STRIP.SHOW()

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MOTIVATION / THEME

The dynamic occupancy rate is a spatial phenomenon that occurs. In the field of Architecture, this plays a paramount role in designing the volume or scale of a space. In today´s highly efficient and sustainable Building design strategies, this phenomenon is often not given much attention. However, through tools of technology, if a “Source “ could record the number of people in a space, in other words, their occupancy, then this would contribute to better analysis of the need and requirement of a Space. Furthermore, improving the Service system.

On the other hand, if a “Source” could also interpret this phenomenon in a very sensory attractive manner, then this could also be an additional value to human experience. For example, Light artwork that blinks, forms a wave, or increments like a progress Bar as the number of people eventually increases inside the space throughout the day and night, forming interesting patterns on the human canvas as well as on architectural elements- wall. Poetically speaking, a Dynamic process is made visible that communicates through artistic “Source” about changing Occupancy in a volumetric space as the day transforms to night.

Personal Intention- our senses are continuously overwhelmed by information all around us. Through this work, the intention was to develop a “Form” that is responsive to Human movement, which could be used in real-life for analysis and development of operational efficiency of Spaces as well as artistically interesting for human experience. Thereby contributing to the communicative environment of the data centre.
There is a play of changing Light intensity and a small aspect of Red-Light therapy involved to make a comforting ambient for the field of vision(Eye).

OVERVIEW

Title of the project: Strip.show()

Short description of the project: The installation is made with an intention to showcase Light as a Medium to analyse a spatial phenomenon and interesting irregular square patterns on the wall and Human Canvas that is eventually increasing in proportion as the day transforms to night. This way, installation shifts from data-driven visualization to poetic expression, allowing light to be experienced as material rather than information.

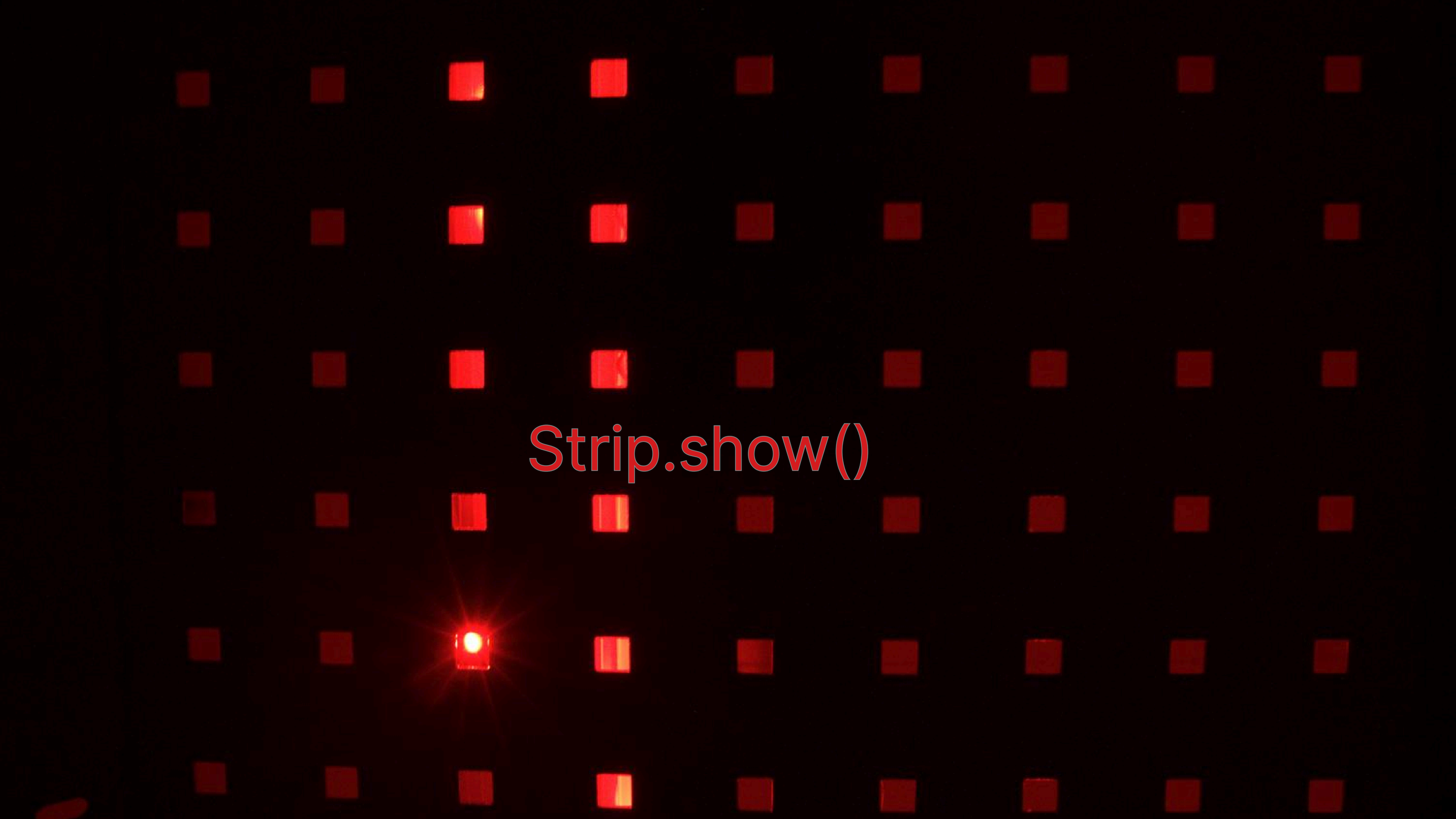
Type of project: Installation, Interface

