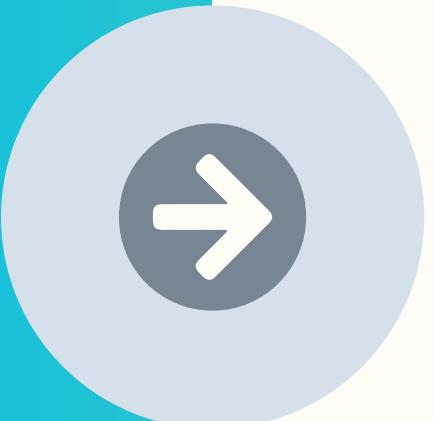
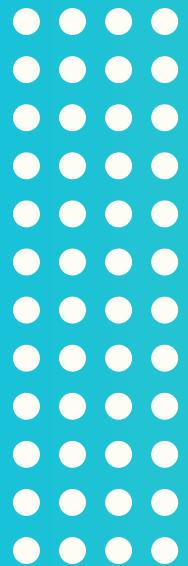


11/19/2024



**Smart Light for
Smart Tenants**

PROFESSOR

Dr. Juurong Hsieh

GROUP 2

Tulin Ece Ozcetin

Xuan Mai Tran

Maria Ruiz Urdaneta

Mohamad El Helou



Roles:

Team Leader: Tulin

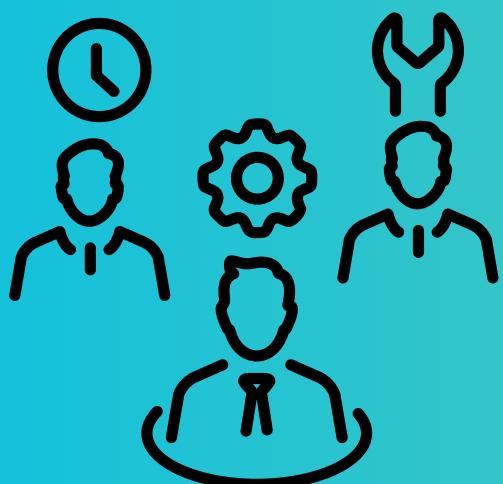
Technical Writer: Mai

Prototype: Maria, Mai, Tulin

Presentation: Everyone

Poster: Mohamad, Mai

Data Collector: Everyone



Introduction



Renters in Texas

Over 4M renters, 90% earn under \$30K, spending 30% of income on rent and utilities (Texas Tribune, 2024).



Energy Burden

40% of low- to moderate-income Texans can't afford electricity; 50% struggle with monthly bills (TEPRI, 2024).



High Costs

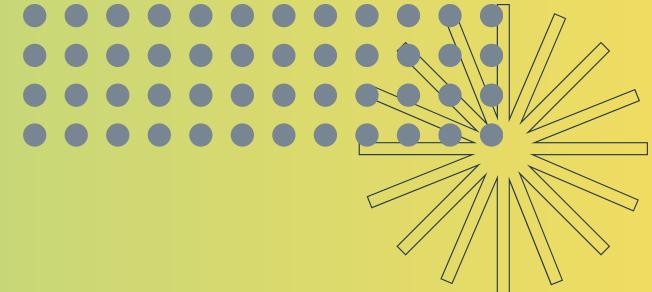
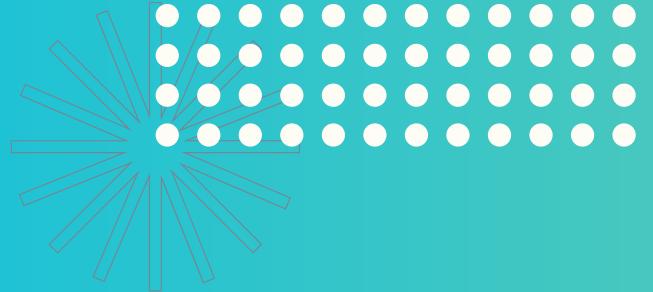
Texas energy rates are 14% above the U.S. average. ([EIA], 2024)



Solution

Energy-efficient lighting can reduce costs and support vulnerable households.

Problem Statement



This project aims to create an affordable, standalone smart lighting system for Texas renters, reducing energy consumption and electricity costs with a user-friendly, easy-to-install design suitable for shared tenancy conditions, while enhancing security through non-technology-based connections.

Affordable



User-Friendly



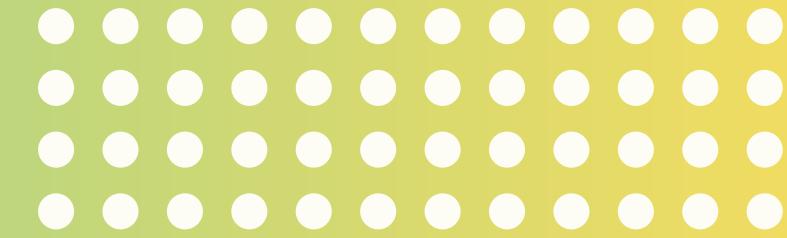
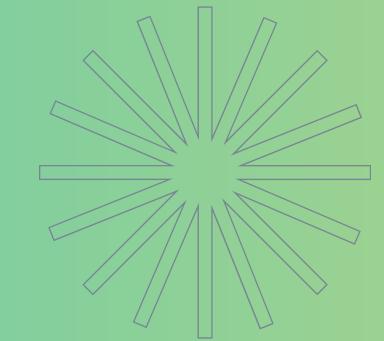
Easy-to-install



