

Project Concept Document (PCD)
Smart Home Appliance Control System (SHACS)

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Approval

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PROJECT CONCEPTS DOCUMENT

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Project Concepts Document

1. Executive Summary

The Smart Home Appliance Control System will allow a user the ability to control several common household items: household fan(optional), light bulb, thermostat, and controlling blinds. The user will be able to wirelessly control these items from anywhere in their home. Not only can the user be able to control all of these items, but the light and blind control modules will be able to work autonomously due to sensors on the modules. You might be asking yourself, but why would I or anyone need something like this? A simple answer to that is convenience, but the reason behind the SHACS is to aid people with disabilities in which it is a burden for them to walk around and manually turn on and off or adjust an appliance.

A bonus product of the system that can be partially autonomous is that it has the potential to save on energy bills. Overall, the system will be a great addition to any home weather to aid you in everyday activities, or just simply for the simple fact of it being convenient.

2. Product Users

Primary and Secondary list of users

Primary:

- Elderly People
- People with permanent disabilities (primarily those with walking problems)

Secondary:

- Anybody who wants control over their home appliances

3. External Impacts on / of Project

3.1. Environmental impact

The SHACS will not have a huge environmental impact, but it could help reduce the carbon footprint of your home. The way this would happen is when the light is in automation mode with the blind control module and thermostat reminder settings. The thermostat will inform the user that they are/aren't using energy saving temperatures during winter and summer seasons. The system might help lower energy bill by allowing the user to switch off certain appliances more conveniently; this will help eliminate unwanted use of electricity inside the home.

3.2. Social impact

The SHACS will only have a real social impact among the elderly and people with permanent disabilities that involve making it hard to walk and/or get up and move around. This application will help these communities by lowering the risk of injury by not forcing them to constantly get up in order to control an item in their home.

3.3. Economic impact

The SHACS will provide very limited economic impact. The economic impact correlates alongside with the environmental impact. What I mean by this is the more energy that is saved will correlate with the more money you save on your energy bill.

3.4. Political impact

Not Applicable

3.5. Ethical impact

Not Applicable

3.6. Health and Safety impact

The SHACS will improve the health and safety of the aforementioned groups of people. It will provide them with the peace of mind that they can access appliances around the house without having to risk injury from walking one point to another. This fact will have a great impact on their health and safety in day to day activities.

4. Assumptions, Dependencies, and Constraints

4.1 Manufacturability

- **Assumptions:** Person using system within required range of Xbee specs.
- **Dependencies:** Light module and blind control module be ran autonomously apart from the overall system.
- **Constraints:** Designed within a small budget. Limited in wireless range from central hub. Limited life time is constrained to battery life.

4.2 Sustainability

- **Assumptions:** System will be able to run off of ~3.5v battery supply.
- **Dependencies:** Fan, light modules depend on main voltage to drive appliances. Modules power supply will be dependent only on battery power supply.
- **Constraints:** Battery life will control how sustainable the system is. Will be constrained on the quality of design that interact with main voltage.

4.3 Supportability

- **Assumptions:** SHACS will be able to support at least these basic modules
- **Dependencies:** SHACS Xbee network will rely on the STAR networking protocol
- **Constraints:** SHACS will be constrained on design of the Xbee network, in which will need to be tested thoroughly to decrease chances of failure.

4.4 Reliability

- **Assumptions:** SHACS system works according to plan and no errors are encountered.
- **Dependencies:** The reliability will depend on the lifecycle of the battery supplied to the modules.
- **Constraints:** The reliability constraints are that the battery life of the system will be constrained to the battery life of the modules and will have to be replaced.

5. User Accessible Features

Touch Screen on Main module – User will be able to interact with the TFT LCD to tell the system what to do along with requesting data from the other modules.

Light Control – User will be able to turn on and off a light bulb. The user will be able to dim the light to a specified brightness. The module will also have an autonomous mode that will turn on the light according to a trigger from a PIR sensor. Additionally, the user will be able to request voltage and current statistics from appliance.

Fan Control(Optional) – User will be able to turn on and off a household fan. The user will be able to vary the fan to a specified speed. Additionally, the user will be able to request voltage and current statistics from appliance.

Thermostat Control – User will be able to see the thermostats status and temperature/humidity. The user will also be able to set the thermostat to a specific set point that will control the switches to the AC/HEAT/Fan units. The thermostat module will also be programmed to inform the user that they are/aren't using energy saving techniques during the summer and winter months. The user will be able to request temp/humidity readings from modules.

Blind Control – User will be able to control the blinds to open or to shut them. The module will also be able to run autonomously with the input coming from the lux sensor and the module determining whether or not to shut or open the blinds. Along with being able to do that, the user may request a log of the suns intensity throughout the day.

6. Estimate Project Costs

Parts List:

- 1 x STM32F4 board with TFT LCD	\$15
- 4 x STM32F3 board	$\$11 \times 4 = 44$
- 5 x Xbee wireless modules	$\$20 \times 5 = 100$
- 1 x light sensor	\$6
- 1 x servo motor	\$10
- 1 x thermostat	\$24
- 1 x fan (Optional)	\$40
- 1 x light bulb	\$8
- Other electrical components, Wires, adapters	\$40
Total	~\$300

7. Glossary

Word or Phrase	Meaning in this document
SHACS	Smart Home Appliance Control System
Appliances	Normal household appliances with extra addition of blinds
Central Hub	Main communication module that interacts with all other modules.
PIR Sensor	Passive Infrared Sensor that will detect change in a still room

8. Appendixes

N/A