Dimensions: 800×800mm

Keywords: Strip LEDS, one-way motion

Software:
Arduino IDE
HIVEMQ platform
Mix of MQTT and ESP-now

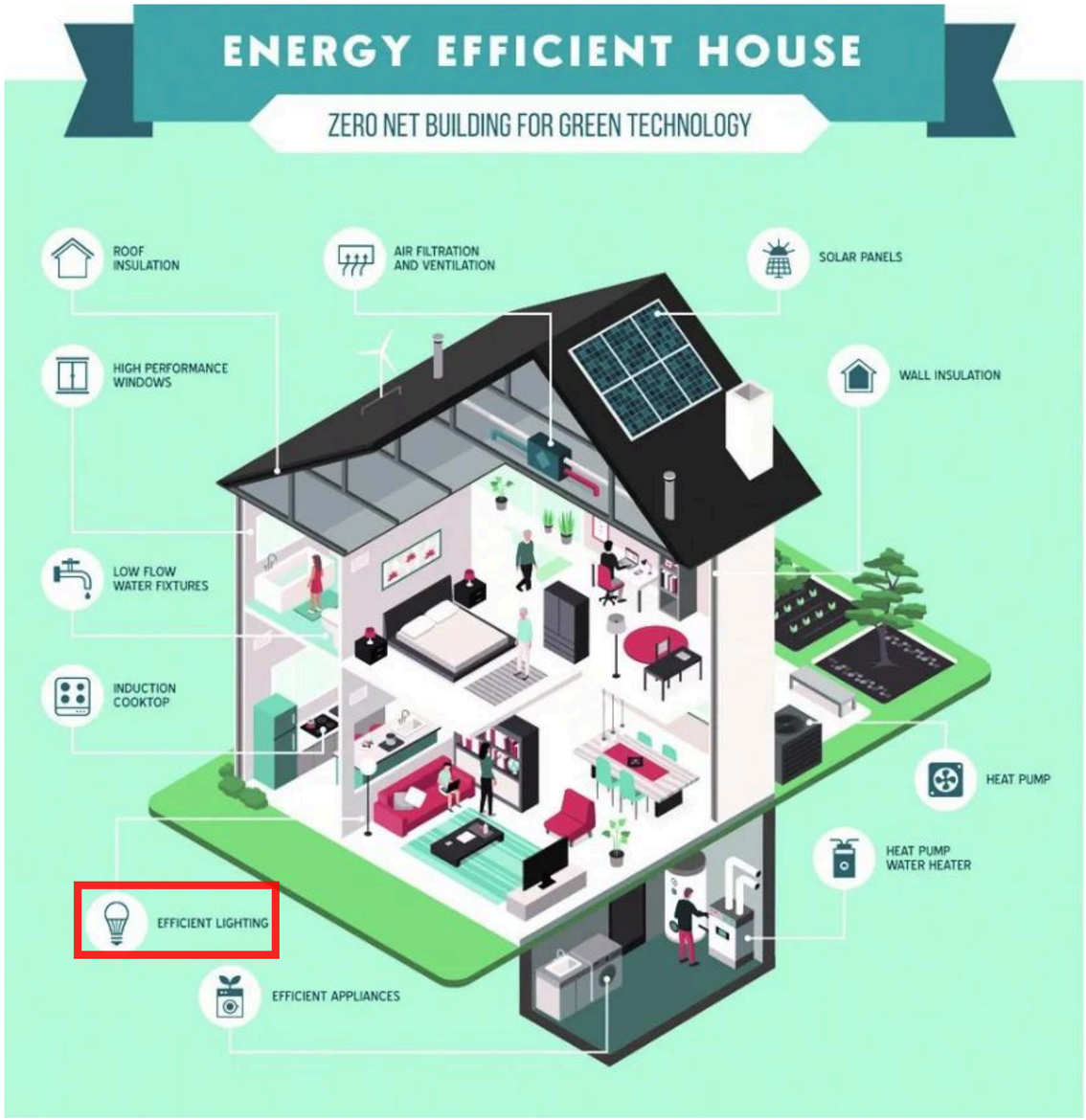
Hardware:
ESP-32
ESp-32s3
Ultrasonic Distance Sensor


Strip.show()

Objective

- Playful Light Dispersion: Use refraction, reflection, and color to create an engaging and immersive spatial atmosphere.
- Understanding Occupancy Patterns: Visualize real-time and peak usage of the space to better understand how and when it is used.
- Energy Awareness: Demonstrate how occupancy data could inform adaptive building systems—such as HVAC and lighting—for more efficient energy use.
- Health and Comfort: Explore how light intensity and color influence human comfort, mood, and perception within enclosed spaces.

By merging sensing technology with media architecture, the installation bridges functional data and sensory experience—turning invisible patterns of use into a visible, tangible, and emotionally resonant spatial narrative.



Design Concept

Inspiration of Idea: The earth's atmosphere filters the light from the Sun, which is why the light we see(colour) and feel(intensity) changes with the time of day and night

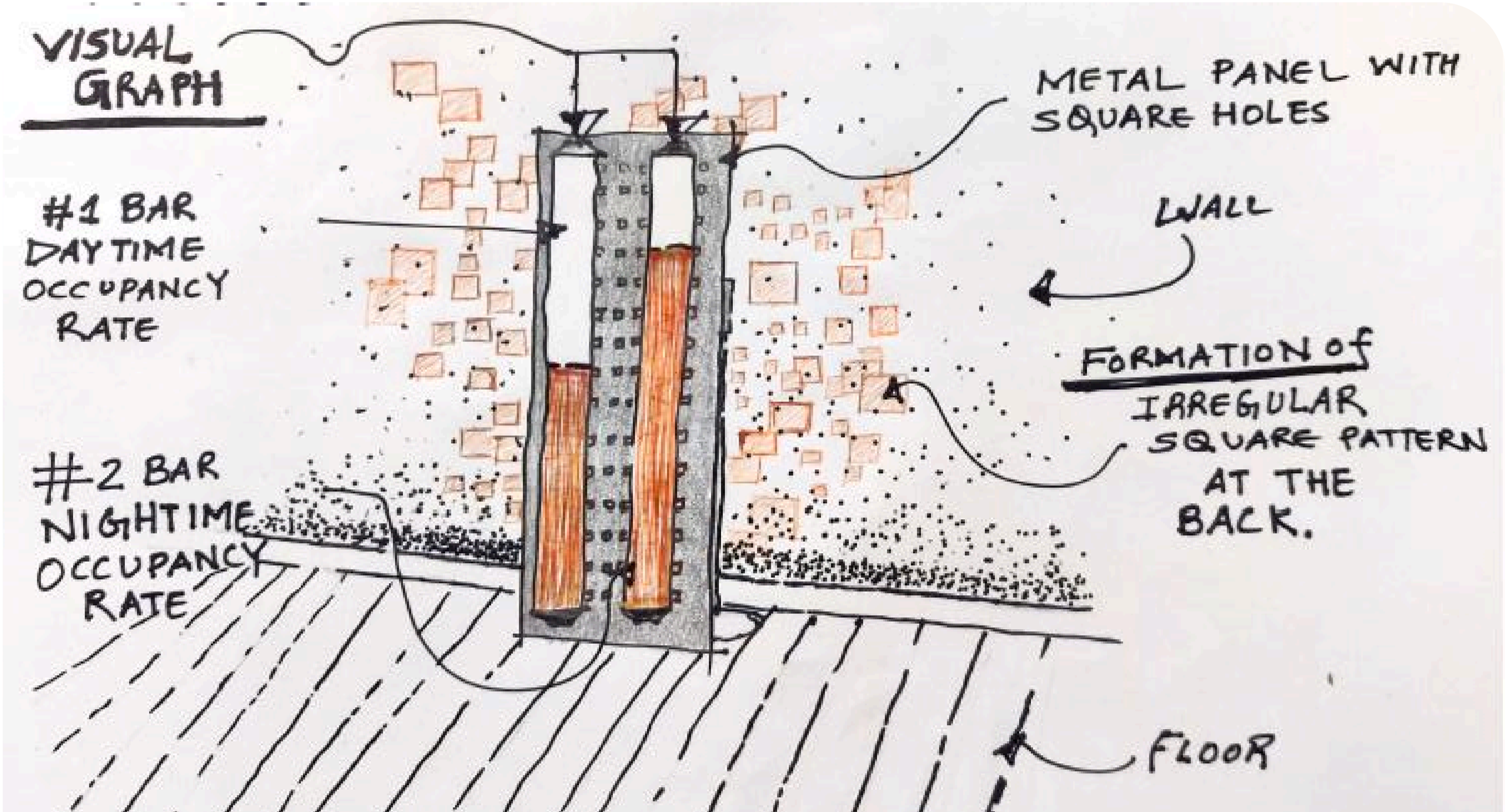
Dynamic Occupancy

The number of people in a space is never constant. Occupancy fluctuates irregularly throughout the day, influenced by routines, spontaneous movement, and the transition from day to night. Yet these changes often remain invisible. This installation reveals these hidden dynamics by transforming occupancy data into light.

