Smart Curtain Document

FlexShade

Aim of the Smart Curtain System

- Aim of the Smart Curtain System:
- Let's you control curtains from anywhere, set timers, and adjust based on weather conditions—saving energy, increasing security, and improving comfort

Smart Curtain Hardware and software

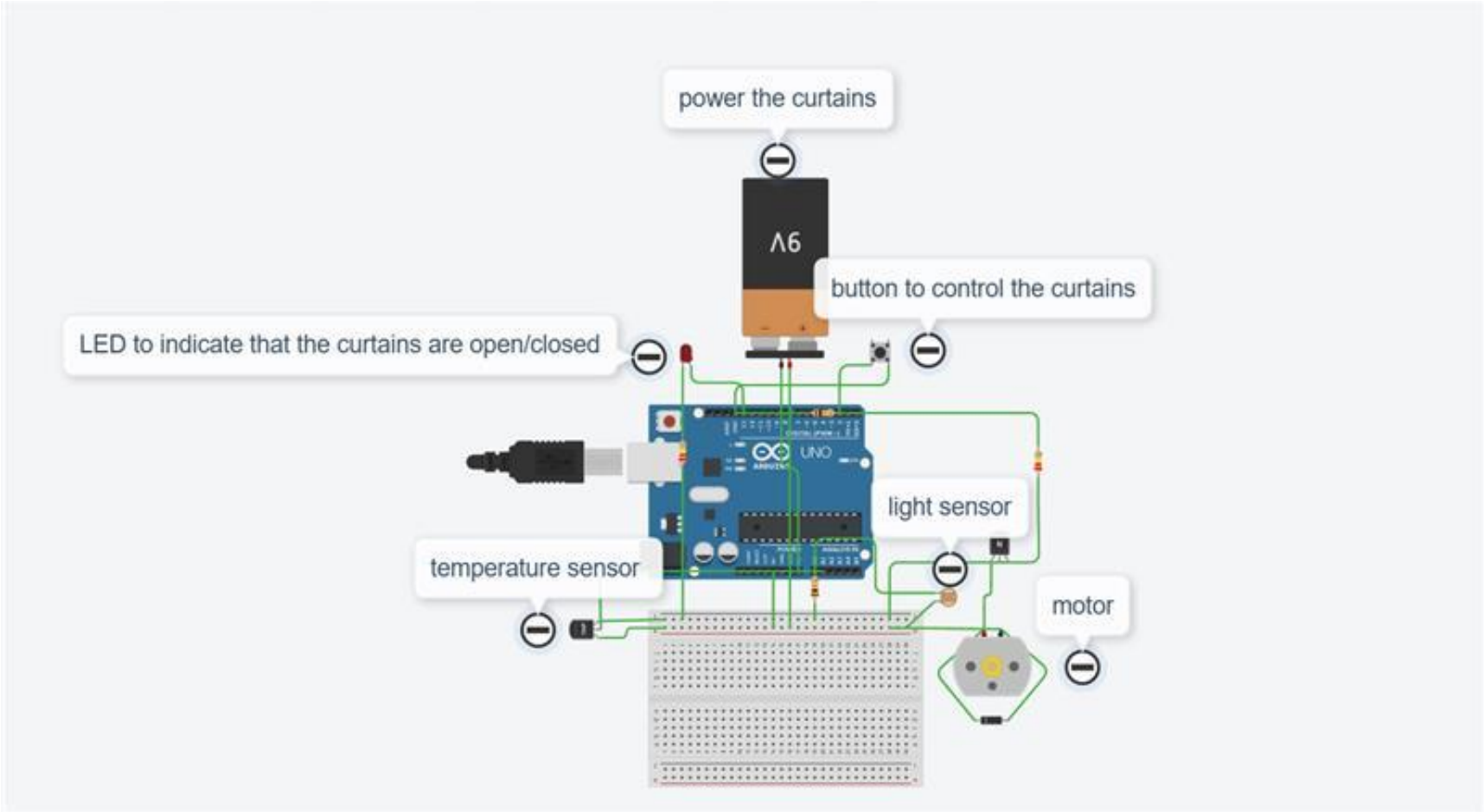
Hardware Components

Component	Quantity	Price	Supplier
Arduino Uno	1	16.64	cpc Farnell
Light sensor	1	7.75	cpc Farnell
Stepper Motor	1	29.50	cpc Farnell
Temperature sensor	1	5.43	cpc Farnell
Humidity Sensor	1	5.20	cpc Farnell
Breadboard	1	2.50	cpc Farnell
Jump wires	15	4.50	Cpc Farnell

