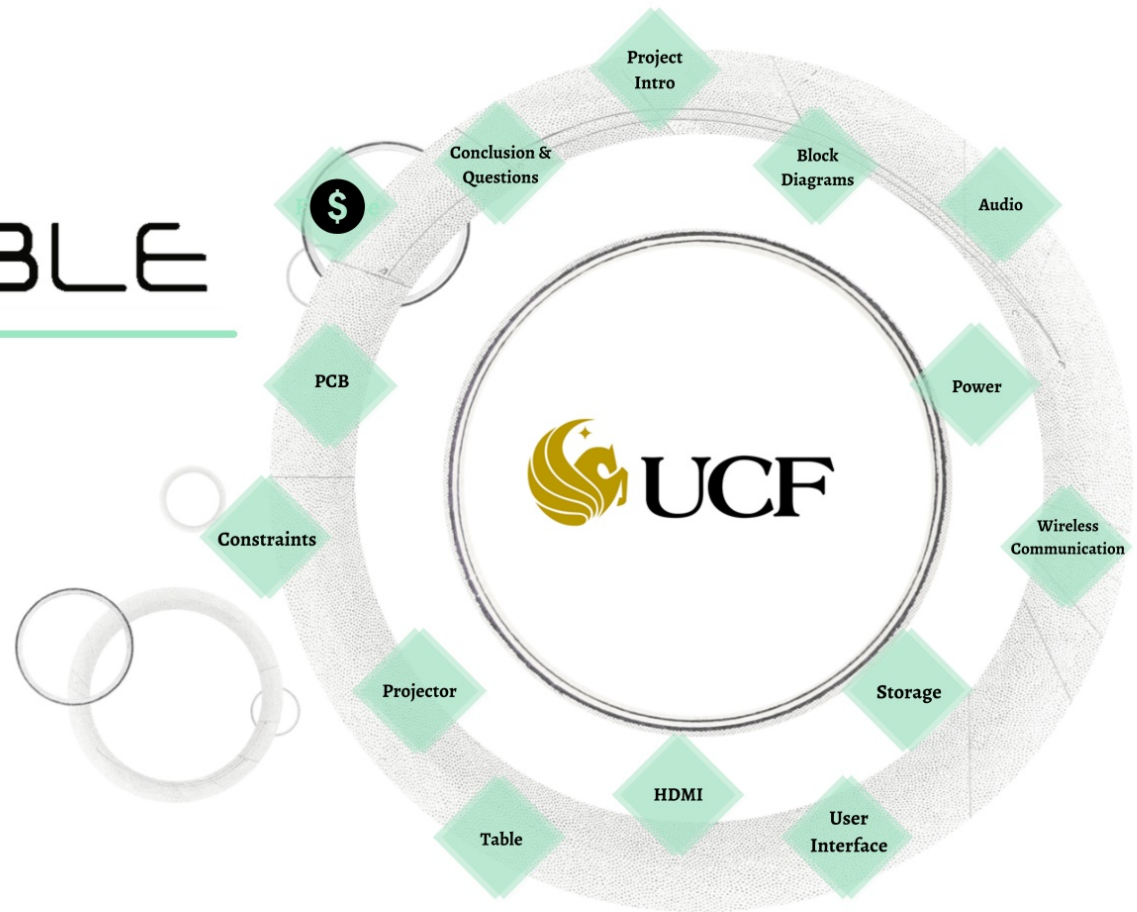


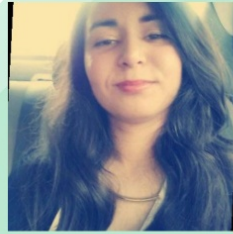
SMARTTABLE

Presented by:

Group 2



Group 2



HOUDA ALAAFYA
ELECTRICAL
ENGINEERING -
Communication and
Signal Processing
Track



**SERGIO
PADILLA**
ELECTRICAL
ENGINEERING -
Comprehensive Track



YOUSAF AUSAF
ELECTRICAL
ENGINEERING -
Comprehensive Track



**ISRAEL
CASTILLO**
Photonic Science &
Engineering | CREOL

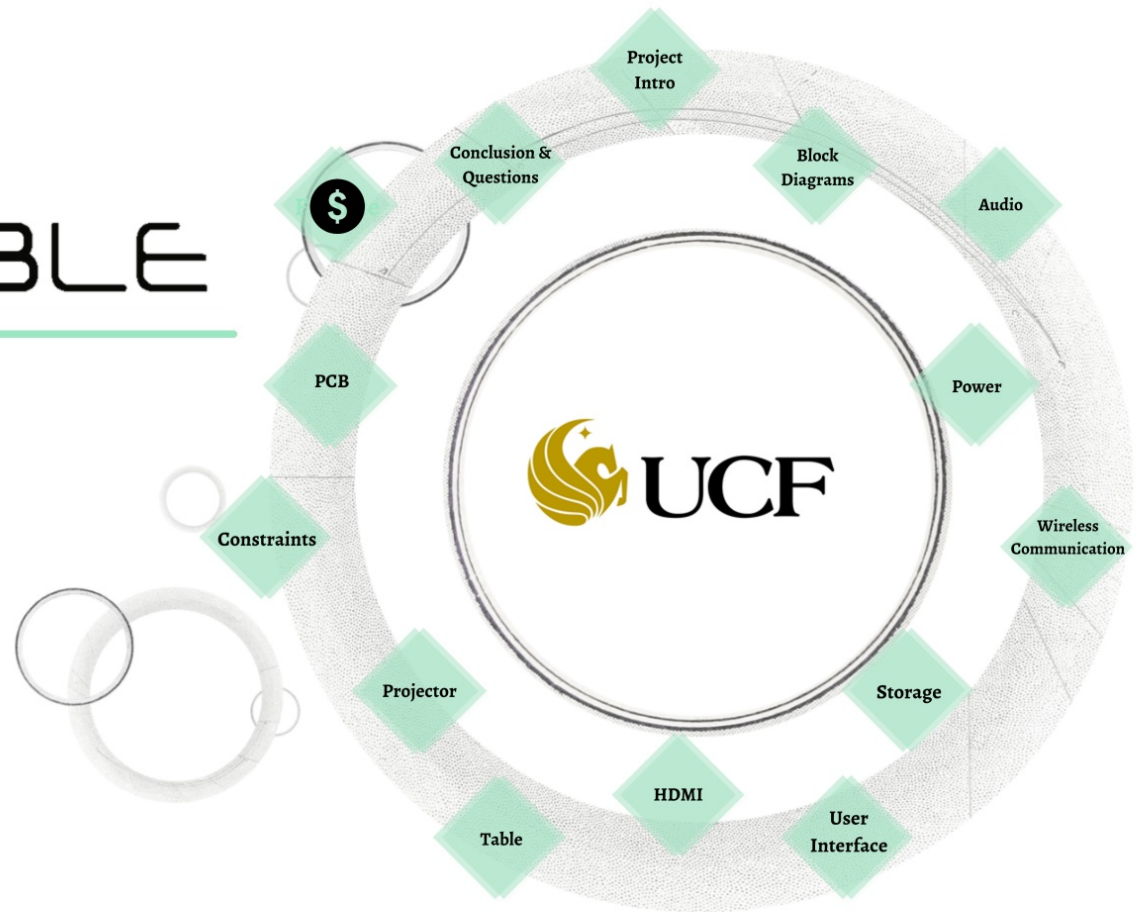
**SERGIO
PADILLA**
Speaking



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Project Description

YOUSAF AUSAF
Speaking



Motivation

Goals & Objectives

Specification

The Smart Table:

- What is it?
- What can it be used for?
- What will be in the table?



Motivation

What made our group decide on the smart table?