Rather than presenting data in a purely analytical way, the project embraces light as both an informational and artistic medium. The result is the formation of an irregular square light pattern that animates (change in proportion) itself on the Human canvas and Wall in the space while simultaneously communicating its usage.

Design Concept

1 Sketch of Idea

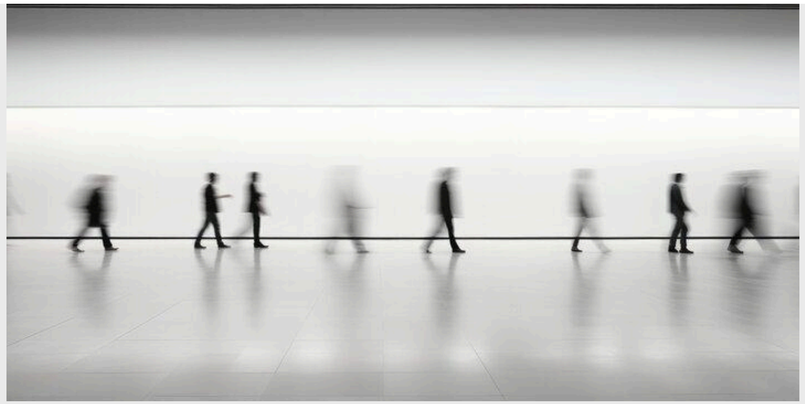


Context of interaction

2 Elements:

LED strips

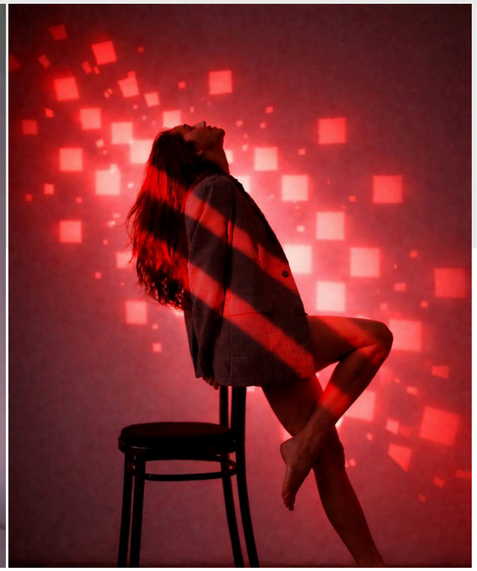
+



One way Motion detection

=

Aspect 1: 3d Graph of Dynamic Occupancy



Aspect 2: Pattern projection on Wall and Body

Concept

3

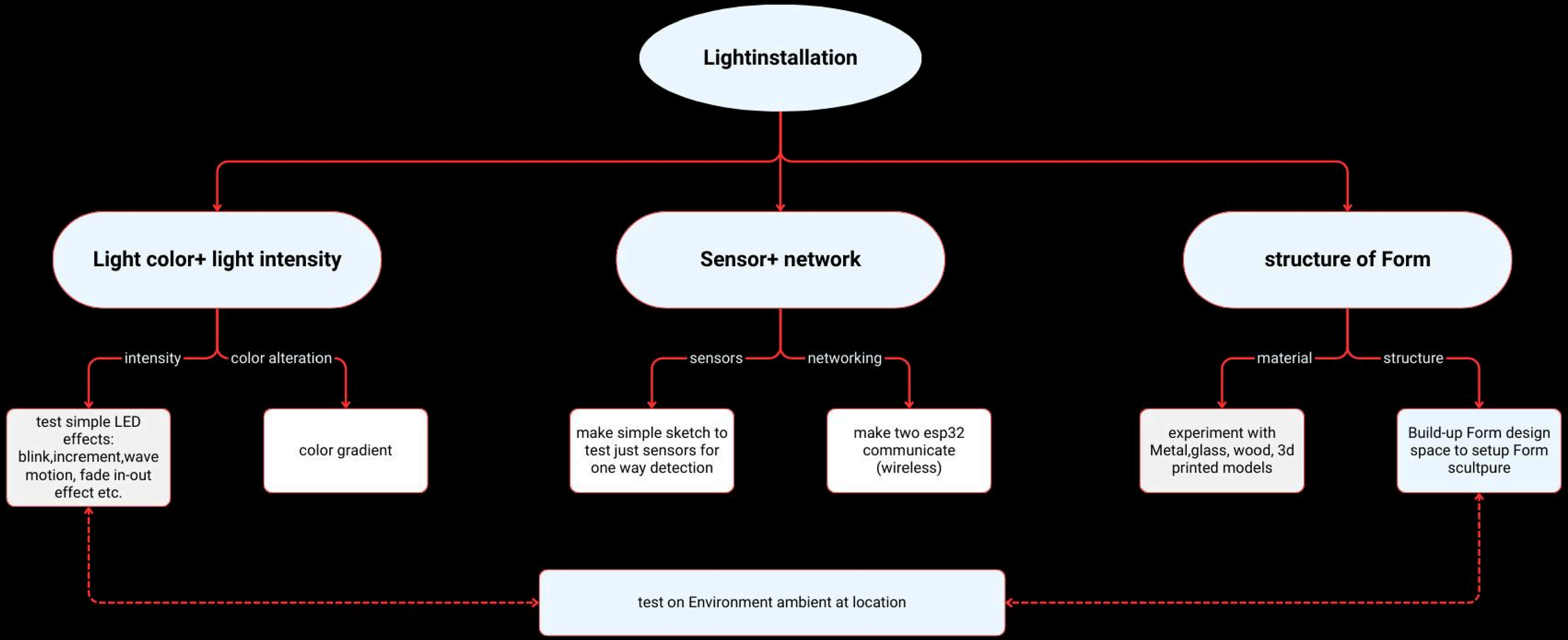
Method:

Time duration of Exhibition 10 hours (10 am to 8 pm), divided into the first 6 hrs as Daytime and the next 4 hours as Night-time. Based on this timeline, the work is developed on a smaller time scale where 60 min represents 6 hours and 40 min represents 4 hours.
In other words, values of the One-way motion count first transfers to Strip 1 for 60min(6 hrs depiction) and then for the next 40 min(4hrs depiction) to strip2.

