



Senior Design I

Home Pro

Divide & Conquer V2.0

Group 2 Creol IC

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I. Project Narrative & Motivation

- **Motivation & Background**

Humans have arguably been looking for ways to make life better and more comfortable since written history and the advent of technology is a great example, having improved the quality of life and lifestyle. Smart devices have had a tremendous impact on humanities everyday life. Since the word “smart” has become synonymously used for different devices and products, our idea needs further context and clarification. For the constraints of this project we are defining “smart” as the interconnectivity between our separate systems to attain a larger system. This project outlines the constituents of fabricating our smart table. The goal for our smart table is to bring students, families, and friends together in this tough time by facilitating an interactive entertainment system (safely) utilizing devices and features that humanity has come to expect and use in modern society.

- **Overview & Description**

This collaboration work has culminated into a “coffee table” sized smart table with a projector and interconnectivity for human interface and control. The projection system will be mounted inside the table and will be able to project to most flat surfaces outside the table in 1080 x 1920 resolution through HDMI connection to give the users freedom of media. The MCU & IoT system will as well allow the user to control the brightness of the protection system to symbiotically accommodate the varying ambient lighting any user may have. The smart table will also contain an (internal modular wireless) audio system for the interconnectivity with the currently displayed media and will have most user chosen media accommodation.

- **Features & Constituents**

The smart table will allow the person to control the disposition of the projector wirelessly through their phone or raspberry pi, the purpose of this feature is to allow different audiences to choose the perfect disposition of the projector they desire. The brightness of the light source in the projector will as well be controlled by the app for the user to choose the right image brightness. Another feature the project will include is the wireless speakers which will be built on one side of the table. The wireless speakers will not only be used for the projector but will also allow cell phones, computers, and other devices that contain the wireless feature to produce sound. The powering of the project is decided to be through an outlet.

II. Goals & Objectives

The goal for our smart table is to bring people and families together in this tough time by facilitating entertainment and group activities (safely) utilizing devices and features that humanity has come to expect and use in modern society. Our group is committed to providing a system that can go in anyone's home, office, or most indoor. Our objective is to provide an all in one self-contained projection system with the interconnectivity modern society has come to love and expect.

III. Constraints

This project can be very complicated or simple depending on how to approach it. since the goal of this project is to build everything from scratch from the projector to the speakers and power systems. However, many obstacles such as time and budget might interfere with the progress of the project by making it very challenging to accomplish (Complete). Knowing that senior design 1&2 happen to occur while the Corona Virus is still spreading. The resources UCF provides for its seniors become very limited, not forgetting that most of the group meetings with the group members and the mentors; which are conducted online, will create many conflicts and misinterpretation of different scenarios.

The Solution to these potential obstacles would first be scheduling mandatory meetings every week in order to keep track of the progress of the project and the responsibilities of each member. Next, keeping track of where the money goes towards or what is more important but before any of this the scope of the project has to be realized who would be the customer and the application of the project.

IV. Specification & Requirements

- Ac to Dc power supply for entire project's powering requirements
- Coffee Table Dimensions

Height	15 – 20 Inches
Length	36 – 50 Inches
Width	20 – 30 Inches

- HDMI (2.0, MIPI DSI display port)
 - Wired Connection to connect a computer so the screen can be projected
 - HDMI ports supporting up to 4K at 60Hz displays
- USB Type A 3.0 for charging devices
- Wireless communication to speakers will not only play the audio of what is being projected but also a phone or anything with Bluetooth capability.
- Projector system
 - LCD Screen will have a resolution of 1080 x 1920
 - Projector Display area 68.04 x 120.96 mm
- Fingerprint Reader Connected through host MCU
 - Allow a level of security for Home Pro accessibility
 - Access features such as opening a storage compartment
- Controller through software application Connected through host MCU
 - Controller that controllers the brightness level of the light within the projector
 - Controlling volume levels