Secure



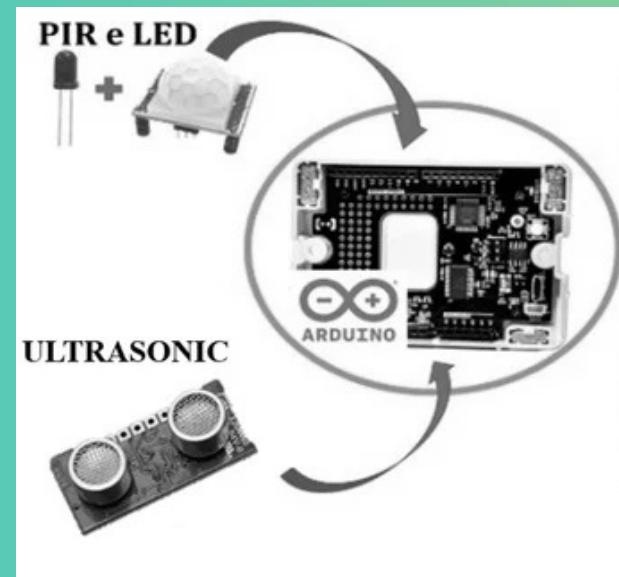
Recommendation



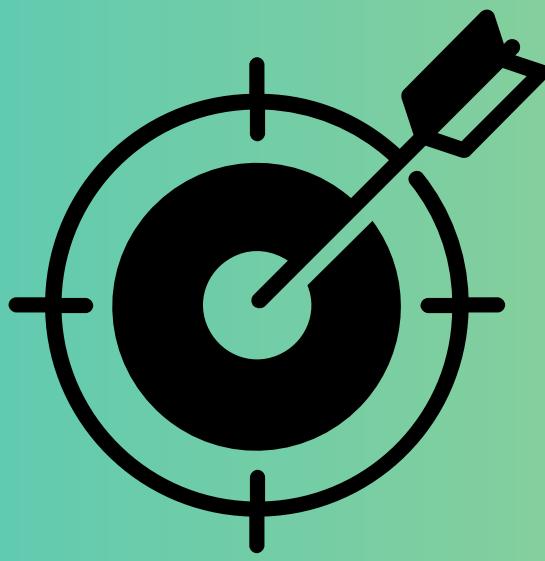
SMART LIGHTNING
SYSTEM



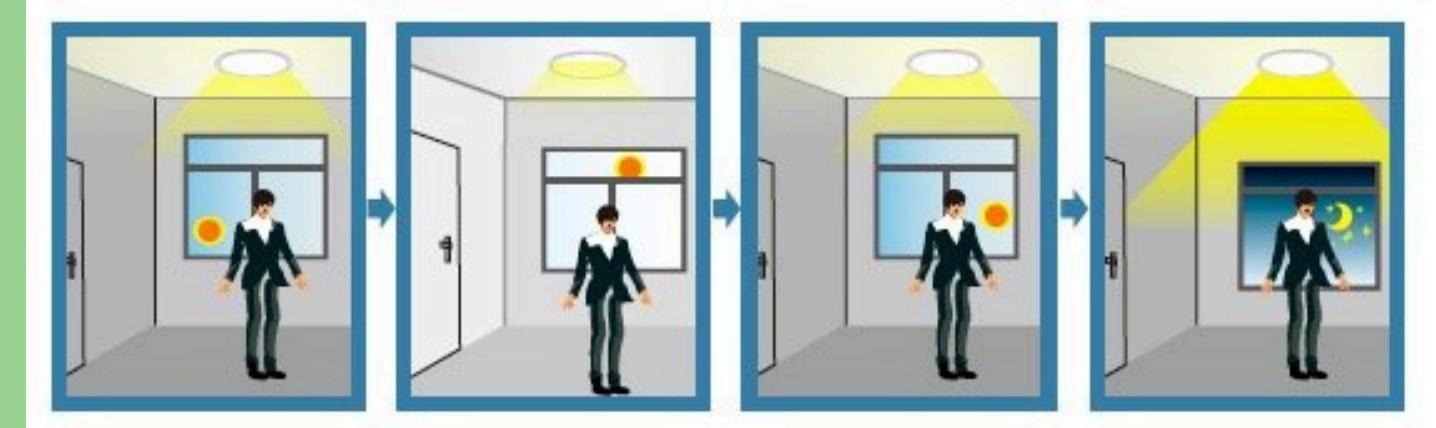
SECURE



HUMAN DETECTION



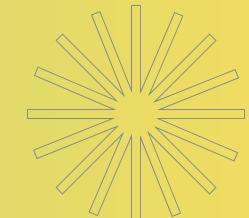
ACCURACY



ENERGY EFFICIENCY

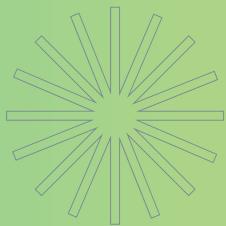


SAVING