Total number of LEDS at strip 1= 40, strip 2= 35
increment +1 at each detection of one-way motion
LEDS Strips glow with an Intensity of 60
Color- RED
First phase strip 1 records the motion count for 60 minutes(6hrs depiction)
Second phase strip2 records the motion count for 40 minutes(4hrs depiction)

Special condition
Each LED strip, through programming structure, is given the capability to glow a maximum value of 255 whenever the full LED count of 40 in an individual Strip is reached during the time cycle. After which, a reset occurs, and the cycle repeats again from strip 1, then strip2.

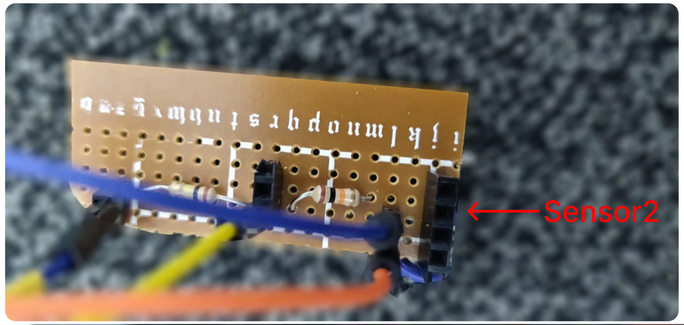
PROCESS

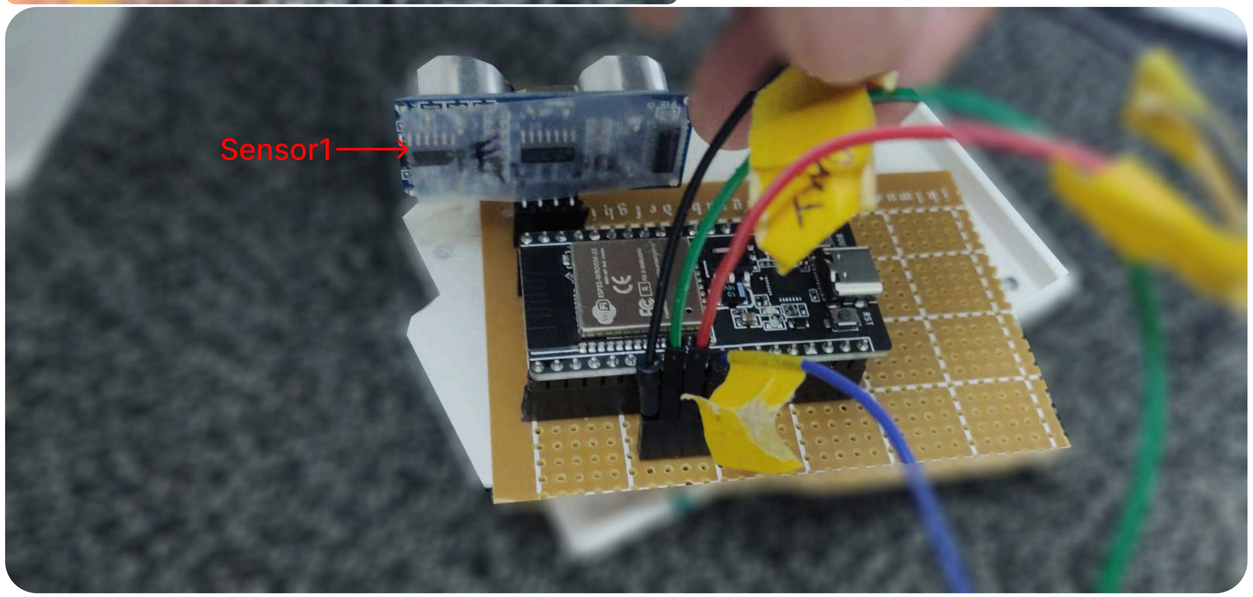

Lightinstallation
Light color+ light intensity
Sensor+ network
structure of Form
intensity
color alteration
sensors
networking
material
structure
test simple LED effects: blink,increment,wave motion, fade in-out effect etc.
color gradient
make simple sketch to test just sensors for one way detection
make two esp32 communicate (wireless)
experiment with Metal,glass, wood, 3d printed models
Build-up Form design space to setup Form scultpure
test on Environment ambient at location

PROCESS

Hand-made PCBs :

Input Unit

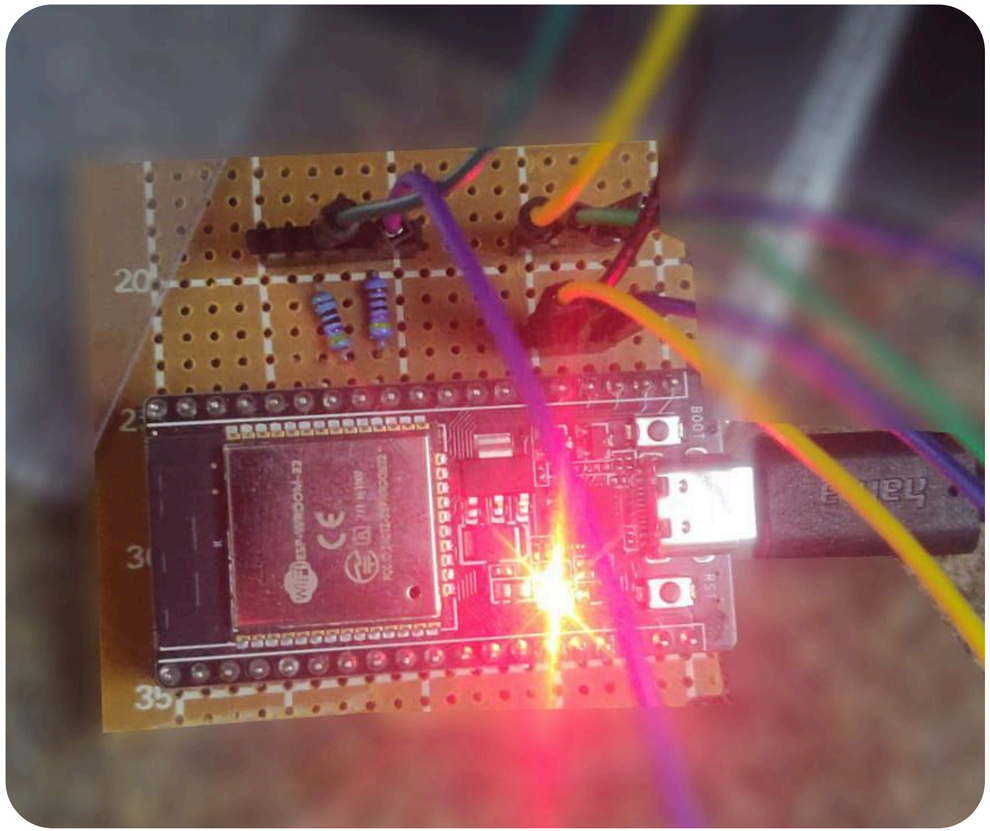




Sensor: Ultrasonic sensor

The ultrasonic sensor detects one-way motion of people within the space, translating human occupancy inside the space during daytime and nighttime into real-time light responses for a better comparison of when the basement space is most visited.