Table I: Optical Projector Specs

Optical Projector Specifications & Requirements	
YUJILEDS® High CRI 95+ COB LED	Function: To transmit light through the object plane and create an image onto the image plane Dimensions : 16 x 16 x 0.38 mm Emission Angle : 120°
HDMI To MIPI Converter Board	Function: To control and support video to an LCD Screen Dimensions: 50 x 40 x 3 mm
5.5” LCD Screen	Function: To create an object for the projecting system to image Resolution: 1080 x 1920 Outline Size: 70.44 x 129.59 x 1.61 mm Display Area: 68.04 x 120.96 mm Brightness: 450 cd/m ² Contrast Ratio: 1000:1 Viewing Angle: 160° Signal Interface: 2 ch, 4 data lanes, 40 pins (MIPI)
Fresnel Solar Lens	Function: To collimate light from the LED, converge light rays through the object plane and focus on the projecting lens Material: Both made from optical polymethyl methacrylate (PMMA) material Front Fresnel mirror size: 140 x 90 mm Focal length: F185 Rear Fresnel mirror size: 140 x 90 mm Focal length: F120
LED Driver, Constant Current Power Supply	Function: To provide a constant power supply and to provide a voltage boost to the LED Operating frequency: 150 KHz Conversion efficiency: up to 96% Weight: 50 g Module size: 70 x 36 x 13 mm
Raspberry Pi	System-on-a-chip: Broadcom BCM2711 CPU: Quad-core 1.5GHz Arm Cortex-A72 based processor GPU: Video Core VI Memory: 1/2/4GB LPDDR4 RAM Connectivity: 802.11ac Wi-Fi / Bluetooth 5.0, Gigabit Ethernet Video and sound: 2 x micro-HDMI ports supporting 4K@60Hz displays via HDMI 2.0, MIPI DSI display port, MIPI CSI camera port, 4 pole stereo output and composite video port Ports: 2 x USB 3.0, 2 x USB 2.0 Expandability: 40-pin GPIO header

V. Block Diagrams & Flowcharts

This Block diagram & flowchart section contains the necessary constituents required to complete our project. This section outlines the overall flow of the system and a pictogram of responsibility per system as well as slightly more detailed itemization of each subsystem.

Figure 1:

System Overview

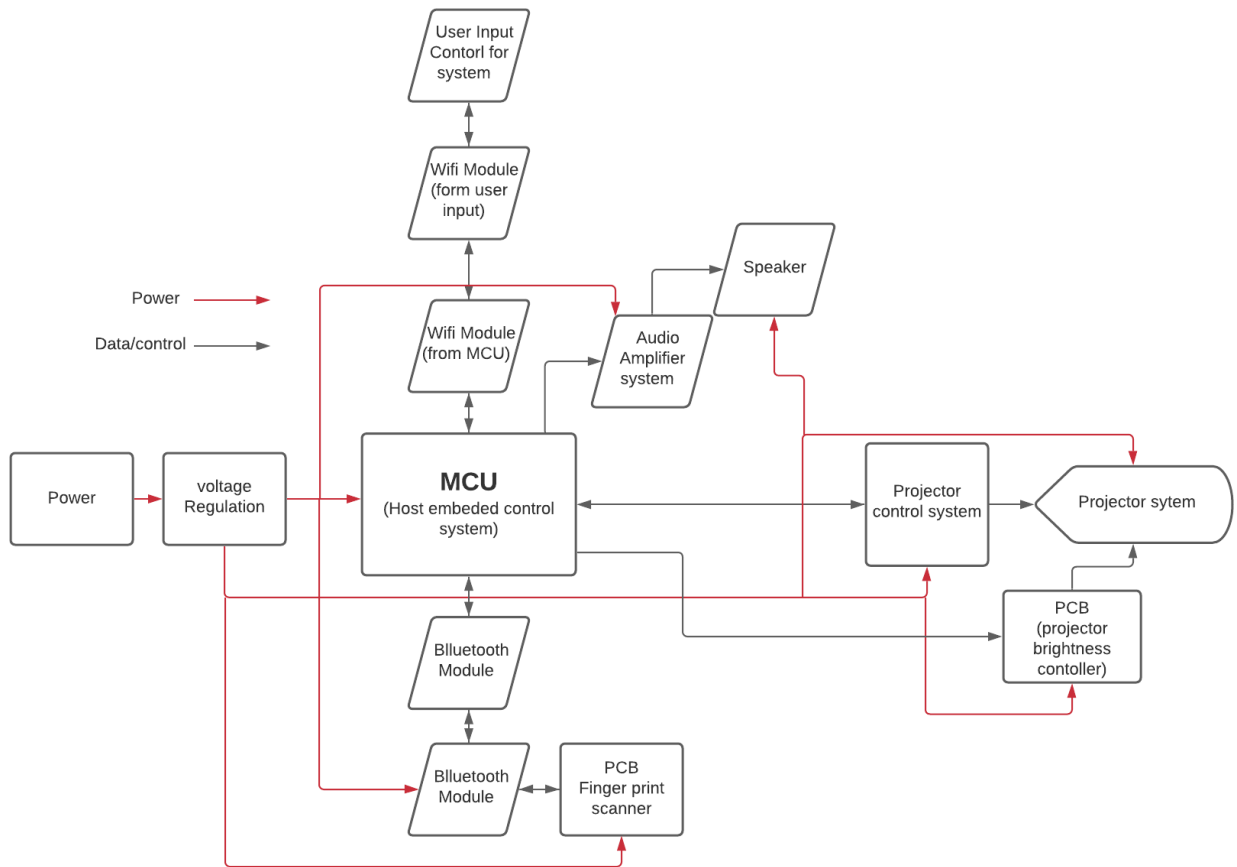


Figure II: *Power Supply*

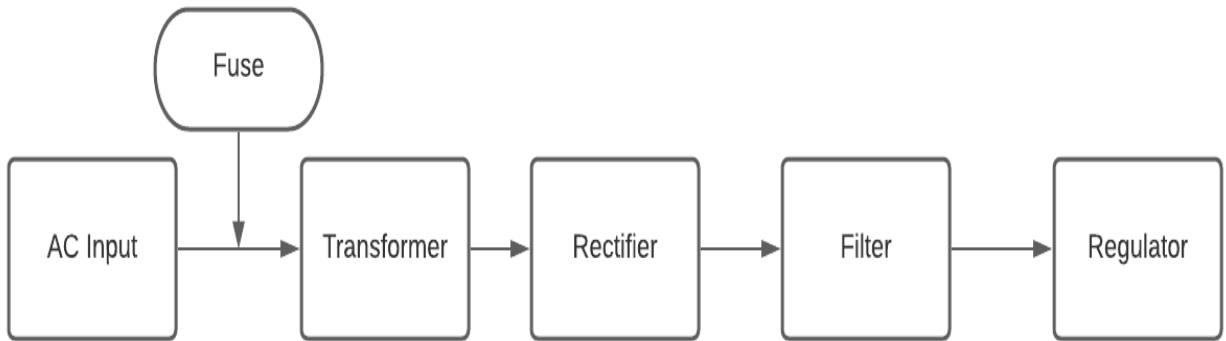