- Underrepresented times
 - Seamless and easy entertainment system to de-stress
 - Stress-free option for meetings presentations, or professional environments
 - People together in a safe way
- The table is already an integral central feature in homes and offices
 - An all-in-one self-contained projection system
 - Combines style as well as functionality



Goals & Objectives

The six objectives and goals we aim to accomplish

- Hardware
- Software & Communications
- Control
- Power Supply
- Fingerprint reader
- Projection system



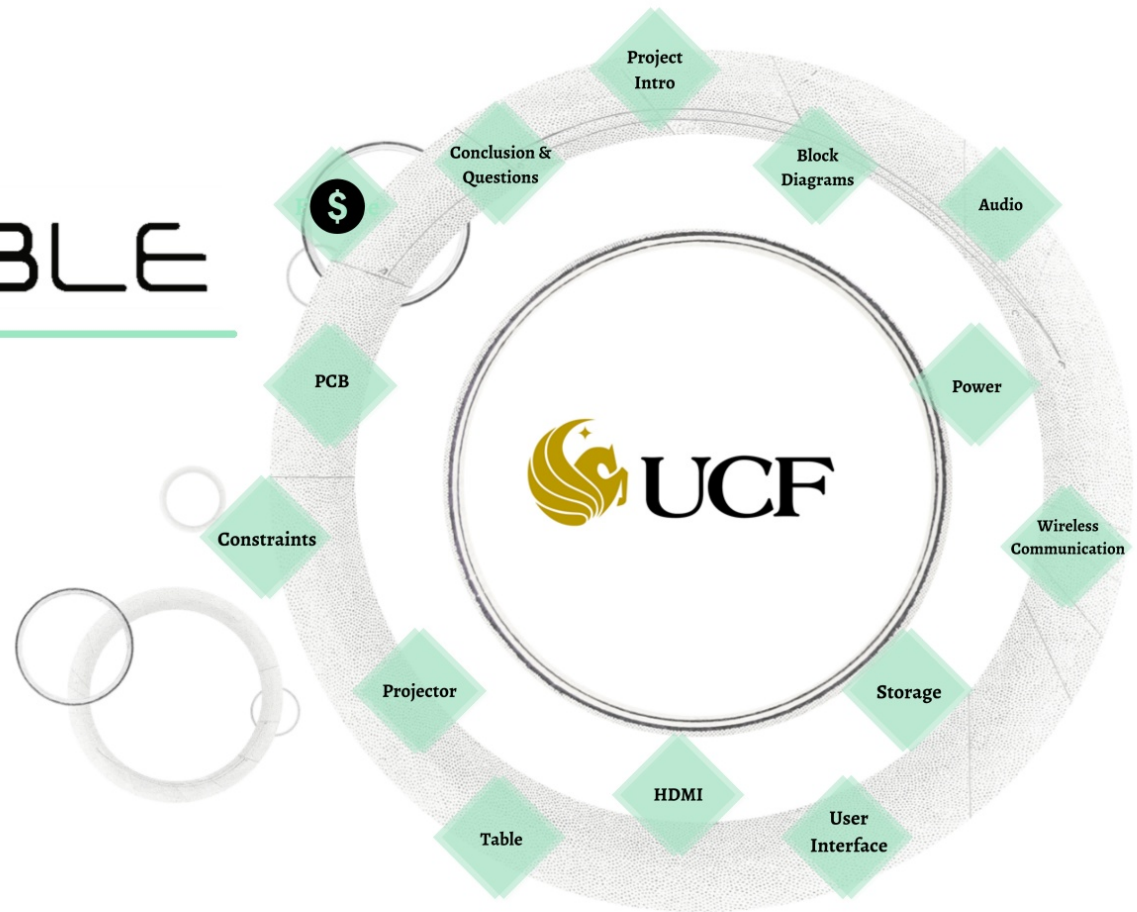
Specification

Power consumption 80 W to 320 W	HDMI/DVI decoder	Resolution (800X480) Projector image from the LCD display	USB Type A 3.0 for charging devices
BLE module for user interface communication	Wireless Speakers	Wireless Projector Brightness control	Wireless dynamic LED lighting
Total cost must not exceed \$ 800.00	Item weight must not exceed 40 <u>lbs</u>	Physical table dimensions (20" x 52"x 32")	

