UNIVERSIDAD NACIONAL DE COLOMBIA

FACULTAD DE INGENIERÍA

OBJECT ORIENTED PROGRAMMING

ENGINERING FACULTY

WORKSHOP 1

AUTHORS:

Eddy Johan Tocancipa Muñoz

Valeria Aranda Pacheco

Luis Santiago Vargas Rodríguez

Bogotá DC.2025

FUNCTIONAL REQUIREMENTS

1. The system must display the project name (“ElecHouse”) on load.

2. It must show an interactive image of a house divided into Bedroom, Living Room, and Kitchen.

3. The user must be able to select a room by clicking on its section.

4. When a room is selected, the system must zoom in smoothly to that area, showing its layout.

5. The right-side panel must display room-specific components:
Bedroom → bulbs, lamps, light fixtures.
Living Room → TV, radio, speakers.
Kitchen → heat, gas, or humidity sensors.

6. The panel must also include common elements, such as outlets or connectors.

7. The user can drag and drop components from the panel to the workspace.

8. The system must allow connecting components with virtual cables that visually represent electric connections.

9. The system must support deleting, rotating, or moving placed components freely within the room.

10. It must be possible to assign electrical values or configuration parameters (voltage, power, resistance, sensitivity, etc.).

11. The system must include a “Test” button to run the circuit simulation.

12. If connections are correct, components should behave as expected:
Bedroom → lights turn on with adjustable brightness.
Living Room → devices display proper visuals and sound.
Kitchen → sensors respond accurately to simulated heat or gas levels.

13. If connections or values are incorrect, the system must display error messages or visual alerts (e.g., red lines, pop-up warnings).

14. The user should be able to reset the current room to remove all components and start again.

15. The user could save a custom-built circuit design for later review.

16. A “Back to House” button must allow users to return to the main house screen.

17. The system must visually highlight active or powered-on components during simulation (glowing lights or blinking LEDs).

18. The program must provide basic feedback messages after simulation (Simulation successful or Incorrect wiring detected).

19. The system may include an educational pop-up or guide explaining basic circuit rules (optional feature)

NON-FUNCTIONAL REQUIREMENTS

1. Usability: The interface must be simple and intuitive, with easily recognizable icons and logical component placement.

2. Accessibility: Texts, buttons, and clickable areas must be large, clear, and suitable for users of different ages and skill levels.

3. Performance:
The initial load time should not exceed 10 seconds.
Simulations should run smoothly, without noticeable delays.

4. Responsiveness: The system must adapt properly to different screen sizes (desktop, tablet, laptop).

5. Scalability: The codebase should allow adding new rooms, components, or sensors with minimal modification.

6. Maintainability: The project structure must be modular and well-documented for future developers.

7. Security: Saved data (user circuits) must be stored locally and securely, without exposing user information.

8. Privacy: No personal data (login, name, or email) should be required for basic use.

9. Interactivity and Realism: Animations for lighting, sound, or alarms must realistically simulate real home-automation behavior.

10. Reliability: The system must function consistently under normal use, without crashes or data loss.

11. Error Handling: The application must provide clear error messages in case of invalid actions (e.g., wrong connections, missing cables).

12. Educational Value: The design must promote learning outcomes, helping users understand how circuits function in everyday home environments.

13. Aesthetics: The color palette and visual design should reflect a modern, clean, and technological style, consistent across all pages.

14. Extensibility: Future integration with databases or sensor APIs should be feasible without major restructuring

USER STORIES

Title: Bedroom lighting simulation	*Priority: high*	*Estimate: 5 hours*
User story: As a student learning about home electricity, I want to connect lamps and bulbs to a power source in the bedroom, so that I can understand how lighting circuits work and how brightness depends on power		
Acceptance criteria: Given the bedroom environment is loaded, When I drag a bulb and connect it correctly to the outlet with cables, Then the bulb should turn on when I press “Test” showing adjustable brightness if power values change.		