Mai

Executive Summary



Purpose



Portable,
affordable
lighting for Texas
renters

Methods



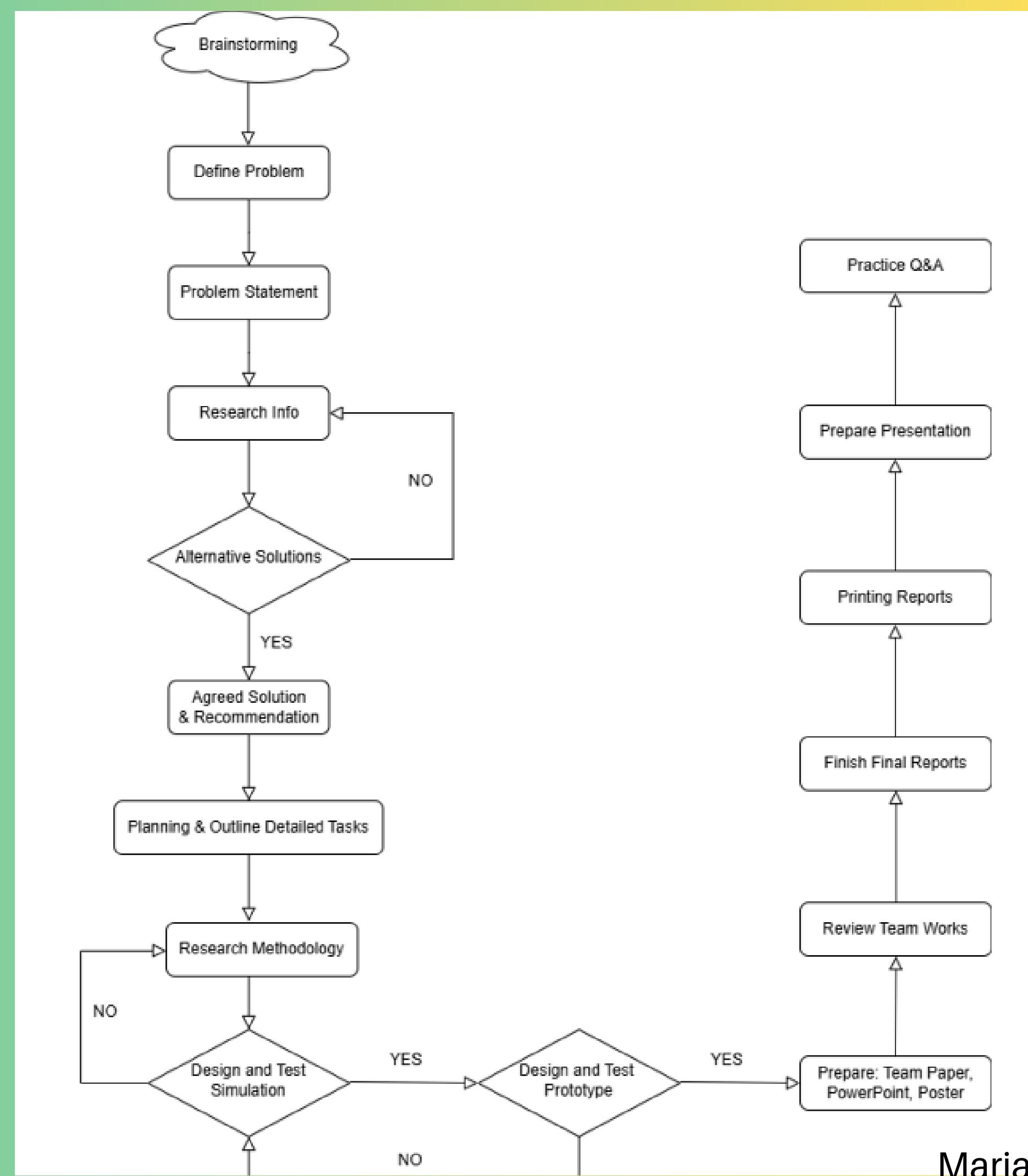
Research,
Tinkercad
simulations,
prototype
development.

Conclusion



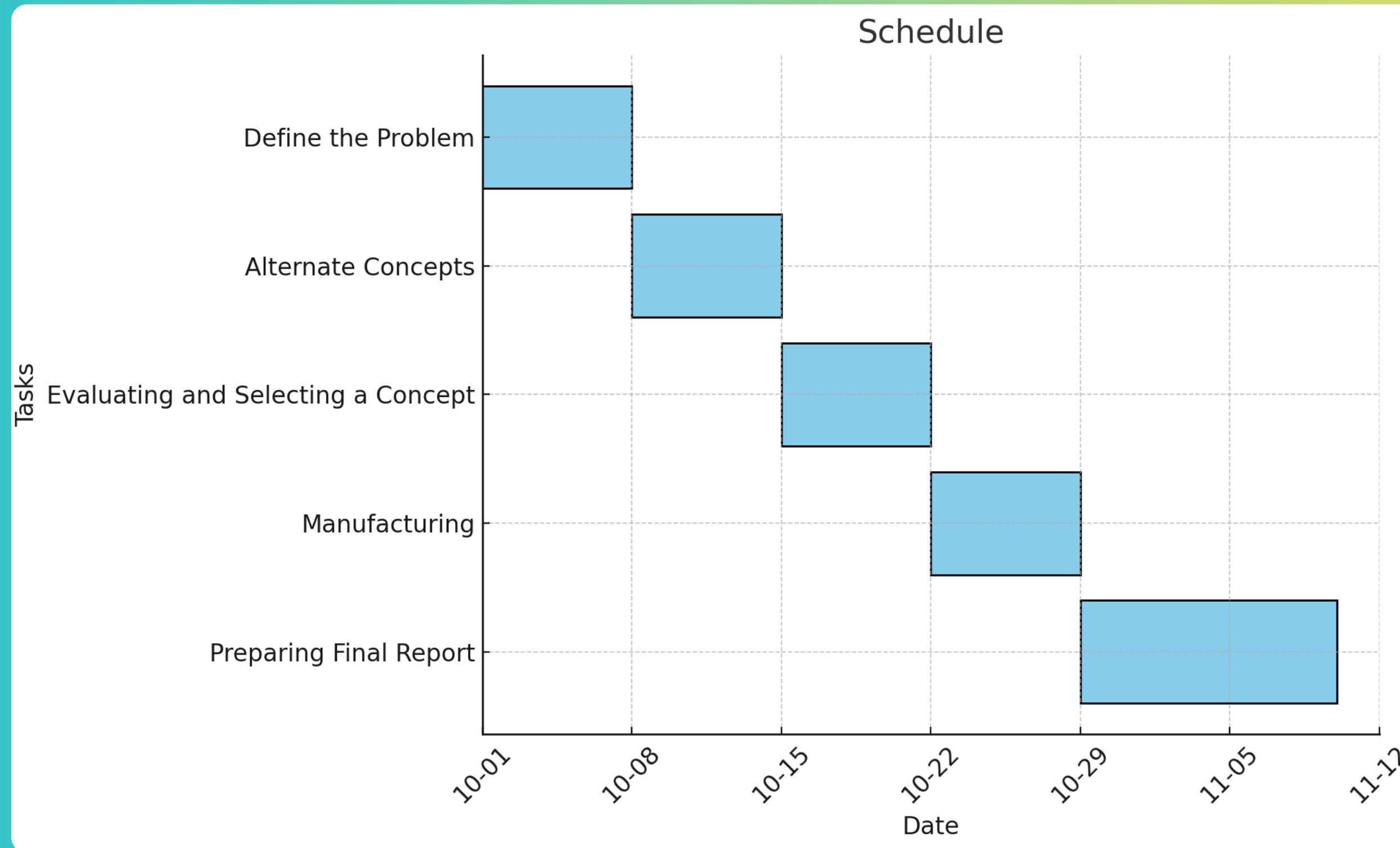
Combines PIR,
ultrasonic and
ambient light
sensors for accurate,
low-cost detection.