Figure III: *Audio System*

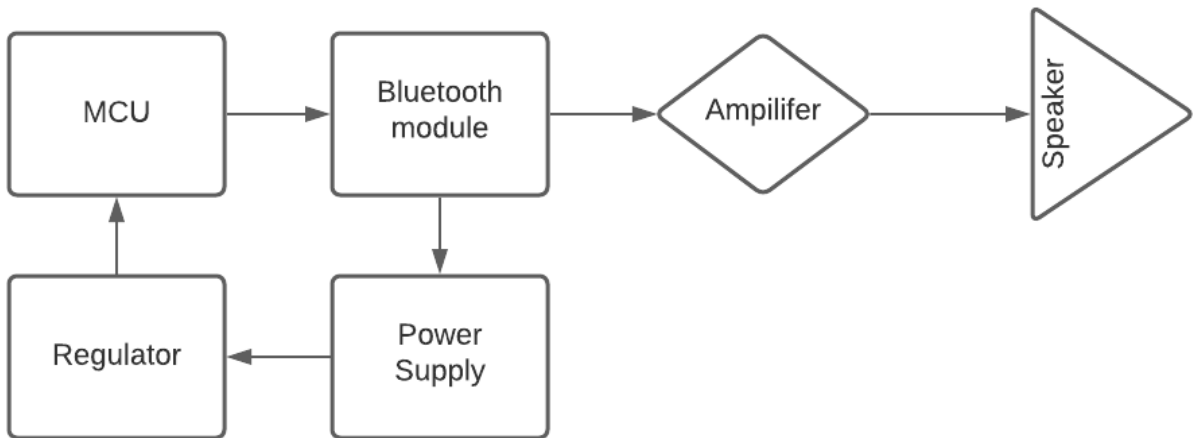


Figure IV: *Projector System*