Title: Living room electronics connection	*Priority: medium*	*Estimate: 4 hours*
User story: As a user exploring how electronic devices use power, I want to connect and test appliances like a TV or a radio, so that I can see how energy distribution and correct wiring affect their proper function.		
Acceptance criteria: Given the living room is selected, when I drag and connect a TV or radio to a power outlet using the “Cables” tool, Then the devices should work correctly (sound and image visible) when I press test, if the connections are wrong then the system, should display an error, message or warning icon		

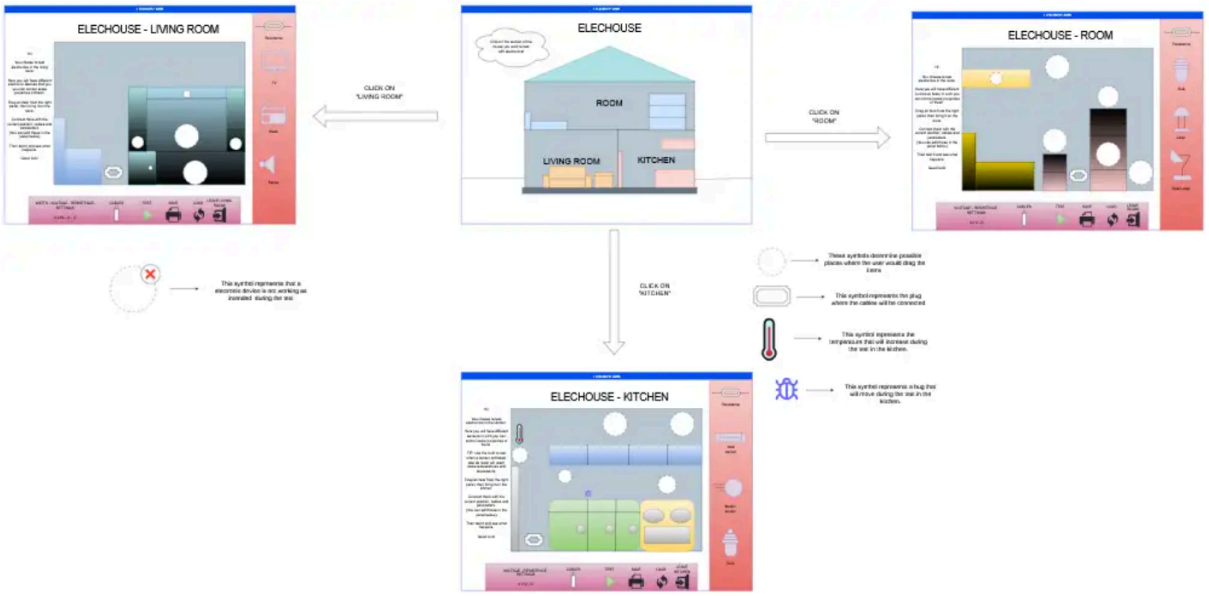
Title: Kitchen sensor calibration	*Priority: high*	*Estimate: 6 hours*
User story: As a learner interested in smart home sensors, I want to connect and calibrate temperature and gas sensors, in the kitchen, so that I can see how sensors react to heat or gas levels and understand the importance of correct calibration.		
Acceptance criteria: Given the kitchen environment is active, when I place and connect sensors to a power outlet, then the system should allow setting calibration values, if it’s correct, the alarm triggers only when high heat or gas levels occur, if its not then the alarm will trigger too early (for example while cooking)		

Title: Save and load circuit design	*Priority: Medium*	*Estimate: 3 hours*
User story: As a user working on my circuit design, I want to save and load my custom connections, so that I can continue my learning or modify previous setups later.		
Acceptance criteria: Given I have created a circuit design When i click “Save” then the system should store my design locally. When i click “Load” then my previous layout and component values should appear exactly as before.		

