Smarter Blinds
Project Requirement Specification

Christopher Casillas
Alejandro Avila
Erik Ramirez
Alexis Lopez
Hector Leon

1. Overview:

The design of Smarter Blinds will feature a simple gear system to lower and raise the blinds. The system will be composed of a few gears (including a worm gear), a band, and a spool. The gears will be powered by a dc motor which will rotate worm gear and in turn the band attached to the rod that holds the spool. The purpose of the spool is to wind the string that holds the blind panels. The system's gears are laid out in a way to minimize the total stress on the motor while at work, and serve as a locking mechanism while at rest. On the other end, we will have a servo motor attached to a rod that controls the angle of the blinds.

Our product, Smarter Blinds, is meant to provide an extra dimension of convenience. Similar products on the market are MySmartBlinds. Their purpose is to simplify the lives of their consumers. Their product gives control of privacy, temperature, lighting, and security via an app. They have an Automation Kit that controls the tilting of the blinds on a schedule and on demand through a smartphone. The kit includes a motor box, battery pack, manual switch, rod adapters for all tilt rod shapes, and other elements. Once we get our blinds to do the basic functions of opening, closing, and tilting the blinds, we wish to add sensors. Like what we wish to do, MySmartBlinds has temperature sensors that enable a feature they call Energy Savings mode. It shuts the blinds when the room heats up. It also has solar charging. Their product provides easy installation and compatibility with IOS and certain android devices. Moreover, Axis Gear is another product that provides similar functions. It is a smart device that lets you control and schedule when your shades open and close. It only works with certain cords or chains. It claims to be cheaper, enhance security and save energy. The objective of smarter blinds is to add an element of convenience to everyday blinds.

Some key challenges include:

1. Creating a clear cut design with a listing of specific materials and measurements.
2. Gathering the materials required for the project.
3. Maximizing the size of the spool and motor within the limited space of the blinds.

2. Statement of the problem:

Correlation Matrix:

	Size	Battery Capacity	Sensors	Performance/ Speed	Display/ Appearance
Size		++	++	++	− −
Battery Capacity			+	+	−

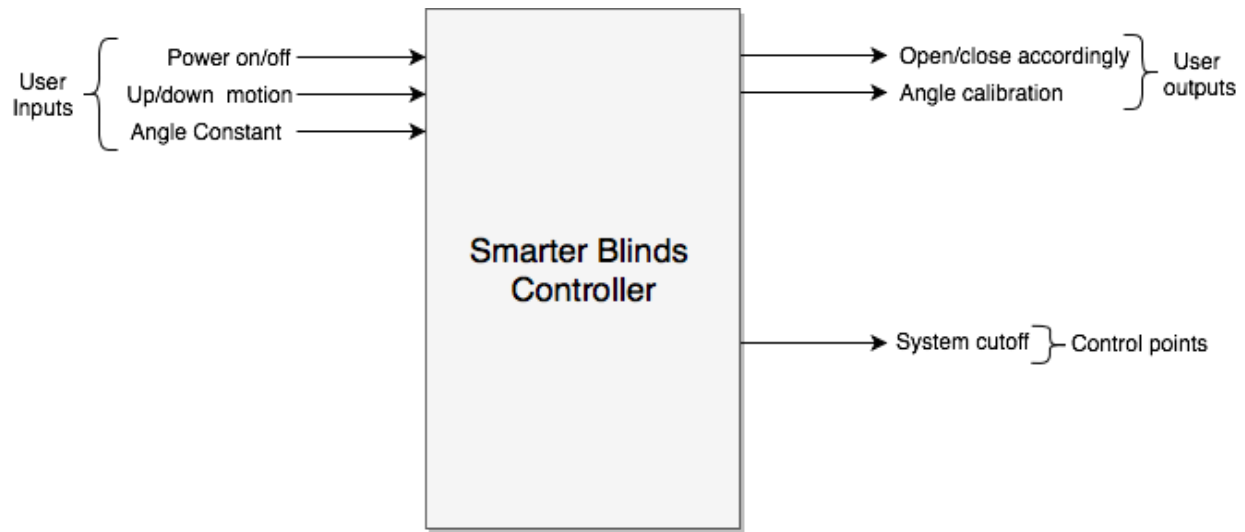|					
Sensors			■	++	_
Performance/ Speed				■	_
Appearance					■

++   Highly correlated positive
+   Moderately correlated positive
_   Moderately correlated negative
_ _   Highly correlated negative

Our project design objective is to facilitate the daily lives of the customer by automating blinds using a Raspberry pi 3b+.