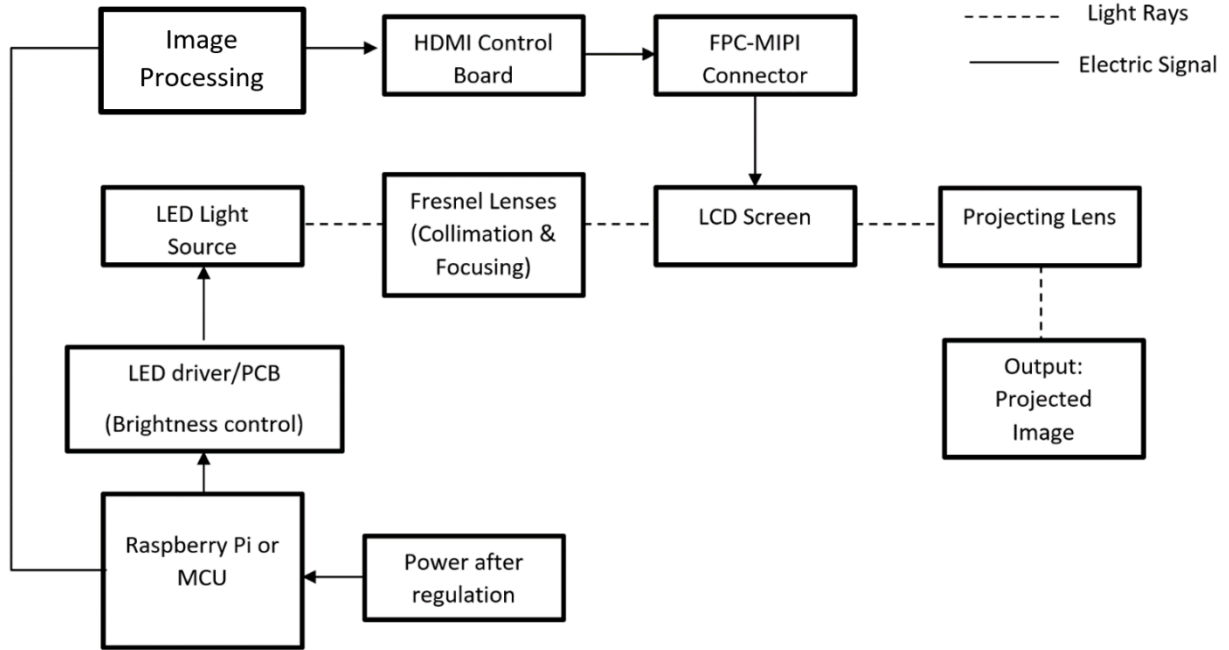


Figure V: *Responsibility Chart*

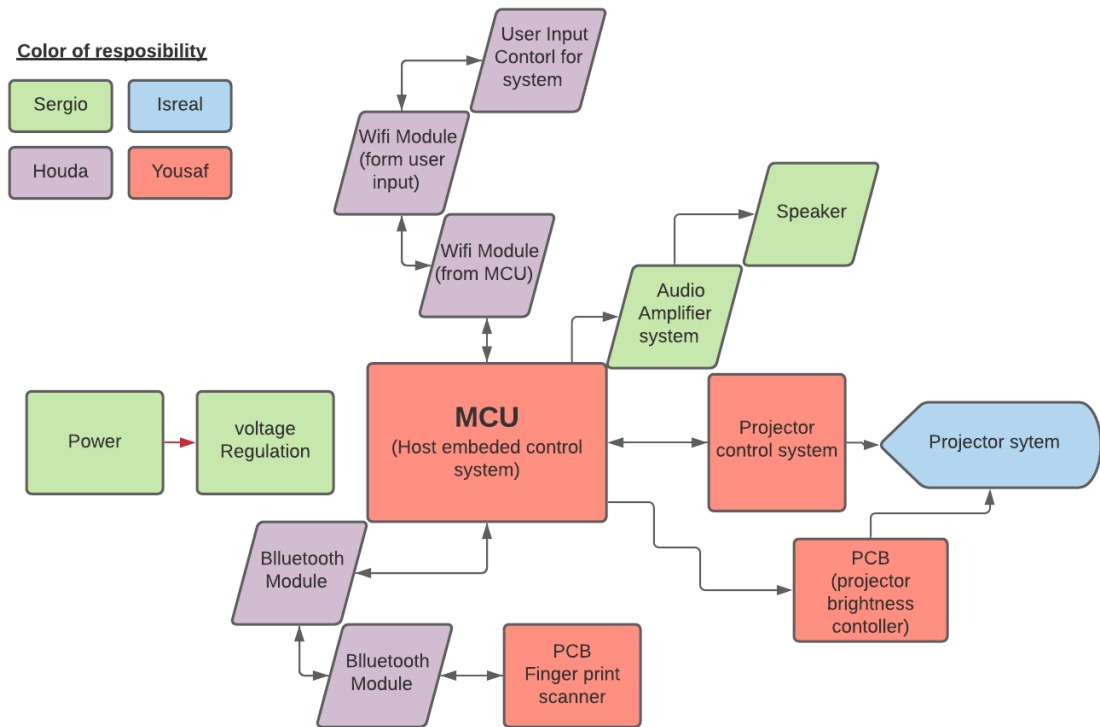


Figure VI:

Software Flow

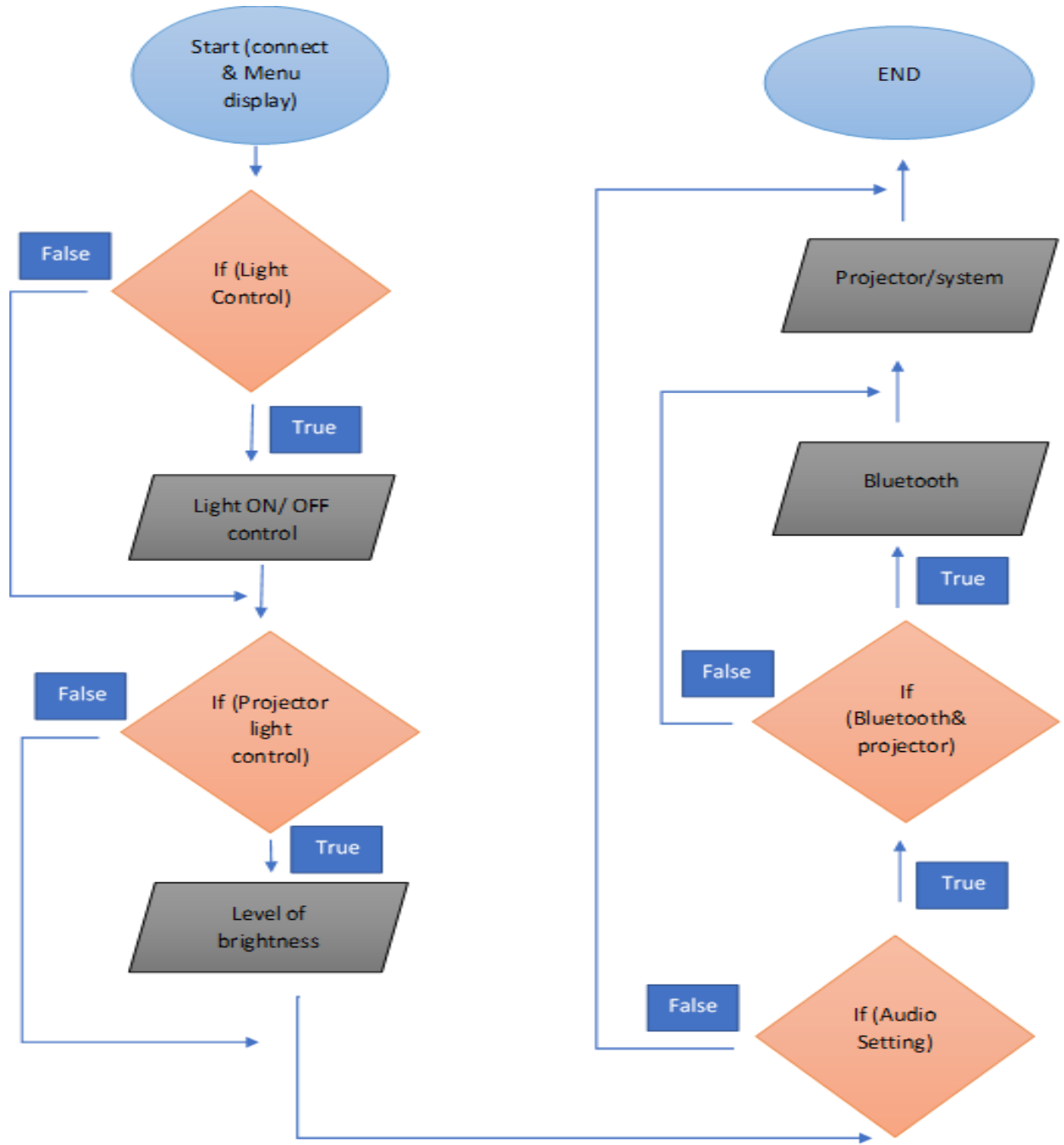
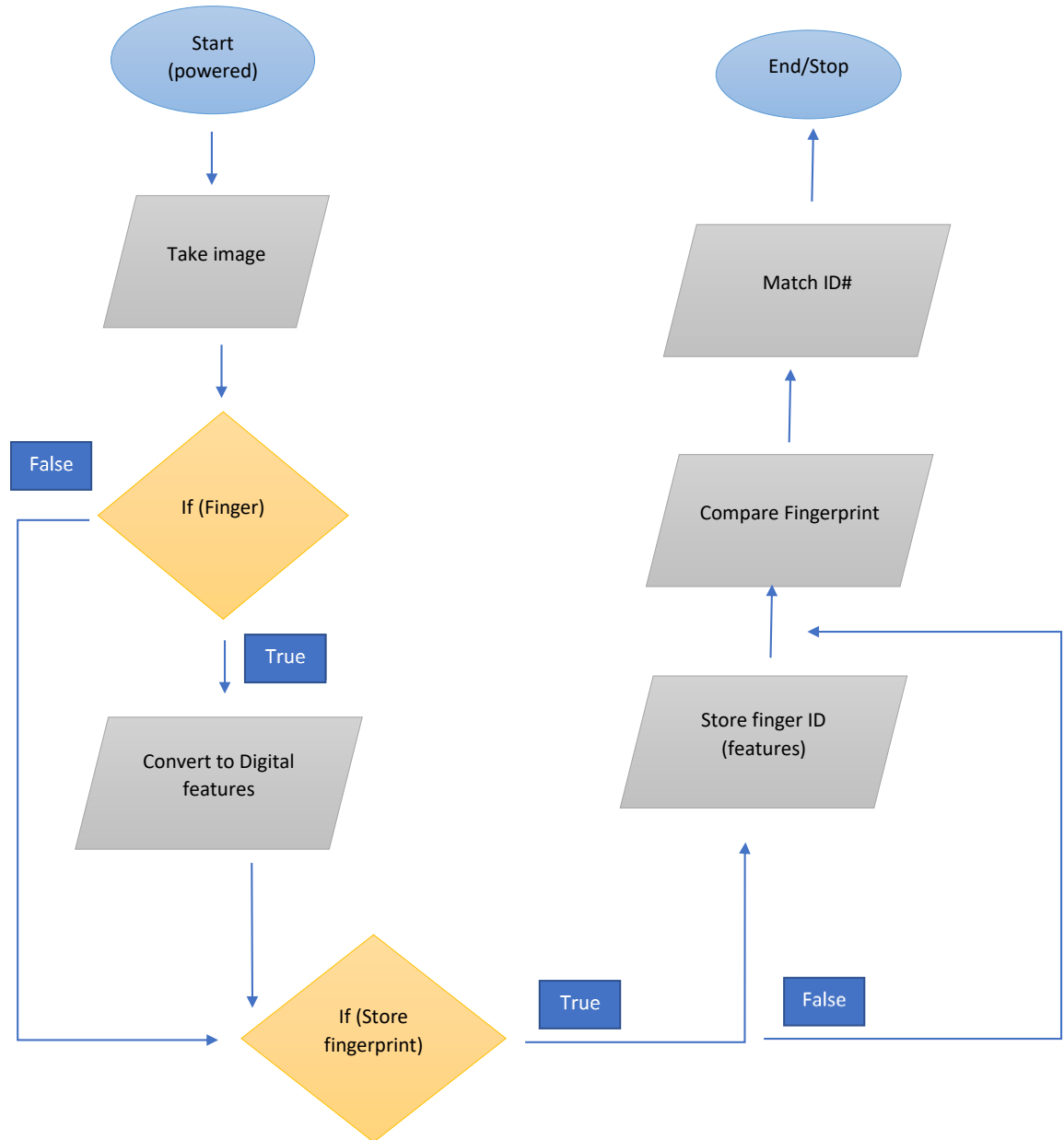