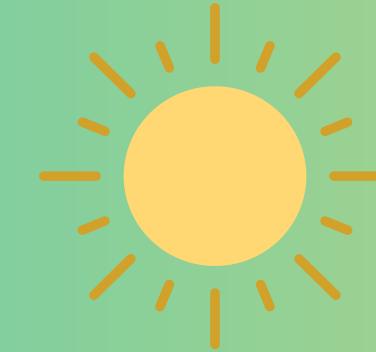
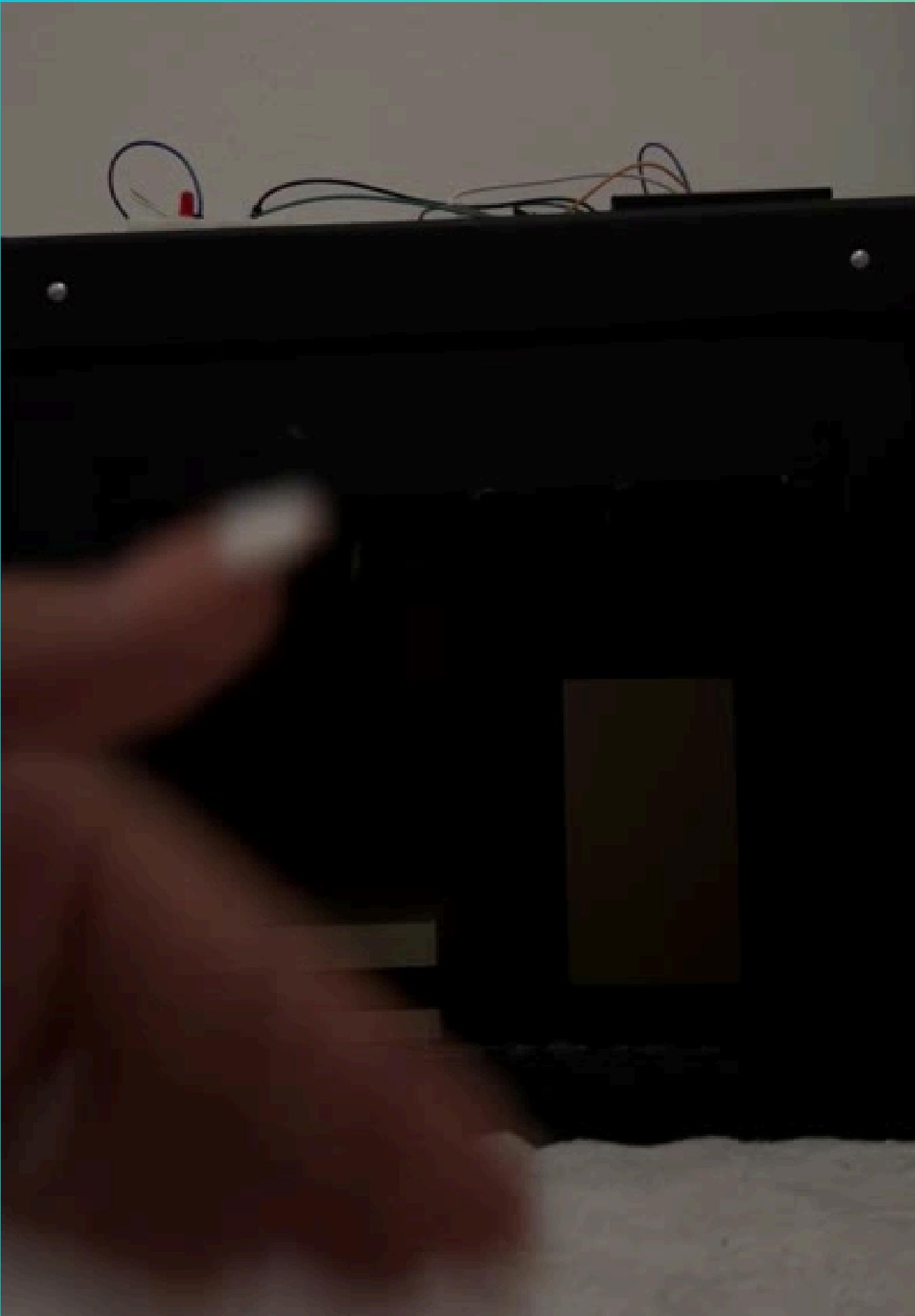
Process of Design



Maria

Scheduling

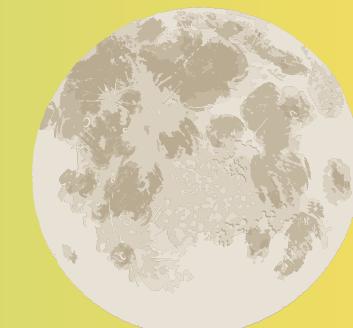




Prototype

Room light represents outside sunlight

when the outside light is bright enough (Morning and Afternoon) to bring in sunlight into the home, LumiSmart will still provide extra light into the home, but it will be dim in order to conserve energy. When the outside light is darker, LumiSmart will light it's brightest to make sure people have enough light to do their everyday necessities.