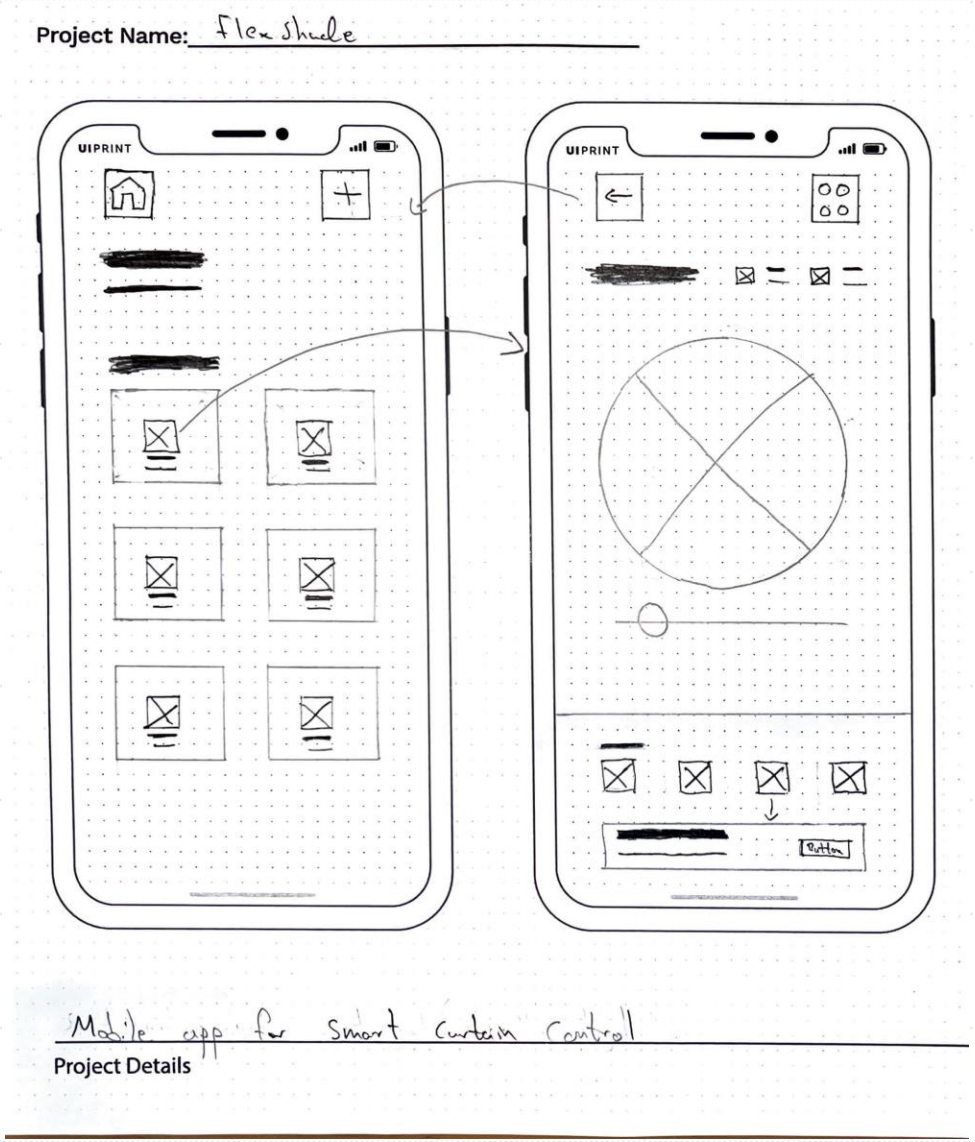
Software Components

- Arduino IDE
- Mobile App

Design Diagram



Wireframe for App



Inputs and expected outputs

Test ID	Action/Input	Purpose	Expected Result	Actual Result
T1	Varying light levels (bright, dim, dark)	Ensuring the curtain open and closes at the correct levels of light	Curtain adjust accordingly open in dim light close in bright light.	
T2	Motor control open and close partial movement command	Ensures the curtain moves correctly to the specified position	The DC motor should rotate in one direction	
T3	Temperature Sensor	Reading different temperature	Curtain adjust to help regulate the room temperature	
T4	Mobile App control test	Open and closing from the mobile app	Curtain responds correctly	
T5	Voice commands, through connected virtual assistant	Allow communication through the smart assistant for performing operations (open and close	Curtain responds accurately to voice instructions	