Output Unit



Prototype experiments

videos:

Simple blink test
https://drive.google.com/file/d/1pGWVOaKZlDpcXY3nFCUa-wQF1ic3qdGh/view?usp=drive_link

Simple_ Ultrasonic distance detection_test
https://drive.google.com/file/d/1wKDWFwZRJl3aOwFfPjvwz3X7KgPAiNKJ/view?usp=sharing

REDLightwithMetal_Panel_test
https://drive.google.com/file/d/1lIuBLZ-kaqB-TUiOelKtRpjf0CPBjyRI/view?usp=sharing

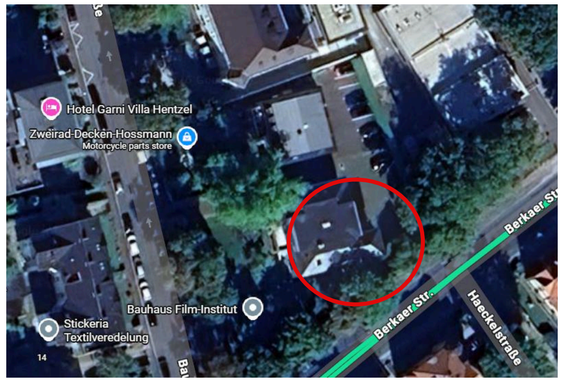
Pattern_analysis
https://drive.google.com/file/d/1tDhLWVYP1Y7X2lDyZSCgkJKFzlbPYa-N/view?usp=sharing

videos of 2nd phase testing:

Strip1 testing_60 minutes time lapse
https://drive.google.com/file/d/1dEndt6Y0EQk_8aSWPoKMiinyMLMbT2KB/view?usp=sharing

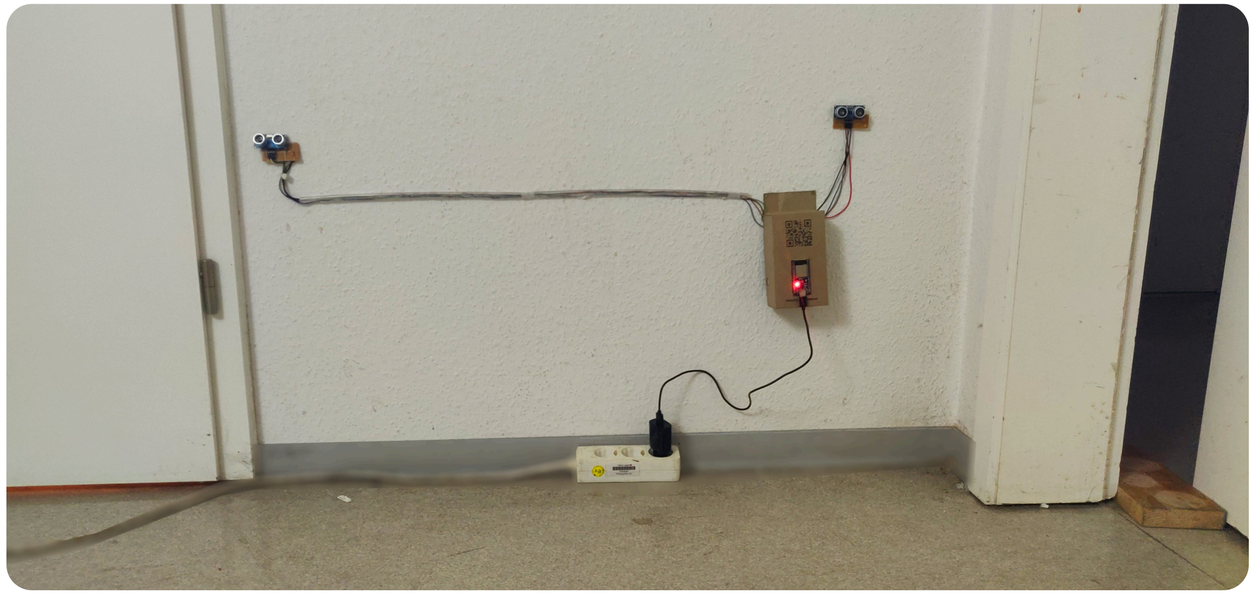
Strip2 testing_40minutes time lapse
https://drive.google.com/file/d/156q0vmlrZShshiJwWo_EZxY82OSTnrll/view?usp=sharing

Final setup & analysis



Location : Bauhausstraße 15

Input Unit at the Location 1- Basement Corridor



Location 2 : Bauhausstraße 15, room K07 DIY Electronics Lab

Output Unit at the Location 2- Data Center (Exhibition space)