Methodology



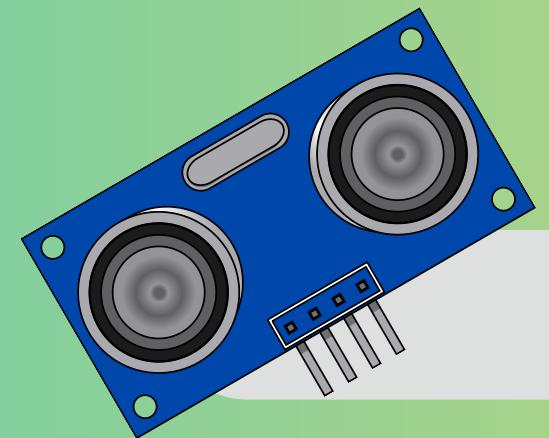
PIR SENSOR

The PIR sensor detects movement by sensing body heat. It tells the system when someone is moving in the room. It works with the ultrasonic sensor to keep the lights on even if motion stops.



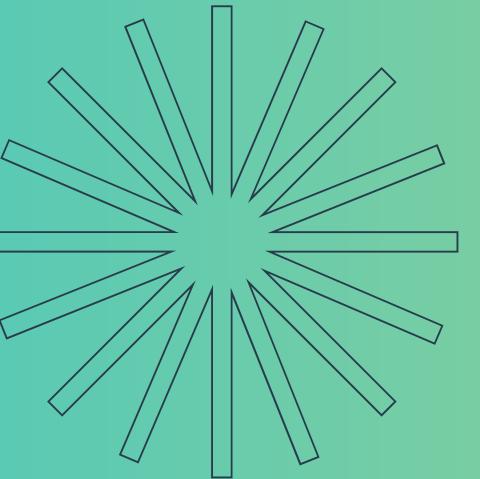
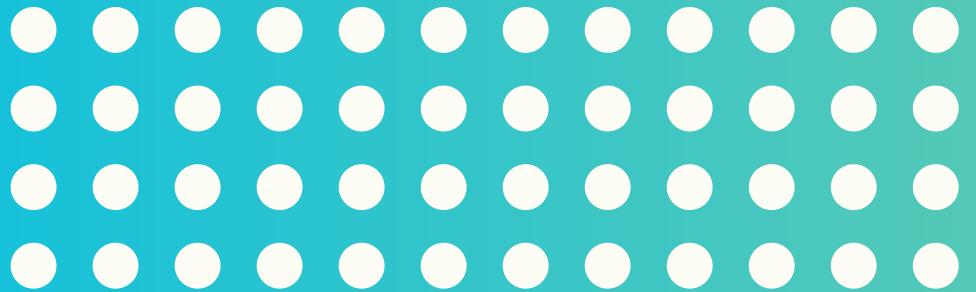
AMBIENT LIGHT SENSOR

The ambient light sensor checks how bright the room is. It adjusts the lights to save energy, working with the other sensors for the best lighting.



ULTRASONIC SENSOR

The ultrasonic sensor finds out if someone is in the room by using sound waves. It makes sure the lights stay on even if the person isn't moving.

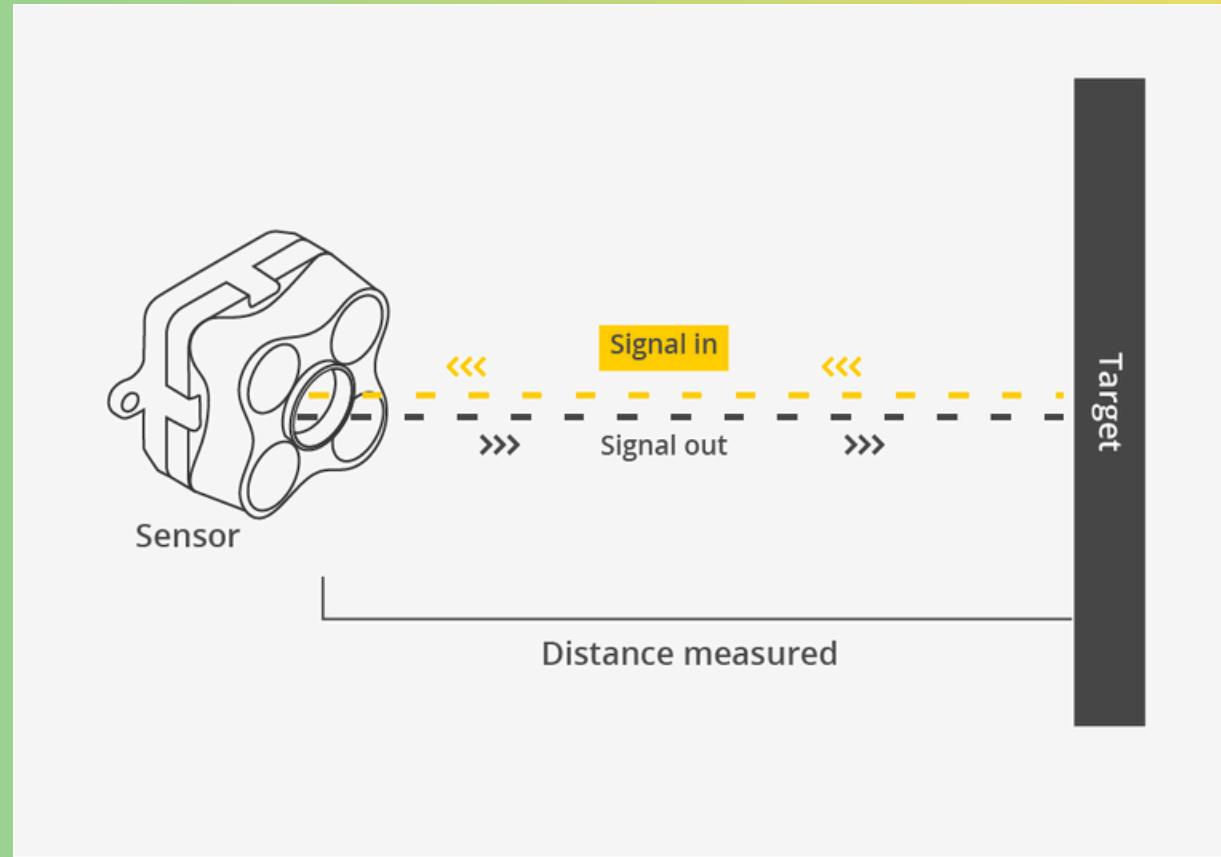


Calculations

Time-of-Flight (ToF)