Continuation Test Case

Test ID	Action Input	Purpose	Expected Result	Actual Result
T6	Set security schedule for different times	For opening and closing curtains at different times	Curtain opens and close automatically at programmed times	
T7	Weather-based adjustment test	Adjust the curtain based on weather conditions (cold , moderate, hot)	When it's cold Curtains open to let in sunlight for warmth, when its moderate curtain remain in their default position, when its hot curtain close to block the heat and keep the room cool	
T8	Power Failure Test	Ensure system resumes operation after a power loss	System should resume operation from the last known state after power restoration	

Continuation Test Case

Test ID	Action Input	Purpose	Expected Result	Actual Result
T9	Safety Test – Obstacle detection	Ensure curtain stops if obstructed by an object	Curtain stops automatically if an obstacle is detected in its path	
T10	Manual Override	Ensure users can operate the curtain manually if needed	User can manually open or close the curtain at any time, regardless of automation settings	
T11	Curtain Response Time	Test the time it takes for the curtain to open/close	Curtain should respond within a specified time frame (e.g., 3 seconds) after a command	
T12	Environmental Sensitivity Test	Test curtain's sensitivity to surrounding environmental conditions (light, temperature)	Curtain adjusts appropriately when environmental conditions change (e.g., lighting intensity, temperature)	

Project Timeline

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https://www.vertex42.com/ExcelTemplates/simple-gantt-chart.html

Project Start: Mon, 17/02/2025

Display Week: 1

TASK	ASSIGNED TO	PROGRESS	START	END
Project Meeting				
Create a List of Main Resources	Saad Mikidam	100%	17/2/25	18/2/25
Design Diagram	Kyamni Coote/Abraham Sharkey	100%	17/2/25	20/2/25
Test Plan	Saad Mikidam	100%	17/2/25	21/2/25
Project Plan	Tuhin Miah	100%	17/2/25	22/2/25
Risk Register	Abraham Sharkey	100%	17/2/25	25/2/25
Project Meeting Video				
Write video script	Whole team	100%	26/2/25	1/3/25
Record voiceovers	Whole team	100%	26/2/25	1/3/25
Edit video	Harley Cooper	100%	26/2/25	2/3/25
Submit project video	Whole team	100%	26/2/25	3/3/25
Oppurtunistic Plan				
Product (defined offering)	Saad Mikidam	0%	4/3/25	24/3/25
Customer (target audience)	Tuhin Miah	0%	4/3/25	24/3/25
Market (competitors, adjacent product)	Saad Mikidam	0%	4/3/25	24/3/25
Operations (operational plans)	Kyamni Coote	0%	4/3/25	24/3/25
Team (skills and capabilities)	Harley Cooper	0%	4/3/25	24/3/25
Financials (sustainability, growth potential)	Abraham Sharkey	0%	4/3/25	24/3/25
Professional presentation	Whole team	0%	4/3/25	24/3/25
Construct, Demonstrate, and Exhibit MVP				
First prototype development	Whole team	0%	25/3/25	10/42025
App development	Whole team	0%	25/3/25	20/4/25
Initial Testing	Whole team	0%	25/3/25	15/5/25
Complete prototype	Whole team	0%	25/3/25	22/5/25

Risk Register

Hazard	Priority	Likelihood	Impact Score (1-5)	Control Measure	Mitigation
Sensor malfunction (temperature/light)	High	Medium	4	Use high-quality sensors and perform regular calibration	Have a backup manual control option
Mechanical failure (motor issues)	High	Medium	5	Use durable components and test extensively	Design for easy repair or replacement
Safety concerns (curtain entanglement/obstruction)	High	Low	5	Implement safety sensors and auto-reverse features	Emergency stop mechanism
Software bugs or failure	High	Medium	4	Thorough testing and regular software updates	Provide a fallback manual mode
Teamwork issues & miscommunication	High	Medium	3	Set clear roles, schedule meetings, use collaboration tools (e.g., Teams)	Regular check-ins and a shared project timeline
Limited time & workload management	High	High	4	Break tasks into smaller milestones, track progress	Use time management tools
Damaged components during transport	High	Low	3	Use shock-resistant packaging and handle components with care	Inspect all components upon arrival and have spare parts available