Figure VII: *Fingerprint Reader*



VI. Budget & Finance

- The table below is a representative table for the initial financial needs for the HomePro system. Some elements and constituents require purchasing, however whenever possible our group will be designing and fabrication each. We have attempted to evaluate the pricing accordingly

Table II: Budget

Items/Parts	Quantity	Prices Estimate \$
MCU	1	\$15
Bluetooth module	1	\$10
LCD Screen & HDMI Control Board	1	\$80
Video Processing PCB	1	\$35
LED (Projector lighting)	1	\$99
Wood	4	\$20
Speakers	2	\$20
Fuses	10	\$10
Lenses	2	\$40
Fingerprint scanner	1	\$40
System PCBs	10	\$20
Estimated Total	N/A	\$374.00

VII. Milestones

Table III: Schedule Milestone

Projector / Smart Table			
Number	Tasks	Start	End
<i>Senior Design I</i>			
1	Ideas brainstorming	8/24/2020	9/13/2020
2	Project idea selection	9/14/2020	9/14/2020
3	Project designs investigation	9/14/2020	9/16/2020
4	Project Budget investigation	16-Sep	16-Sep
5	Initial Doc- Divide & Conquer I	14-Sep	18-Sep
6	Project Scope Decision	TBA	TBA
7	Initial Doc- Davide & Conquer II	9/25/2020	10/2/2020
8	Quiz A - E	10/5/2020	11/6/2020
9	60 Page Draft Senior	10/26/2020	11/13/2020
10	100 Page Report	11/9/2020	11/27/2020
12	Final Document	11/23/2020	12/8/2020
<i>Project Report</i>			
13	Project report scope	TBA	TBA
14	Project Introduction	TBA	TBA
15	Requirement Specifications	TBA	TBA
16	Design constraints & standards	TBA	TBA
17	Design	TBA	TBA
18	Prototyping	TBA	TBA
19	Testing	TBA	TBA
20	Team Administrative Evaluation	TBA	TBA
21	Conc	TBA	TBA
22	Prototype	TBA	TBA
23	Prototype testing	TBA	TBA
24	Prototype redesign (if necessity)	TBA	TBA
25	Finalizing Prototype	TBA	TBA
26	Peer Presentation	TBA	TBA
27	Final Report	TBA	TBA
28	Final Presentation	TBA	TBA

VIII. House of Quality

In order to succeed in a project, the decisions the team makes should be carefully orchestrated. In the engineering industry, an engineer’s success or failure factor down to time for mistakes, budgeting, and where the time is most utilized in a project. Therefore, to avoid any failure points or mishaps for the HomePro, our group has elected to use the Engineering Marketing Trade Off Matrix shown below to narrow the marketing and engineering requirements.

Table IV: Quality Symbols

Symbol	Meaning
+	Increase the requirement
-	Decrease the requirement
++	High correlation
+++	Super High Correlation
--	Low Correlation
---	Super Low Correlation

		Efficiency	Quality	Install time	Weight	Cost	Dimension
		+	+	-	-	-	-
Sound Quality	+		+++	-	--	-	--
Projector Quality	+		+++	-	--	-	--
Connection Efficiency	+	+++		-	--	-	--
High power	+	++	++	---	--	--	--
Install difficulty	-	+	+	---	---		
High Performance	+	+++	+++	-			
Creativity	+	++	++		---		
Exterior Features	-		++	---	---	---	-
Cost	-	-	-	-	---		---
Specification:		>70%	>80%	< 2 weeks	< 30 lbs.	<1000 400>	2X3 feet