Room Temperature: speed of sound in air ~ 343 m/s
(Helmenstine, 2023)

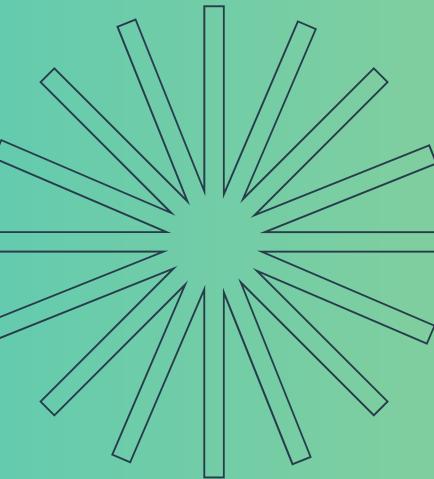
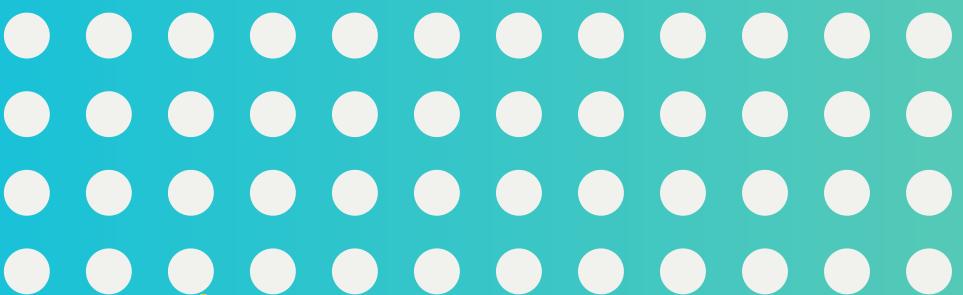


$$\text{Distance} = \frac{\text{Time} \times \text{Speed of Sound}}{2}$$

Prototype & Mass Production Cost

Component	Estimated Cost	Source
Arduino Uno	\$3.28	AliExpress
LCD display	\$6.99	Amazon
HC-SR04 Ultrasonic Sensor	\$0.39	AliExpress
Potentiometer	\$0.34	AliExpress
Bread Board	\$0.53	AliExpress
Led light bulb	\$1.00	AliExpress
Wires etc.	\$0.99	Ebay
Total Prototype Cost	\$13.38	

Component	Estimated Cost	Source
Plastic Shell	\$1.5	Estimated
Arduino Uno	\$3.28	AliExpress
HC-SR04 Ultrasonic Sensor	\$0.39	AliExpress
Potentiometer	\$0.34	AliExpress
Bread Board	\$0.53	AliExpress
Led light bulb	\$1.00	AliExpress
Wires etc.	\$0.99	Ebay
Estimated Total Mass Production Cost per Unit	\$8.03	