Title: Error feedback and guidance	*Priority: Low*	*Estimate: 2 hours*
User story: As a beginner user, I want to receive helpful messages when I make mistakes, so that I can understand what went wrong and fix my circuit easily.		
Acceptance criteria: Given a connection or value is incorrect when I press “Test”, then the system should show a clear error message, highlight wrong connections, and suggest possible fixes		

Title: Power consumption indicator	*Priority: high*	*Estimate: 4 hours*
User story: As a user interested in energy efficiency I want to see the total power consumption of connected devices, so that I can learn how much electricity is used by each circuit.		
Acceptance criteria: Given devices are connected in any room, When i press “Show consumption” then the system should display total wattage and energy usage in real time		

MOCKUP



Below is the link for the mockup in more detail

https://drive.google.com/file/d/15RemuRcy8BPD1x-mOrKWjnZAuIR8gHRs/view?usp=sharing

CRC CARDS

Class: Main Interface	
Responsibilities:	**Collaborators:**
It displays the project title and main menu.	Rooms
Load the general house layout (bedroom, living room, kitchen).	Component Panel
Detect clicks on rooms and zoom into the selected one.	Connection Simulator
Load the corresponding side panel according to the selected room.	

Class: Rooms	
Responsibilities:	**Collaborators:**
Graphically represent a room (bedroom, living room, or kitchen).	Electronic Element
Contain the electrical and electronic elements placed by the user.	Component Panel
Validate that components are properly connected.	Connection Simulator
Send data to the simulator to run the test.	

Class: Component Panel	
Responsibilities:	**Collaborators:**
Display available components depending on the selected room (lights, sensors, appliances, etc.).	Rooms
Allow drag-and-drop of components into the room.	Electronic Element
Display the Cables tool.	Cable

Class: Electronic Element	
Responsibilities:	**Collaborators:**
Represent an individual electronic component (bulb, lamp, sensor, TV, etc.).	Cable
Store its electrical properties (voltage, state, calibration value).	Room
Respond to events (turn on/off, connection error, alarm).	

Class: Cables	
Responsibilities:	**Collaborators:**
Represent connections between components.	Electronic Elements
Verify electrical continuity.	Rooms
It Detects connection errors (short circuits, missing ground, etc.).	Connection Simulator
Conducts current	Plug
Need to connect to an earth	

Class: Connection Simulator	
Responsibilities:	**Collaborators:**
Analyze user-made connections.	Rooms
Determine if the circuit is correctly assembled.	Electronic Element
Execute the test and display the results (lights on, sensors activated, errors).	Cable
Provide visual or sound feedback.	Result Panel

Class: Result Panel	
Responsibilities:	**Collaborators:**
Display messages about the simulation status.	Connection Simulator
Indicate whether the components work properly or have malfunctions.	Rooms
Show specific alerts (Sensor not calibrated correctly, Short circuit in living room).	

Class: Resistance	
Responsibilities	**Collaborators**
Allows to regulate the current	Electronic Elements
Prevents electronics to burn	Plug
Gives ohms	Cables

Class: Bulb	
Responsibilities	**Collaborators**
Generates light	Resistance
Gives differents intensities of light	Cables
Consume Volts	

Class: Lamp	
Responsibilities	**Collaborators**
Can give differents colors of lights	Resistance
Gives differents intensities of lights	Cables
Consume volts	

Class: Desk Lamp	
Responsibilities	**Collaborators**
Gives differents intensities of lights	Resistance
Consume Volts	Cables

Class: Heat Sensor	
Responsibilities	**Collaborators**
Detects high temperatures	Resistance
Can give an alarm when temperatures are high	Cables
Parameters vary by volts received	Bulb

Class: Motion Sensor	
Responsibilities	**Collaborators**
Detects Movement	Resistance
Can give an alarm when it detects movements.	Cables
Parameters vary by volts received	Bulb

Class: TV	
Responsibilities	**Collaborators**
Gives display	Stereo
Gives audio	Resistance
Consume watts	Cables

Class: Radio	
Responsibilities	**Collaborators**
Gives audio	Stereo
Plays music	Resistance
Plays news	Cables
Plays podcast	
Consume watts	

Class: Stereo	
Responsibilities	**Collaborators**
Gives audio	TV
	Radio
	Cables

Class: Plug	
Responsibilities	**Collaborators**
Gives volts	Electronic Components
Give a terminal connection to the cables	Cables
Gives earth	