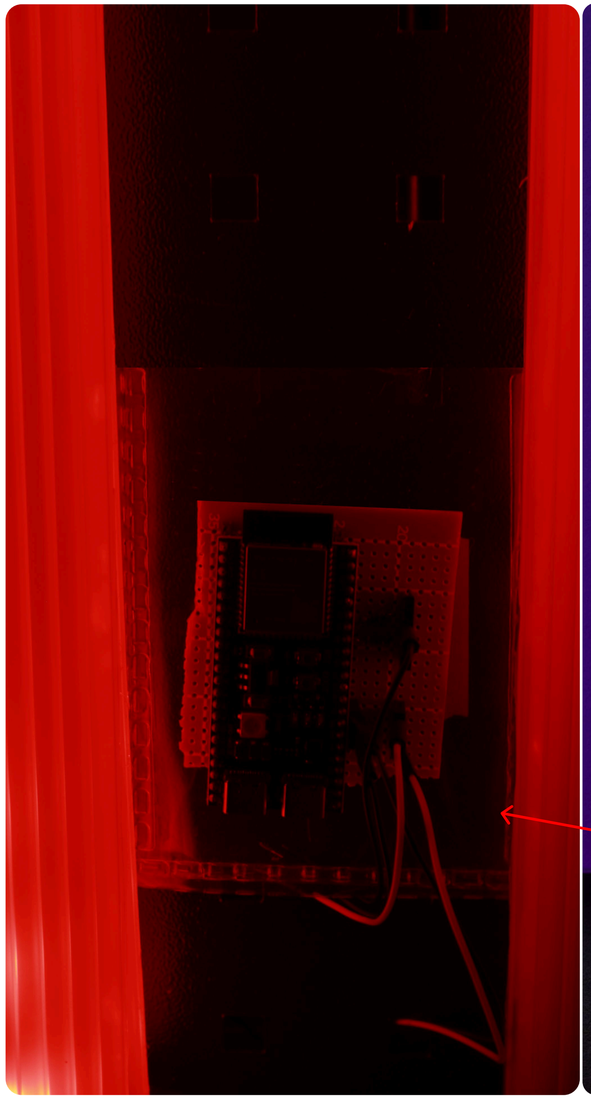


Image credit: Lilian Fuchs

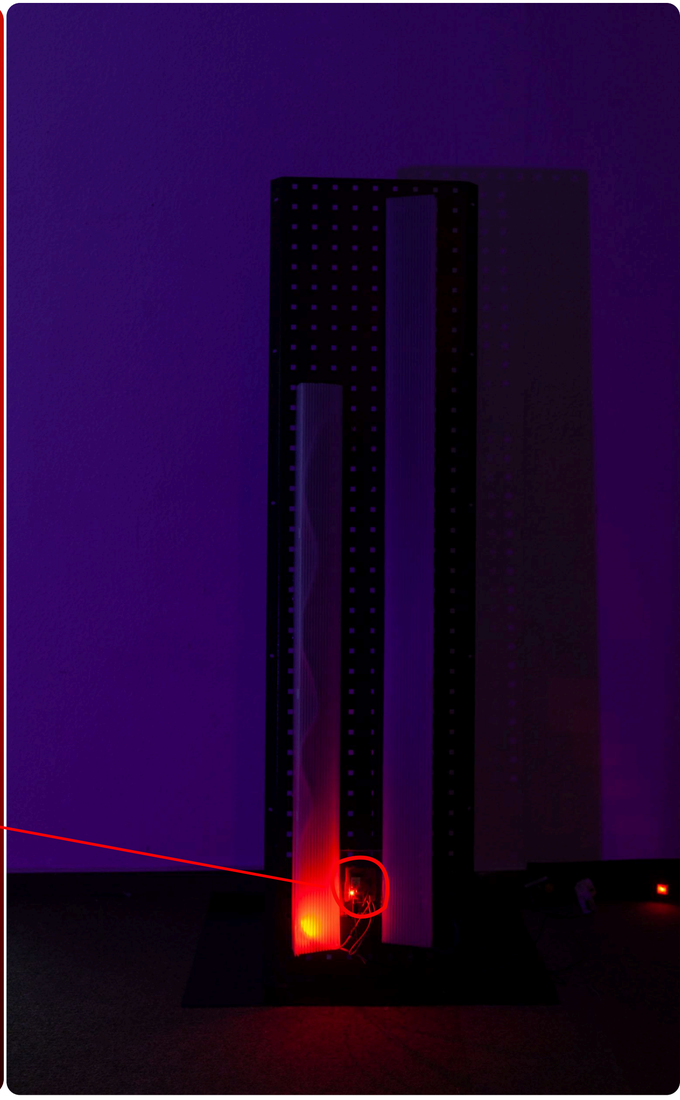


Image credit: Christian Döller

Code:

Mqtt_HIVEMq_code

SENDER- ESP32 code:
https://acrobat.adobe.com/id/urn:aaid:sc:AP:cda65a4a-3114-4ab5-83ba-7a919cfa3fff

RECEIVER-ESP32 code:
https://acrobat.adobe.com/id/urn:aaid:sc:AP:ea37b85e-eb5a-4bf7-8743-e1702846139c

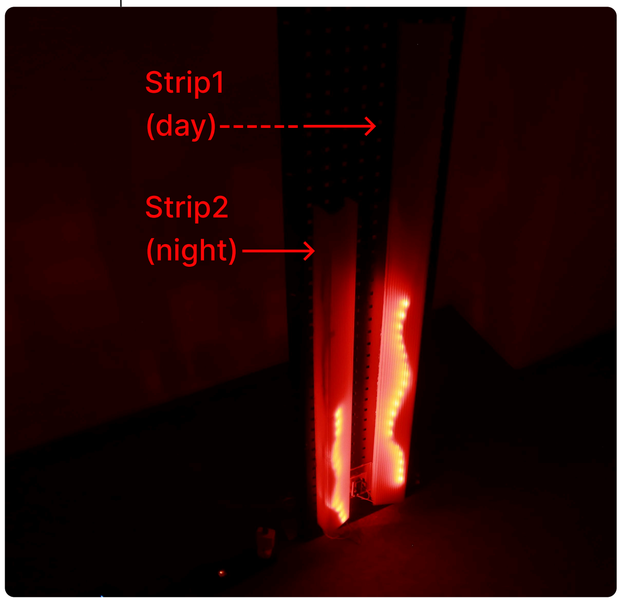
ESP-NOW library_code

functioning_ Sender code:
https://acrobat.adobe.com/id/urn:aaid:sc:AP:f6a5c5cb-da9c-43a0-98c1-70d6d36279a4

functioning_ receiver code:
https://acrobat.adobe.com/id/urn:aaid:sc:AP:ff95b399-c961-47b9-9b18-d6fc014b1250

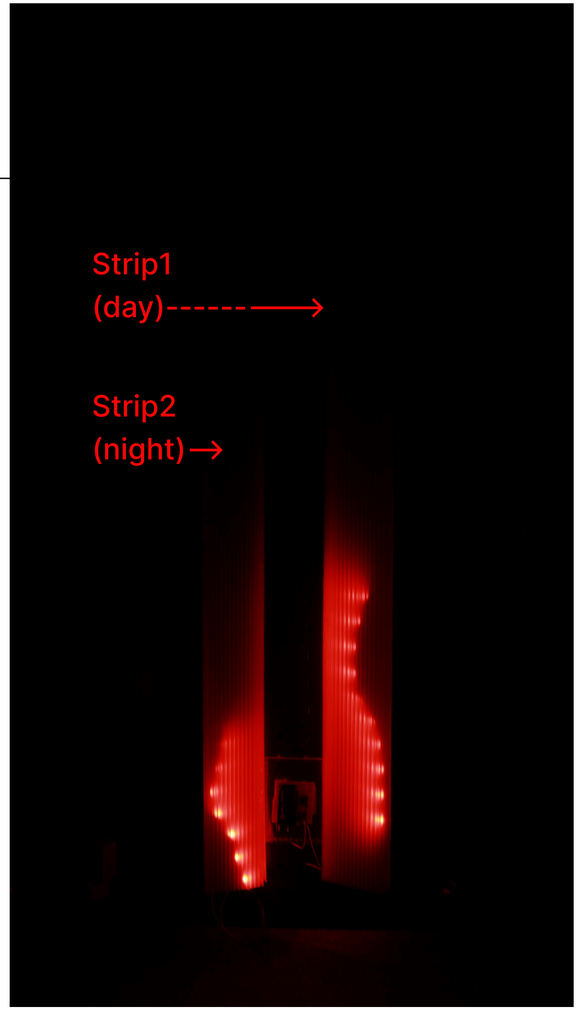
Aspect 1: Dynamic Occupancy Visualization

