed and improved.
Afiq	Build the prototype by making a physical model based on the design.
	Choose the right materials needed for the prototype.
	Oversee the prototype phase to ensure it meets the project's needs and is tested properly.
Aiman	Create 3D models using Blender to show what the design will look like.
	Help with building and testing the prototype.
	Make sure the 3D models follow the project's design requirements.
Hazim	Interview users to learn about their needs and get their feedback.
	Record everything that happens during the project, noting important activities and decisions.
	Edit the project video alongside Pravein.
Pravein	Help the user to test the prototype to see how well it works.
	Work with Hazim to edit the project video and make sure it's clear and easy to understand.
	Help film and create video content to show the project's progress.

Conclusion

To sum up, this project proved how big data and artificial intelligence can be combined to create a smart window system capable of adjusting to both user preferences and environmental changes. Through the design thinking methodology, we thoroughly explored user needs, brainstormed innovative ideas, and developed a functional prototype. Each phase of the design thinking process, from empathy and defining problems to ideation, prototyping, and testing, played an important role in the project's success. By understanding user experiences and challenges with traditional windows, we were able to identify the problem for improvement. This provides us lots of valuable insights into how emerging technologies can transform everyday products and solve modern challenges.

Supplementary Materials

- Slide Presentation:

https://www.canva.com/design/DAGbiqLQffw/d2PdUfukecAVy_eH1fJs_Q/edit?utm_content=DAGbiqLQffw&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton

- Project Video

<https://drive.google.com/file/d/1RFGU7is7RaSVROxLeNV07OdvXII6V3bJ/view?usp=sharing>