3. Operational description:

Smarter Blinds User's Manual

- A. Product overview
- B. Installation
    1. Solar Panel
    2. Cabling
    3. Raspberry pi 3b+
- C. Initial Setup
    1. Alignment of sensors
    2. Calibration
    3. Testing
- D. Operations
    1. Angle specifications and measurements
    2. Monitoring open/close length and applications
    3. Calibration checks
    4. Solar panel integration
- E. Maintenance
    1. Troubleshooting

User Inputs { Power on/off, Up/down motion, Angle Constant }

Smarter Blinds Controller

Open/close accordingly, Angle calibration } User outputs

System cutoff }– Control points

Power

Decrease Angle
Close the blinds

Increase Angle
Open the blinds

SPECIAL FOR MP3

The user interface mainly consists of 3 components. Obviously, the user needs the option to properly turn on/off the product. In our case, we used a controller to let the user input its preferences. The second component is adjusting the angle of the blinds. The user will be able to increase or decrease the angle he/she desires. Lastly, the user will be able to close or open the blinds by pressing the (+) and (-) buttons.

4. Requirement specification:

This product has fairly straight forward design requirement. It is a window blind which is controlled automatically. Just by the touch of a button, a user can get the blinds to open and close, as well as adjust the shades angle. This simplistic mechanism is all commanded by a Raspberry Pi 3 b+. The Raspberry Pi is the computer that holds all the code, responds to the inputs and directs the motors to act in the desired manner. Some of the restrictions our product encounters are basic design limitations. Such as, the limited space within the panel, the range

of the infrared control, the quality of the materials to fit our design needs, and the time span we have to gather the resources required for such project.

5. Design deliverables:

A design deliverable will be our first working prototype. The first working prototype of Smarter Blinds will display all the basic features. It will raise the blinds (100%) and lower the blinds (0%), whereas the next prototype will allow for more flexibility by specifying any percentage. For the angle of the blinds, it is calibrated to open to 0, 90, and 180 degrees with reference to the vertical plane of the blinds. These features will be incorporated via remote control. As for the documentation, the development of the project has involved numerous adjustments, especially with the materials. We always keep older versions of code and physical designs that work and build of that. The test result will demonstrate whether or not the motors that power the system will provide sufficient torque to perform the basic tasks.

6. Preliminary system test plan:

The preliminary system test plan will be conducted to evaluate whether the design meets the requirement specifications.This includes checking if the blinds can be opened and closed within the spaces of installment. We will implement boolean logic into the code to prevent the user from continually submitting input that has already been delivered. For example, if the blinds are already completely open and the user attempts to send input to open them again, the system will show the task has already been completed. Ultimately we are verifying if the inputs produce the proper outputs.

7. Implementation considerations:

We have encountered numerous issues while working on the design. Our primary issue to this point has been gathering materials in a timely manner. For example, for our desired design we require rods and gears. The rods we acquired are not the correct length and the diameter of the hole in the gears is too narrow to fit the rods. Rather than expend time and money, we made some quick adjustments. First, we decided to place a thin sheet of wood on the walls of the interior of the blinds to compensate for the shorter lengths of the rods. Secondly, we heated up the gears to expand the plastic to fit the diameter of the rods. Other practical issues we have dealt with are following a reasonable timeline to complete different phases of the project and incorporating our members suggestions while deciphering whether these suggestions can be accomplished under the time and money constraints. Future directions for this project will include the implementation of various sensors, voice control, and connection to a smart home system. Although these future implementations aren't necessary, they will provide additional options and convenience.