SMARTTABLE

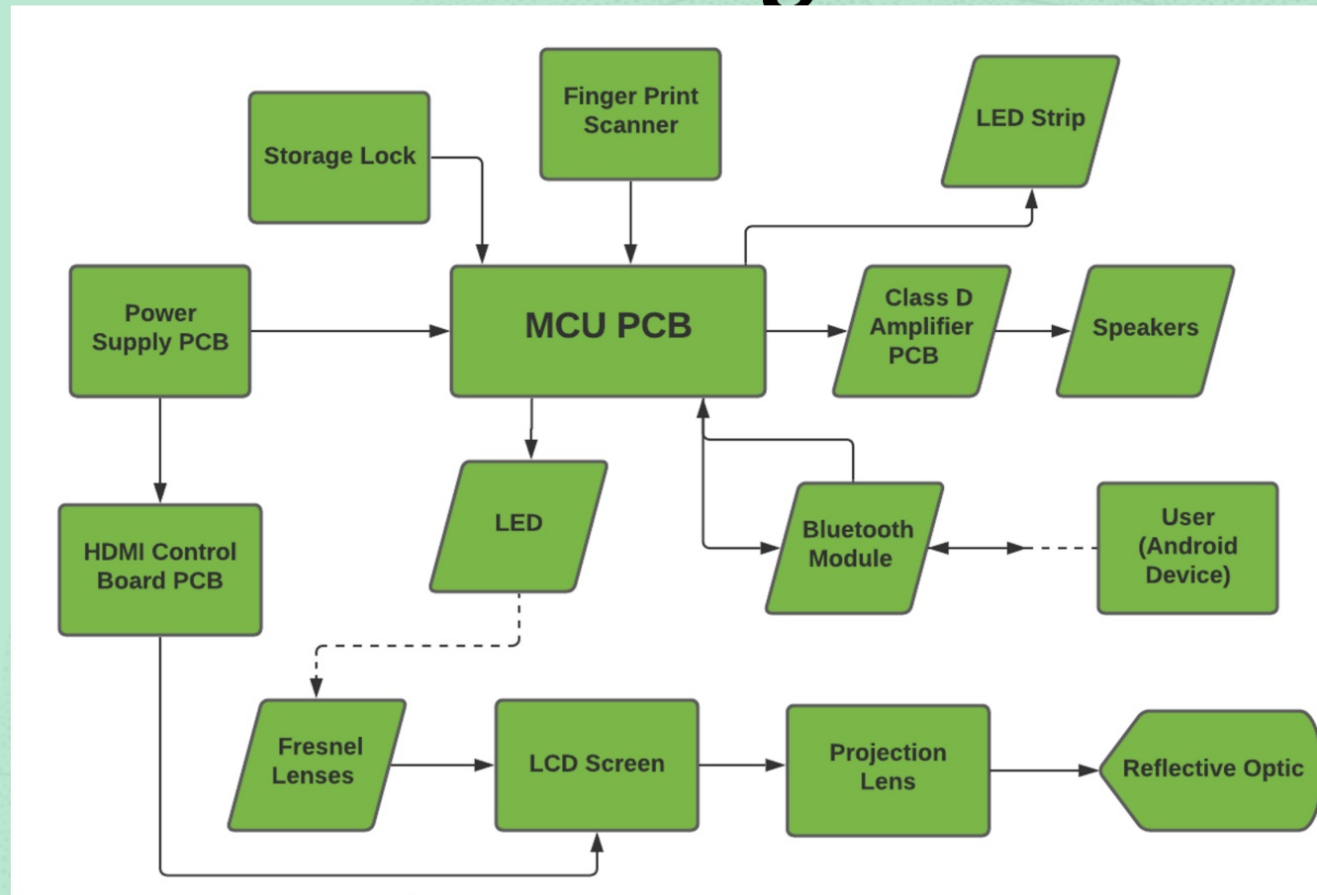
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Block Diagram