6th Feb



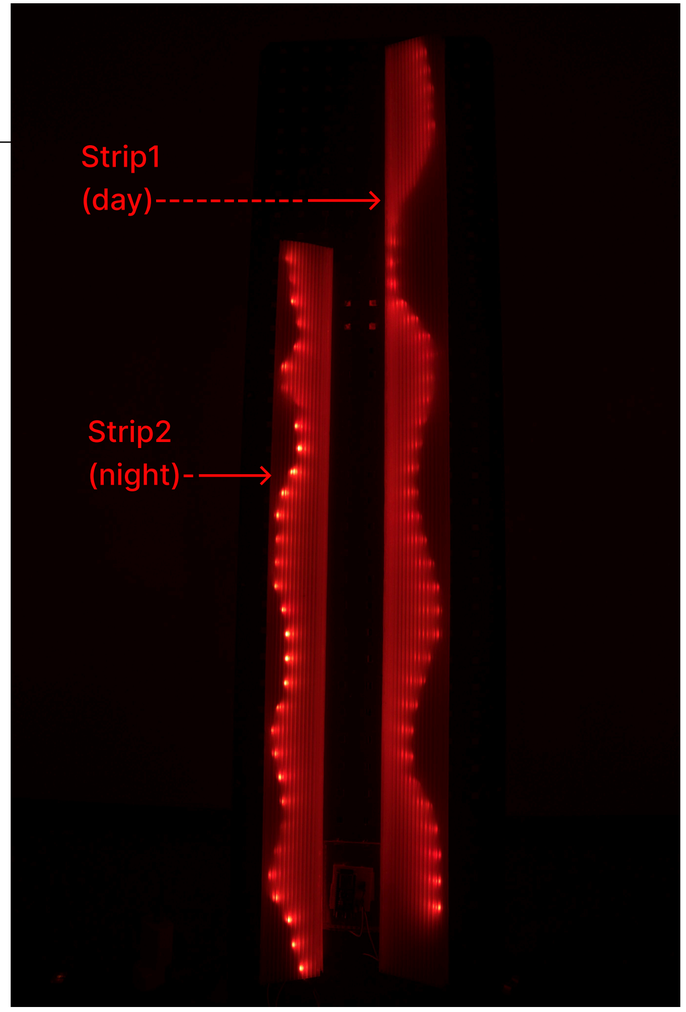
Analysis:
More People visited Data Centre during Daytime than Night.
LED count recorded at strip 1 = 21
LED count recorded at strip2 = 13

7th Feb



Analysis: Fewer people visited on the 2nd day of the Exhibition. Ratio of Day visit was still higher than Night
LED count recorded at strip 1 = 15
LED count recorded at strip2 = 7

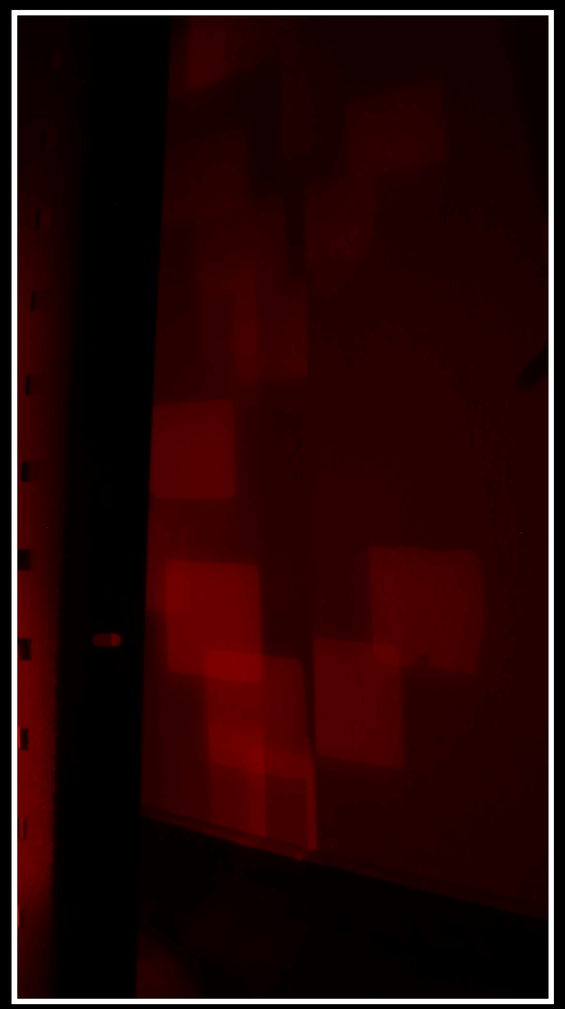
8th Feb

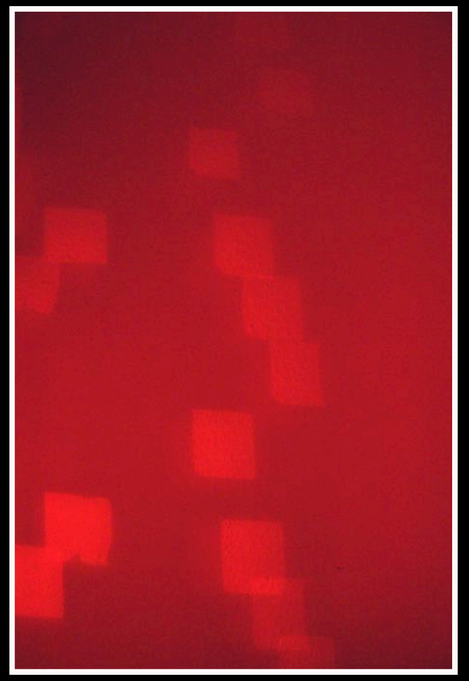
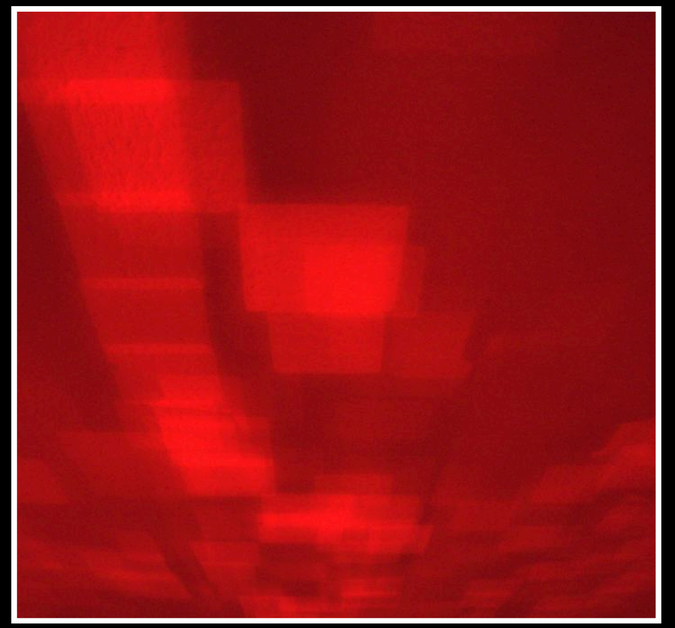