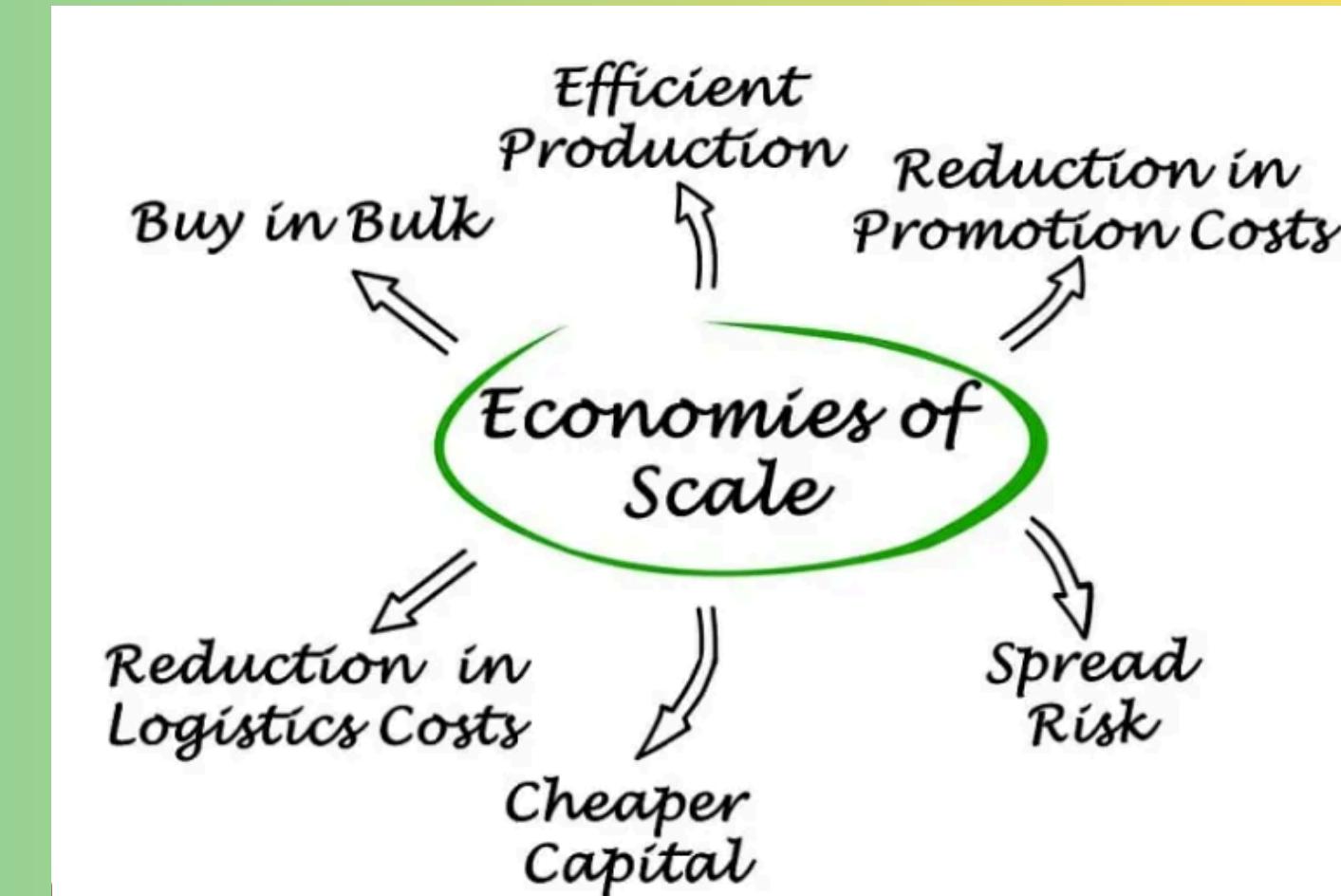


SWOT Analysis

IDEA POTENTIALS



Strengths	Weaknesses
<ul style="list-style-type: none">• High accuracy• Energy efficiency• Affordable price• Easy and non-invasion installation• Easily removable• Safe and low risk of hacking or private data leakage	<ul style="list-style-type: none">• Technical complex• No technology connectivity• Limitations in small production and high initial cost• Technological challenges
Opportunities	Threats
<ul style="list-style-type: none">• Market relevance• Growing of global movements• Tax incentives• Potentials of smart home market	<ul style="list-style-type: none">• Competitive market• Economic factors



Efficient Detection

Combines PIR, ultrasonic and ambient light sensors to reduce unnecessary energy use.



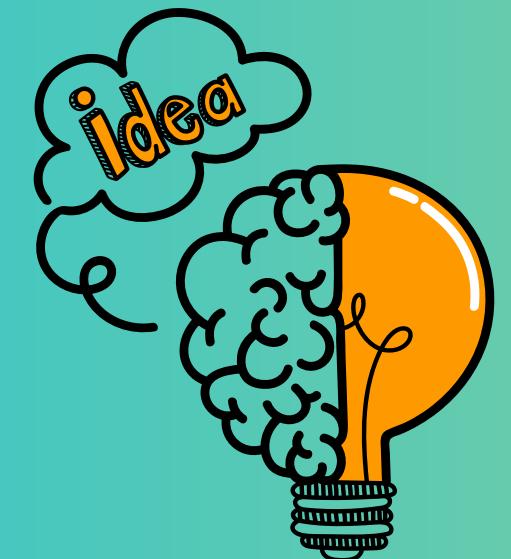
Meaningful Impact

Provides energy savings for low- to middle-income households while benefiting the environment.



Innovative Solution

Affordable, portable smart lighting system tailored for Texas renters.



Environmental Impact

Supports national energy goals by lowering carbon emissions.



Accessible Technology

Simple, secure, and renter-friendly design ensures broad usability.