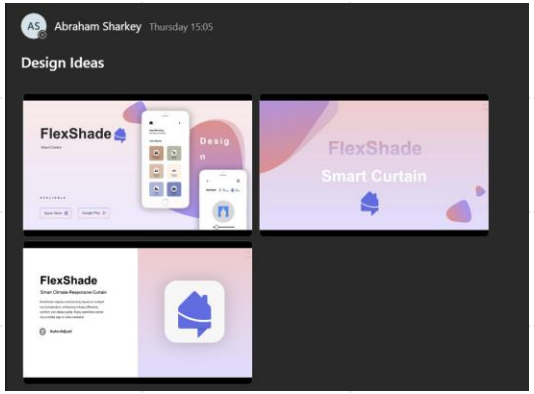
Risk Register (Continued)

Hazard	Priority	Likelihood	Impact Score (1-5)	Control Measure	Mitigation
Security & Privacy	High	Medium	5	Secure authentication protocols and data encryption	Implement robust security measures for IoT integration
Power failure	Medium	Medium	4	Use a battery backup	Ensure manual operation is possible
Connectivity issues (Wi-Fi/Bluetooth)	Low	Low	3	Test network reliability and offer multiple connectivity options	Provide a wired control option
Overheating of electronic components	Medium	Low	4	Ensure proper ventilation and use temperature-resistant materials	Monitor system temperature and include an automatic shutdown feature
Cost overrun	Medium	Medium	3	Budget planning and cost-effective component sourcing	Seek alternative suppliers if needed
Integration Issues	Medium	Medium	3	Ensure compatibility with popular smart home ecosystems	Test compatibility with common smart home devices
Lack of technical skills in the team	Medium	Medium	4	Assign tasks based on expertise and be willing to learn	Seek external help if necessary

Risk Register (Continued)

Hazard	Priority	Likelihood	Impact Score (1-5)	Control Measure	Mitigation
Conflicting ideas on project direction	Medium	Medium	3	Hold brainstorming sessions, document decisions	Keep a shared project roadmap
Supplier delays for components	Medium	Medium	3	Order in advance, have alternative suppliers	Maintain buffer stock for critical parts
Hardware Availability	High	Medium	5	Early sourcing of components and alternative suppliers	Plan purchases early, find multiple suppliers
Limited user adoption due to complexity	Low	Low	2	Focus on user-friendly design and simple setup	Offer tutorials and customer support
Minor Aesthetic Design Issues	Low	Low	1	Quality control checks during production	Inspect components for minor defects
Power Consumption	High	Medium	5	Optimize power usage for sensors and motors	Use low-power components, ensure energy efficiency
Environmental impact concerns	Low	Low	2	Use environmentally friendly materials where possible	Promote recycling and energy efficiency
Market Viability	Medium	Medium	3	Conduct market research to understand user requirements	Conduct market research, refine product features

Evidence


Abraham Sharkey Thursday 15:05
Design Ideas
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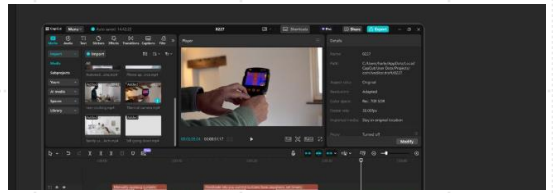
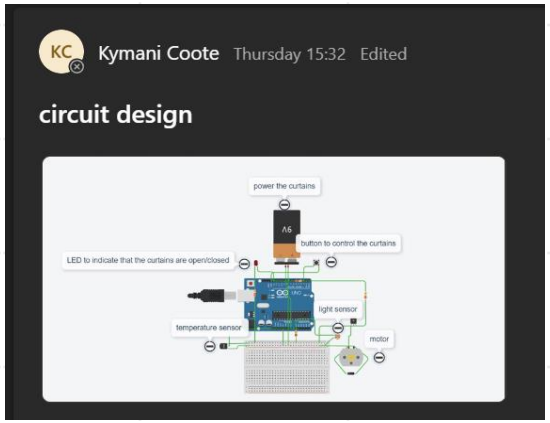
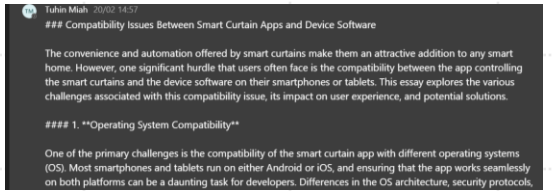
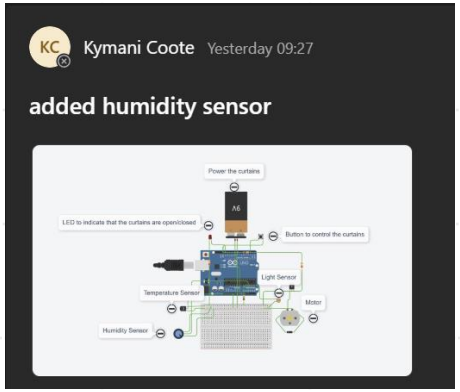
Desig
n
FlexShade
Smart Curtain
FlexShade