Analysis: Most People visited the Data centre on the 3rd day of the exhibition (weekend).
LED count recorded at strip 1 = 40
LED count recorded at strip2 = 35

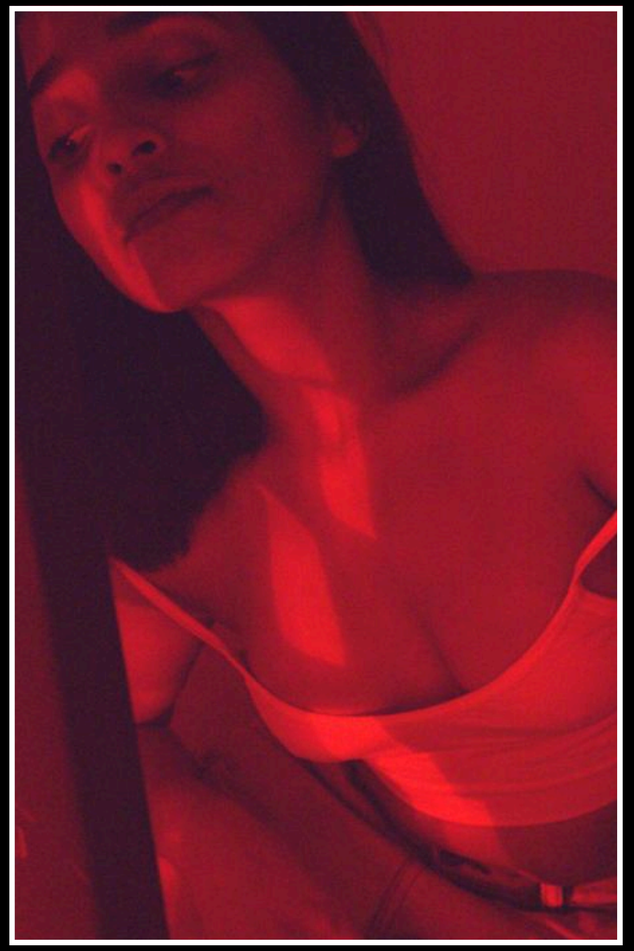
Aspect 2: Patter Projection on Body and Wall

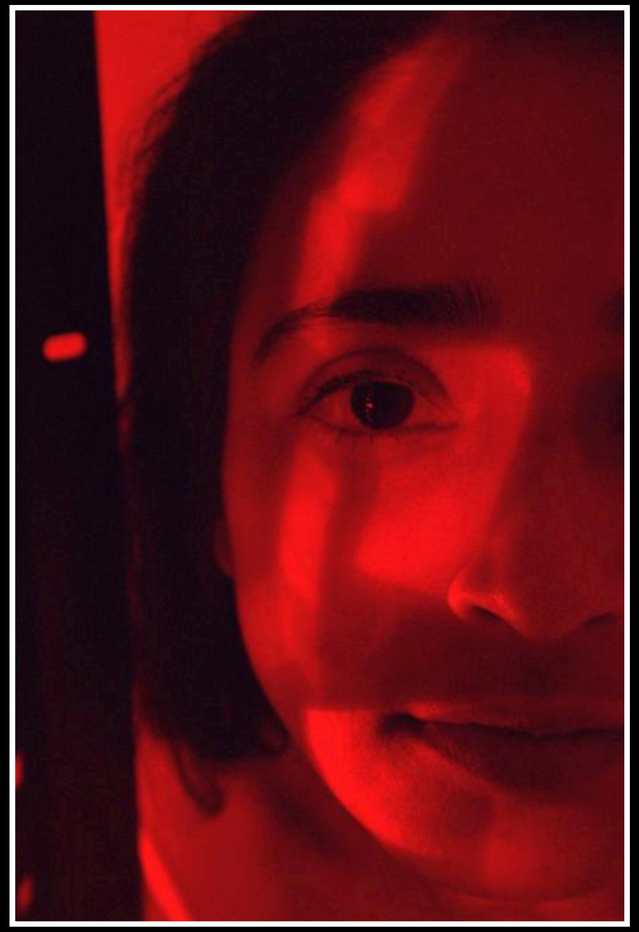
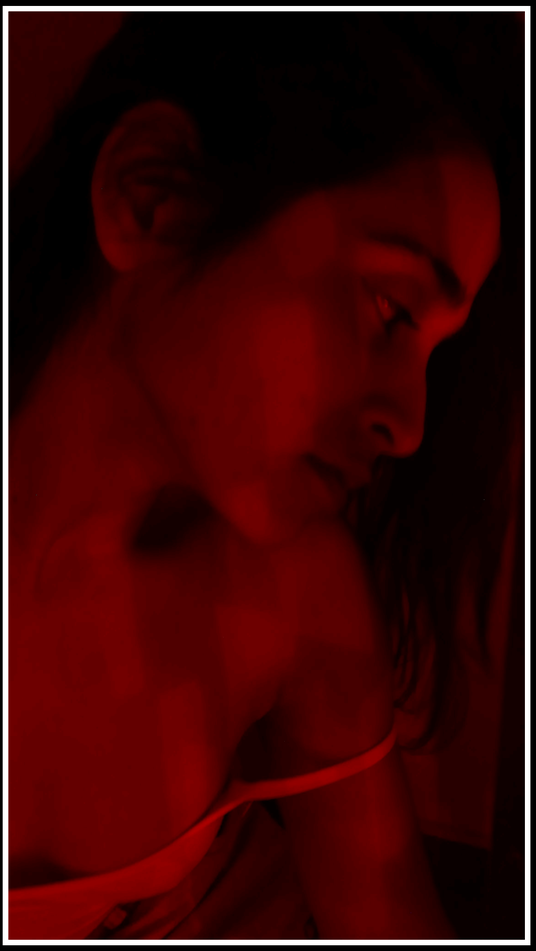


Aspect 2: Patter Projection on Body



EXPERIMENT VIDEOS:

https://drive.google.com/file/d/1I_IX5GpNm0tpK3tturQR0B9GCQ2H5f7H/view?usp=sharing

https://drive.google.com/file/d/1N__WG7Ss-xtGA8mCEMreAT786fa4Kn1m/view?usp=sharing

Name- Vanshika Yadav
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Study programme- Media Architecture
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People Involved
Project Lead: Christian Döller
Role: Concept development and project coordination
Primary Responsibility: Technical support