SERGIO
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Speaking





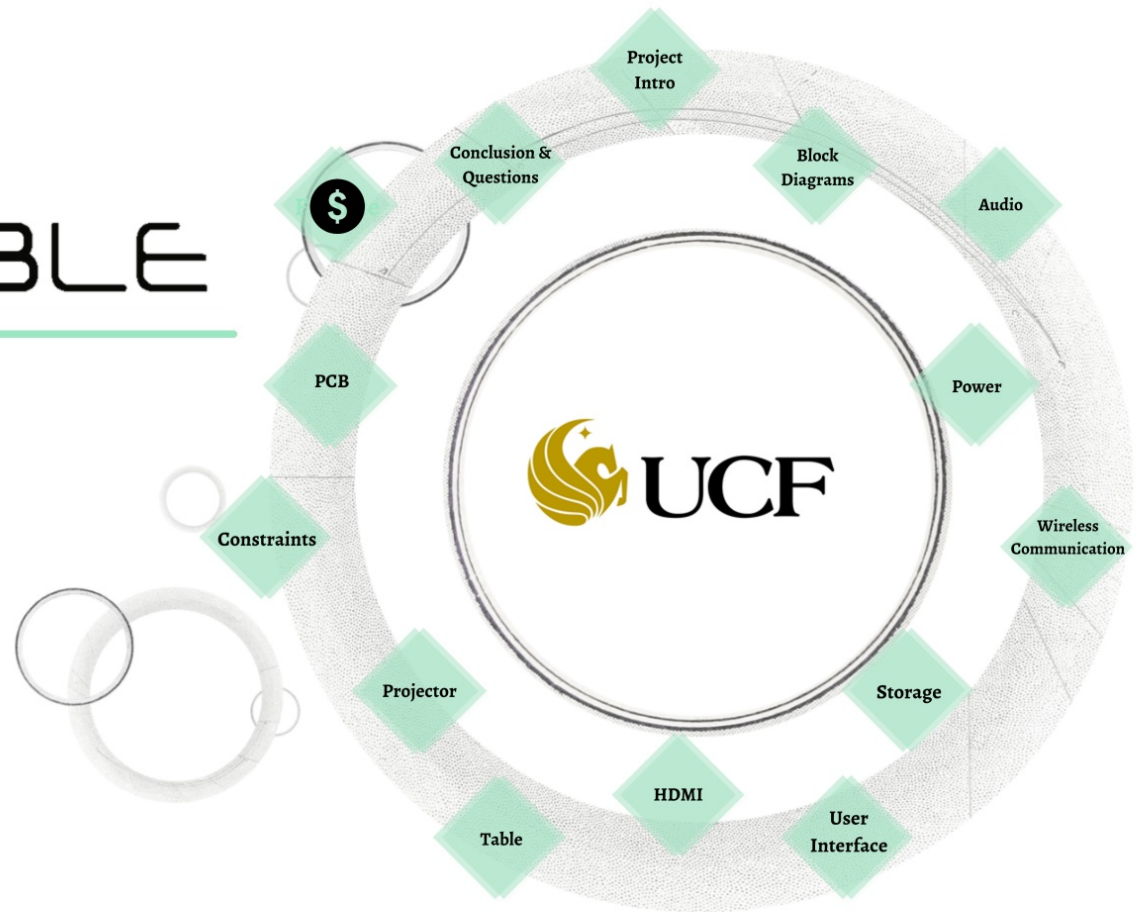
Workload distribution:

System	Sergio	Houda	Israel	Yousaf
Audio	Primary	-	-	Secondary
Power	Primary	-	Secondary	Secondary
Physical Table	Primary	-	-	Secondary
Bluetooth	Secondary	Primary	-	Secondary
Projector	Secondary	Secondary	Primary	-
User Interface	-	Primary	-	-
HDMI	Secondary	Primary	-	Secondary
PCBs	Secondary	Secondary	Secondary	Primary

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Audio Subsystem

Class D type Amplifier

- High efficiency of up to 90 %
- Eliminates the use of a heat-sink or cooling fan
- Smaller physical size which maximizes board space
- Cost effective