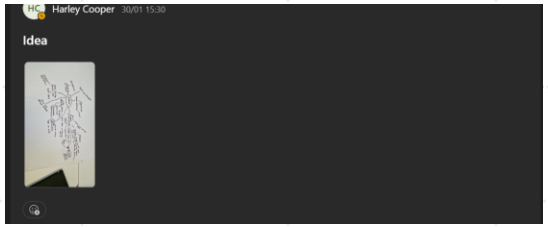



Smart Curtain Hardware and software
Hardware Components
Component
Quantity
Price
Supplier
Software Components


KC
Kymani Coote Thursday 15:32 Edited
circuit design
power the curtains
A6
button to control the curtains
LED to indicate that the curtains are open/closed
light sensor
temperature sensor
motor


Tuhin Miah 20/02 14:57
Compatibility Issues Between Smart Curtain Apps and Device Software
The convenience and automation offered by smart curtains make them an attractive addition to any smart home. However, one significant hurdle that users often face is the compatibility between the app controlling the smart curtains and the device software on their smartphones or tablets. This essay explores the various challenges associated with this compatibility issue, its impact on user experience, and potential solutions.
1. **Operating System Compatibility**
One of the primary challenges is the compatibility of the smart curtain app with different operating systems (OS). Most smartphones and tablets run on either Android or iOS, and ensuring that the app works seamlessly on both platforms can be a daunting task for developers. Differences in the OS architecture, security protocols,


KC
Kymani Coote Yesterday 09:27
added humidity sensor
Power the curtains
A6
LED to indicate that the curtains are open/closed
Button to control the curtains
Light Sensor
Temperature Sensor
Motor
Humidity Sensor


Harley Cooper 30/01 15:30
Idea

Problem Definition (Saad Mikidam):

- We are trying to solve a problem regarding the temperature control for the smart curtain. This requires detecting humidity and pressure so that the curtain knows when to open and close based on the weather. Additionally, the smart curtain will measure how hot or cold the weather is to react accordingly. For example, it will close when the temperature drops to retain heat.

Problem Definition (Abraham Sharkey):

- A smart climate-responsive curtain system can automatically adjust based on real-time temperature, sunlight exposure, and humidity levels to optimize indoor comfort, enhance energy efficiency, and prevent mold growth. By integrating AI and sensor technology with accessibility features like voice control or mobile app integration, this system offers effortless control for all users, including those with mobility impairments, promoting sustainable living and healthier indoor air quality.

Problem Definition (Harley Cooper):

- A big problem we are trying to solve is peoples sleep schedule, many people do not get the recommended amount of sleep due to various reasons, one of those is to do with not having a schedule. with our smart curtain, we can make a routine so that curtains close at a certain time every night, creating a schedule for the user so that they know it's time to sleep, this makes sure they are getting to bed the same time, and also saves them time by not having to go around and close all of the curtains manually, which takes time and can sometimes lead to laziness as they may not be bothered to do it

Problem Definition (Tuhin Miah):

- Smart curtains with weather detection offer energy savings and convenience, but adoption is slowed by low awareness, privacy concerns, and high costs. App compatibility issues with different devices and software updates also affect usability. Overcoming these challenges is key to better integration and user experience.

Problem Definition (Kymani Coote):

- Motorized window coverings have lagged other smart home technologies, offering only basic automation with limited intelligence, poor usability, and weak integration. Current systems fail to adapt to real-time conditions, optimize energy use, or provide a seamless user experience. A smarter solution is

needed—one that is intuitive, efficient, stylish, and fully integrated into the smart home ecosystem.

