UNIVERSITY OF CENTRAL FLORIDA

Senior Design I, Summer 2019
Divide and Conquer, Version 1.0

Project Title: **SunShade**

Group number: **13**

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Narrative Description

For Floridians, the sun is a constant facet of everyday life. They call it the sunshine state; we spend all day in its overwhelming heat, and our beaches thrive on its endless light. But what about when we head indoors? By the time the sun is going down, your options are to completely shut it out, or face blinding lights streaming into your home every few minutes as it sets. What about for those who have delicate plant life that could face overexposure? Obnoxious television glare after a long day of work? Not to mention the financial toll the florida sun takes on the monthly electricity bill. Sunlight making its way into your home can push your air conditioning unit to its limit, and cost you a pretty penny.

SunShade is an application-controlled smart window shade appliance designed to combat the bright Florida sun and heat. Our motivation for the project is to design an easy to use smart-blinds system capable of raising and lowering standard window-shades, as well as tilt for controlled sun exposure. The project will be controlled either manually, with onboard controls, or through a connected smartphone application. Upon connecting your SunShade to the accompanying smartphone application, users will indicate which direction their window faces, and from there, have a variety of features to utilize, including, but not limited to:

- Direct control- this will allow the user to adjust the up, down, and tilt blinds positions with ease, having only to lift a finger from the comfort of their home, or from long distance.

- Automatic brightness control- accounts for direction and exterior brightness to adjust the tilt of your blinds throughout the day in order to only allow a reasonable amount of natural light. This can be useful for keeping a comfortable brightness in the users home throughout the day. This can be achieved with either a sun-facing sensor, weather information, or temperature sensors.

- Scheduling function- this will allow for users to allow for their SunShade to protect their window-dwelling plantlife from over-exposure, as well as save the user on monthly electricity costs by limiting the effects of the sun on air conditioning usage.

Other functionalities still in theory include solar-panels to assist in power requirements, as well as motion sensing capabilities and app alerts for home-defense. One of the major downfalls of existing smart blinds products is their cost. Typically we can find products like this in the range of $150-$250. We aim to create a cheaper alternative, while sacrificing none of the utility. In a survey conducted with the owner of a smart-blinds product, they indicated that the major issues they had with their product was a lack of manual, app-less control options, and a lack of scheduling options. Scheduling can not only assist with maintaining a reasonable interior temperature and brightness, which helps with monthly bills, but can also assist those living with plant-life, ensuring a healthy daily sun exposure, even while the user is away. Another issue arising with existing models is especially apparent among the models that add to already

installed blinds. Some users complain that if the chord mechanism is not tightly bound to the pull strings, functionality suffers. To remedy this we are exploring both a more reliable pull system for these chords, or even a fully-integrated blinds to avoid this all together.

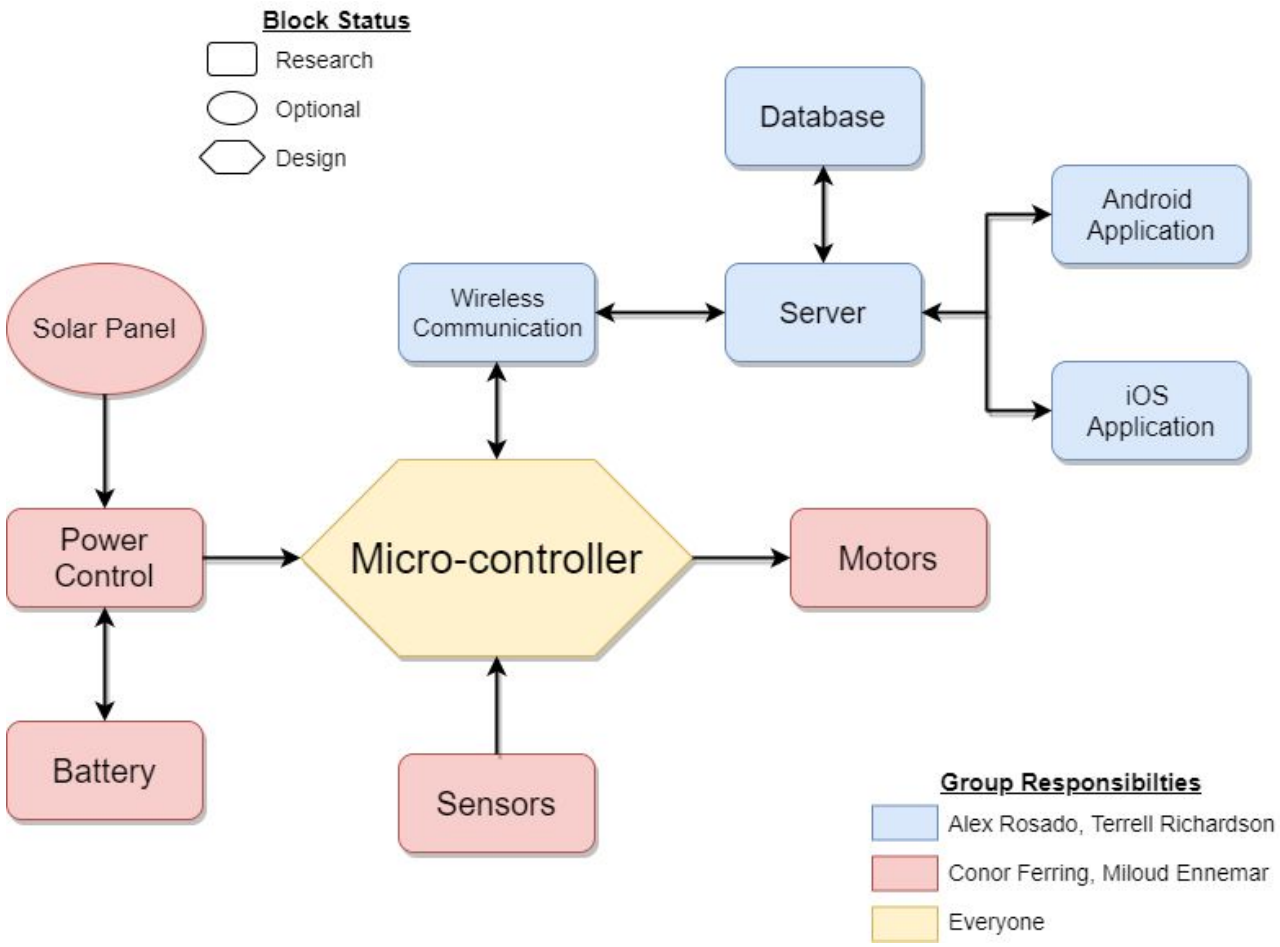
Requirements Specifications:

The system must be autonomous and user friendly, to help minimize user interaction. The system must allow a comfortable amount of light into the bedroom, and requires light input from the interior and exterior in order to be activated, therefore we would have to have sensors (photocell sensors or light dependant resistors) from both sides. For the interior we will need at least one temperature sensor, so that when the temperature exceeds a desired limit, the blinds tilt downward or upward to block the sunlight. We will need three light sensors for the exterior. a microcontroller (Arduino), the microcontroller will instruct a dc motor(a stepper motor) to move when appropriate . For the power source we will be using a 12V battery or a solar panel . we might add a display screen to display the temperature outside.

The mobile applications we are going cross platform to target both android and IOS. The app will contain a dashboard that will display statistics such as: light level, temperature, and blind status. The app will have a user friendly tab that will allow the user to control the blinds remotely. The features will include automated settings, manual adjustment, and predetermined lighting settings. The apps will target current generation hardware and software (iOS 11-12, Android 8-9). User's should be able to identify and navigate the application with little to no instruction, but we will implement a basic help guide for beginners.

1	Open and rotate depending on light intensity
2	Don’t cost too much
3	Solar powered/ batteries with long lifetime
4	Easy to install (does not take too much time to install)
5	Product must follow the IEEE guidelines
6	Only a certain of window sizes
7	Communicate wirelessly through an app, Android or IOS
8	Display temperature
9	Blinds Can be operated manually
10	Sensors outside and inside
11	Control blinds with Motor
12	Display temperature on the App

Project Block Diagram



Estimated Project Budget and Financing

Our group is currently funding the project with no sponsorships. There is a solar panel involved with our design, so we will attempt receive Duke Energy sponsorship donations. The list below is our current calculated cost for the project but is subject to change during prototyping.

Project Budget	
Item	Cost
Arduino MEGA 2560	$36
Stepper Motor (Bidirectional)	$20
Gear Motor 3	$5.75
Solar Panel	$30
Zigbee	$30
Blinds/Frame	$35
Light Sensors & Photocells	$15
USB Charger	$4
Voltage Regulator	$1
Sockets	$0.20
Relay	$5.50
Batteries (Rechargeable)	$15 - $45
Total	**$262.45 - $292.45**

Initial semester milestones

	Objectives	Deadlines	Time Frames
	Senior Design 1		
Documentation	Project Idea	5/28/2019	5/19 - 5/28
	Initial Project	6/2/2019	5/30 - 6/1
	Table of Contents	7/1/2019	6/12 - 6/29
	Draft of document	7/7/2019	6/12 - 7/2
	Final document	8/1/2019	7/8 - 7/30
Formalization	Standards, specs, and cost	6/1/2019	5/28 - 5/30
	Choose servos	6/7/2019	6/2 - 6/7
	Choose controller	6/7/2019	6/2- 6/7
	Choose communication	6/7/2019	6/2 - 6/7
Prototyping	Power supply	6/18/2019	6/9 - 6/17
	Sensor and servo Interface	6/20/2019	6/9 - 6/19
	Communications	6/21/2019	6/9 - 6/20
Design	PCB	7/4/2019	6/17 - 7/3
	Connections	7/4/2019	7/1 - 7/7
	App	7/4/2019	7/1 - 7/7
	Casing	7/8/2019	6/17 - 7/4
	Senior Design 2		
Presentation	CDR Presentation	TBA	TBA
	Conference Paper	TBA	TBA
	Midterm Demo	TBA	TBA
	Final Presentation and Demo	TBA	TBA
	Exit Interview	TBA	TBA
Fabrication	Order and Assemble	TBA	TBA
	Specifications Review	TBA	TBA
	Testing phase	TBA	TBA