Block Diagram

Circuit Design /
PCB Schematic

Part List

Testing &
Issues

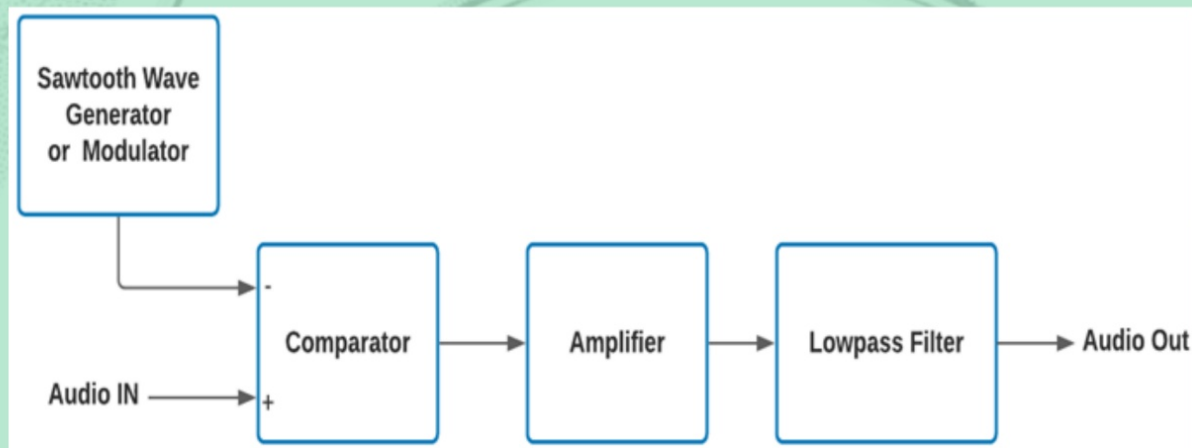
SERGIO
PADILLA
Speaking





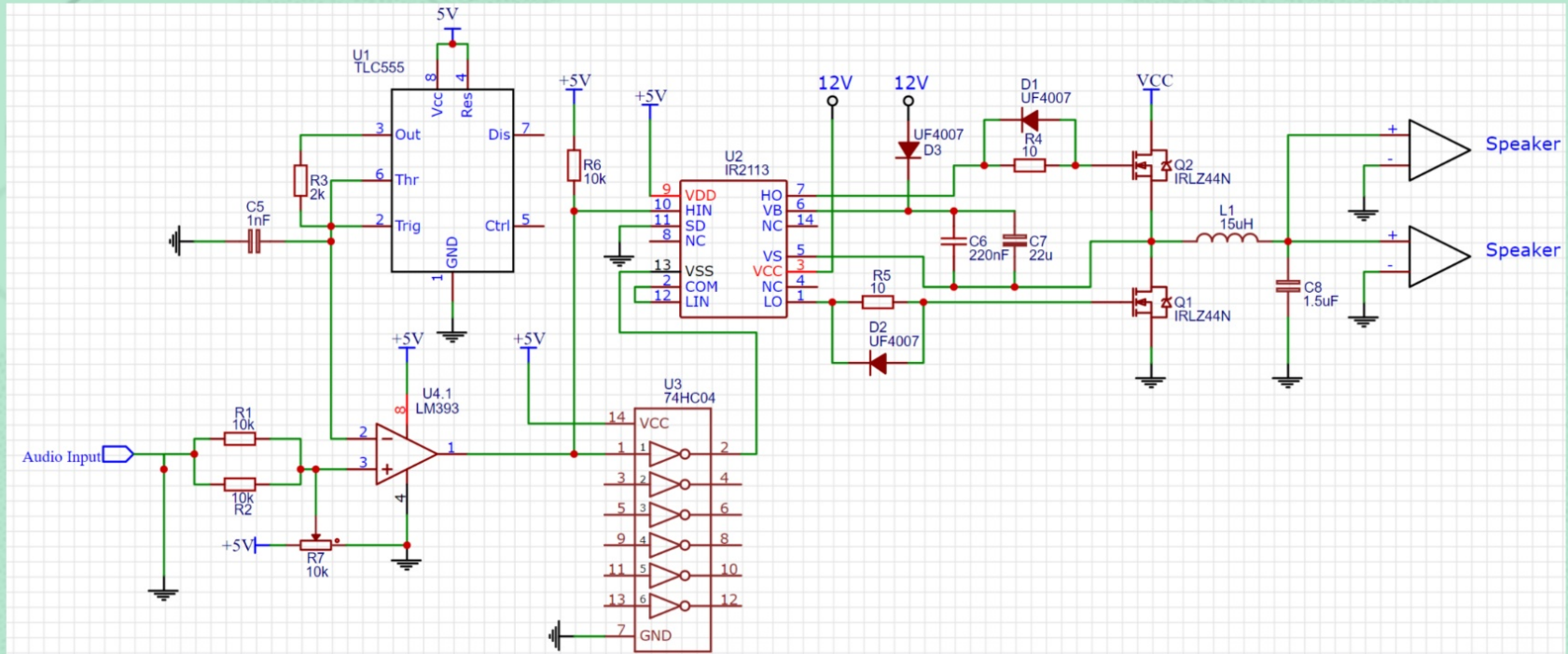
Basic Class D Block Diagram

A class D amplifier consists of four major components shown in the block diagram a Modulator, Comparator, Amplifier and Low-pass Filter.