Final Problem Statement: The Disconnect Between Smart Home Potential and the Stagnation of Window Covering Solutions, Exacerbating Sleep Deprivation and Environmental Inefficiencies The modern home stands at a paradoxical crossroads. While smart home technology has revolutionized countless aspects of daily life, from lighting and security to entertainment and appliances, one critical element remains stubbornly stagnant: motorized window coverings. This stagnation creates a significant disconnect, hindering the realization of a truly intelligent and integrated living experience. This problem is further compounded by the growing epidemic of sleep deprivation, often exacerbated by poorly managed light environments, and the increasing urgency to address energy inefficiency and environmental concerns. The core issue lies in the stark contrast between the burgeoning capabilities of smart home technology and the underwhelming reality of current motorized window covering solutions. Existing systems, trapped in a paradigm of rudimentary automation, fail to capitalize on the true potential of a connected ecosystem. They offer only basic functionalities like pre-programmed schedules or simple remote control, lacking the real-time awareness and adaptability necessary for a truly smart home. This reactive approach, merely executing pre-set instructions, ignores the dynamic environmental factors that significantly impact comfort, energy efficiency, and overall well-being. Consider the inefficiencies of curtains closing on a bright winter day, blocking valuable solar heat, or remaining open on a sweltering summer afternoon, allowing excessive heat gain. Current systems lack the intelligence to discern these nuances, failing to consider real-time sunlight intensity, fluctuating temperatures, localized weather forecasts, and the precise position of the sun. This deficiency translates to missed opportunities for significant energy savings and optimized comfort. Furthermore, the problem extends beyond functionality into the realm of user experience. Current control mechanisms are often clunky, unintuitive, and fragmented, requiring users to navigate complex mobile applications, contend with unreliable voice control, or rely on cumbersome remote controls. This disjointed experience hinders seamless interaction and frustrates users. The initial setup itself can be technically challenging, requiring specialized knowledge or professional installation, further adding to the cost and complexity. This barrier to entry prevents widespread adoption and deprives users of the full potential of smart window coverings. Beyond functionality and usability, the problem encompasses aesthetics and design. Motorized curtain systems often involve bulky and unattractive hardware that clashes with carefully curated interior design schemes. Noisy motors and limited fabric choices further detract from the ambiance of the home. Homeowners are forced to compromise between convenience and visual harmony. Moreover, current systems often neglect critical considerations such as energy efficiency, security, and accessibility. Many systems consume significant power, even when idle, contributing to unnecessary energy waste. They fail to optimize curtain positioning for maximum energy efficiency, such

as maximizing natural light in winter and minimizing heat gain in summer. This lack of focus on sustainability is a significant problem. Similarly, the security of connected devices is often overlooked, leaving smart curtains vulnerable to hacking and unauthorized control. Finally, accessibility for users with disabilities is frequently neglected, with limited control options and complex interfaces. This problem is not isolated to general home comfort. It directly exacerbates the growing issue of sleep deprivation. The human body's circadian rhythm, regulated by light exposure, is disrupted by inconsistent and suboptimal sleep routines. Existing curtain solutions fail to provide the automated light regulation necessary to support healthy sleep-wake cycles. Individuals struggle to achieve the natural transition from darkness to light and vice versa, leading to difficulty falling asleep, fragmented sleep, reduced sleep quality, and difficulty waking up. This lack of environmental control further compounds the negative impact of artificial light and inconsistent schedules on sleep. Moreover, the problem extends to the broader context of indoor environmental quality. Modern airtight homes, while energy-efficient, can trap moisture and pollutants. Traditional curtains, when closed, further impede airflow, creating stagnant air and increasing humidity. This humid environment, combined with dust and allergens, provides ideal conditions for mold growth, posing a significant risk to occupants, especially those with pre-existing conditions. The core problem, therefore, is multifaceted and interconnected. It's not just about automating the opening and closing of curtains; it's about creating a truly intelligent, integrated, and user-centric system that seamlessly blends functionality, aesthetics, security, accessibility, sustainability, and promotes healthy sleep patterns. Current solutions fall short on all these fronts, creating a significant gap in the smart home ecosystem and hindering the realization of a truly connected and intelligent living experience. This gap represents the core problem that this project seeks to address: the need for a smart curtain system that bridges the disconnect between smart home potential and the stagnation of window covering solutions, ultimately improving sleep quality, energy efficiency, and overall well-being.