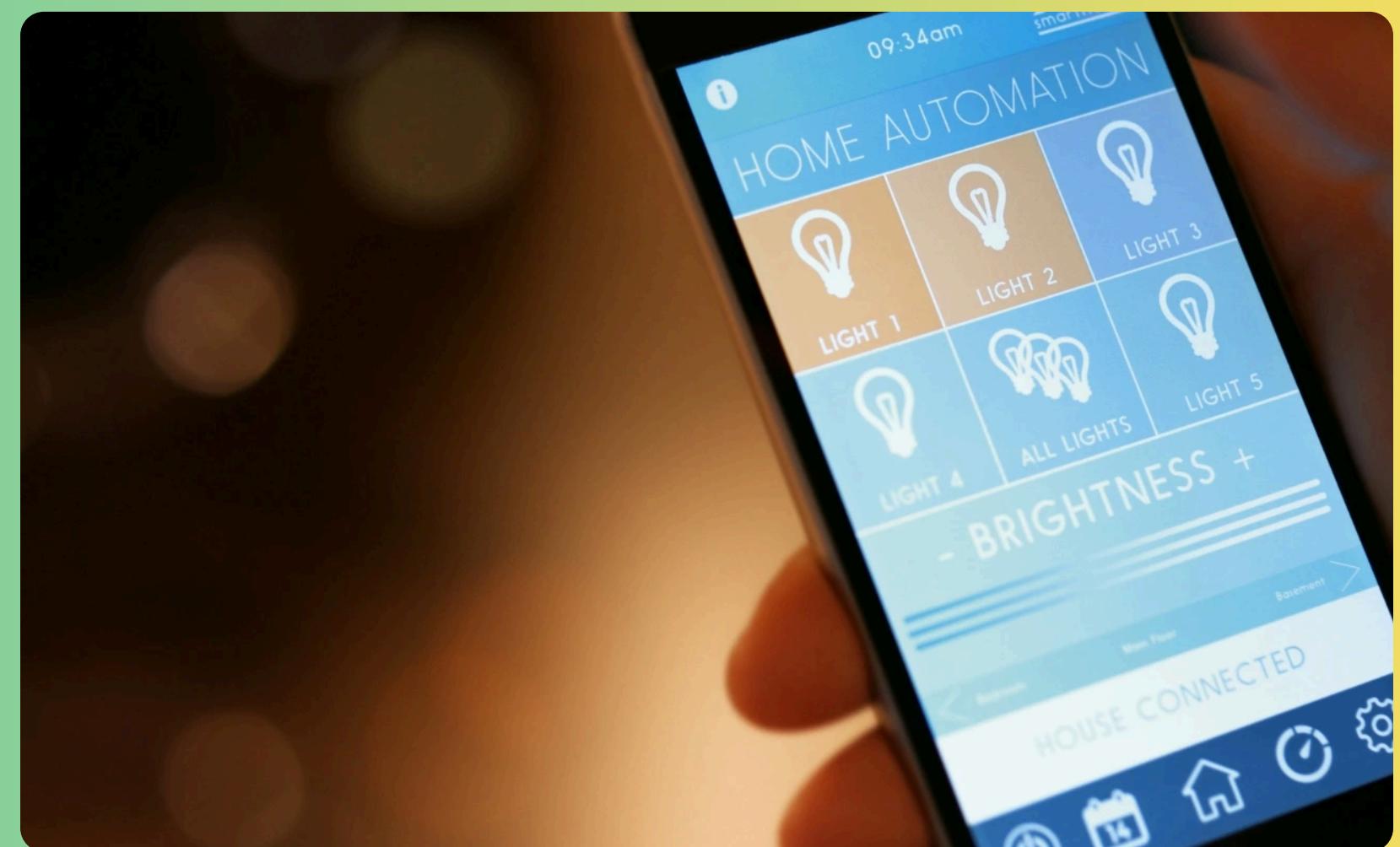
Discussion

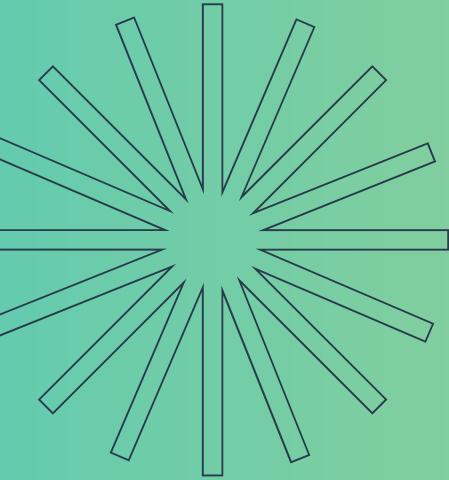
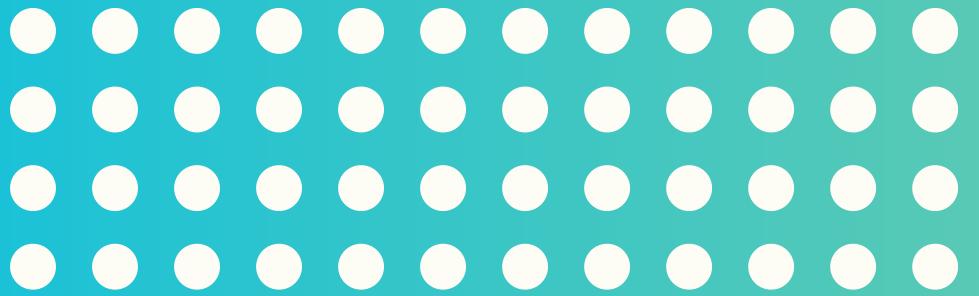


Improve integration 

Enhance affordability 

Expand energy savings 





References

Ciuffreda, I., Casaccia, S., & Revel, G. M. (2023). A multi-sensor fusion approach based on PIR and ultrasonic sensors installed on a robot to localise people in indoor environments. MDPI. <https://doi.org/10.3390/s23156963>

De Bakker, C., Van de Voort, T., & Rosemann, A. (2017). The energy-saving potential of occupancy-based lighting control strategies in open-plan offices: The influence of occupancy patterns. *Building and Environment*, 112, 308-321. <https://doi.org/10.1016/j.buildenv.2016.11.034>

Fireflier Lighting Limited. (2017, October 9). *How do dimming sensors of LED high bay work?* Fireflier Lighting Limited. <https://fireflier.com/dimming-sensor-led-high-bay-works/>

Helmenstine, A. M. (2023, June 17). Speed of sound in physics. *Science Notes*. <https://sciencenotes.org/speed-of-sound-in-physics/>

Mission Audio Video. (n.d.). Smart home lighting system. Mission Audio Video. Retrieved November 19, 2024, from <https://www.missionaudiovideo.com/blog/smart-home-lighting-system>

Perl, K. (2024, October 7). *What to do when you have no internet access but are connected?* Club HDTV. <https://www.clubhdtv.com/blog/what-to-do-when-you-have-no-internet-access-but-are-connected/>

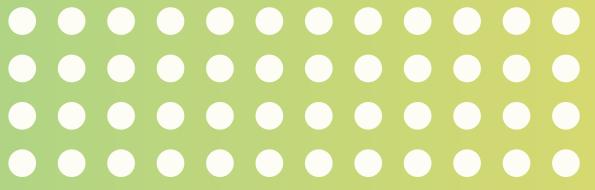
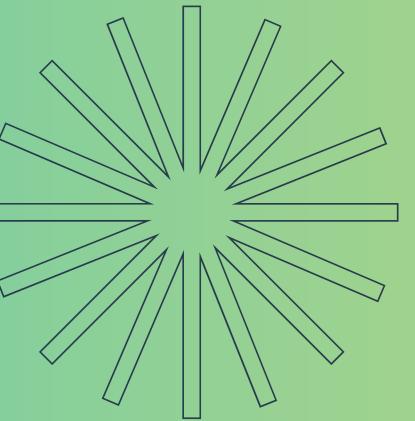
Terabee. (n.d.). *Time-of-Flight principle*. Retrieved November 18, 2024, from <https://www.terabee.com/time-of-flight-principle/>

Texas Tribune. (2024). *Renters in Texas spending 30% on rent and utilities.* Retrieved from <https://www.texastribune.org>

Texas Energy Poverty Research Institute (TEPRI). (2024). *Energy affordability challenges in Texas.* Retrieved from <https://tepri.org>

U.S. Energy Information Administration (EIA). (2024). *Texas energy rates and comparison to U.S. average.* Retrieved from <https://www.eia.gov>

"Efficiency opens up more time to focus on the things that really matter."



**THANK
YOU!**