Circuit Design:

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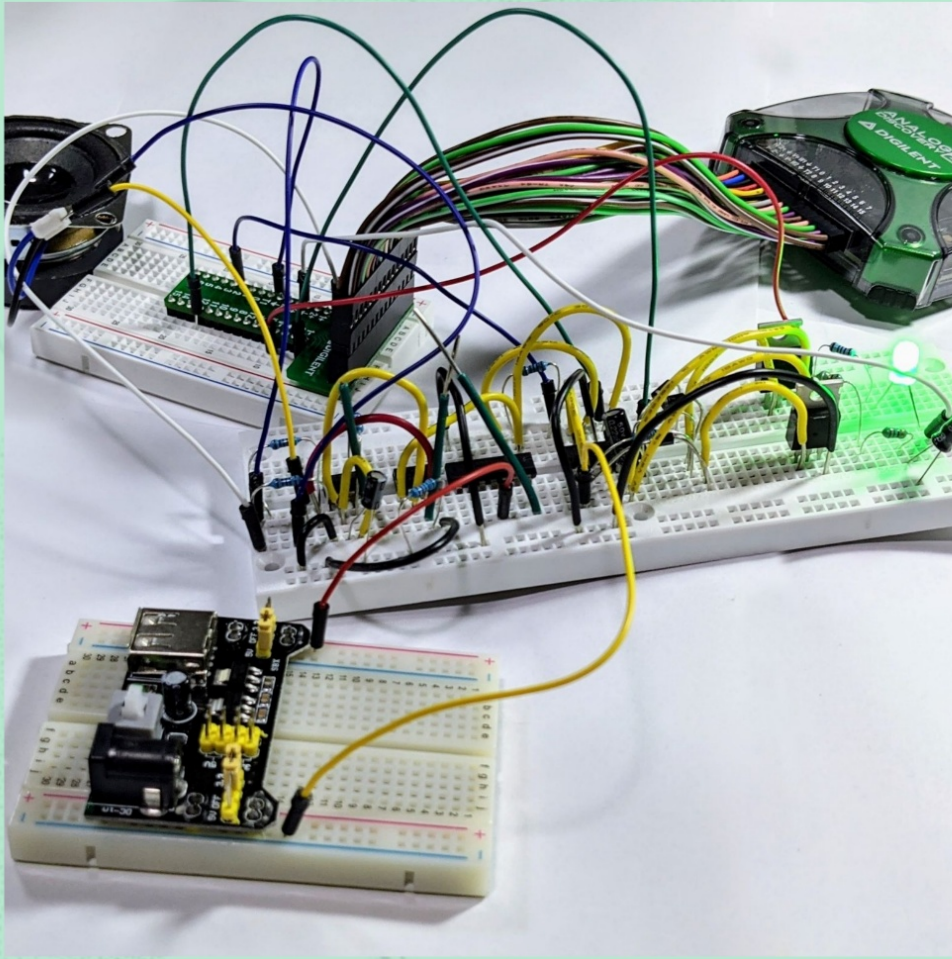
Component List

Components	Type	Manufacturer	Quantity
TIMER	TLC555	Texas Instruments	1
COMPARTOR	LM393	Texas Instruments	1
HEX INVERTER	SN74HC04N	Texas Instruments	1
MOSFET Driver	IR2113	Infineon Technologies	1
MOSFETS	IRLZ44N	Infineon Technologies	2
DOIDE	UF4007	ON Semiconductor	3
VOLTAGE REGULATOR	TPS562209DDCR	Texas Instruments	2
RESISTORS	(2k, 10k)	Texas Instruments	(1, 7)
CAPACTIORS	(1nF, 47u, 220nF, 1.1uF, 22u,)	Texas Instruments	(1, 3, 2, 1, 1,)
INDUCTORS	16.5uH	Texas Instruments	1



Testing & Issues

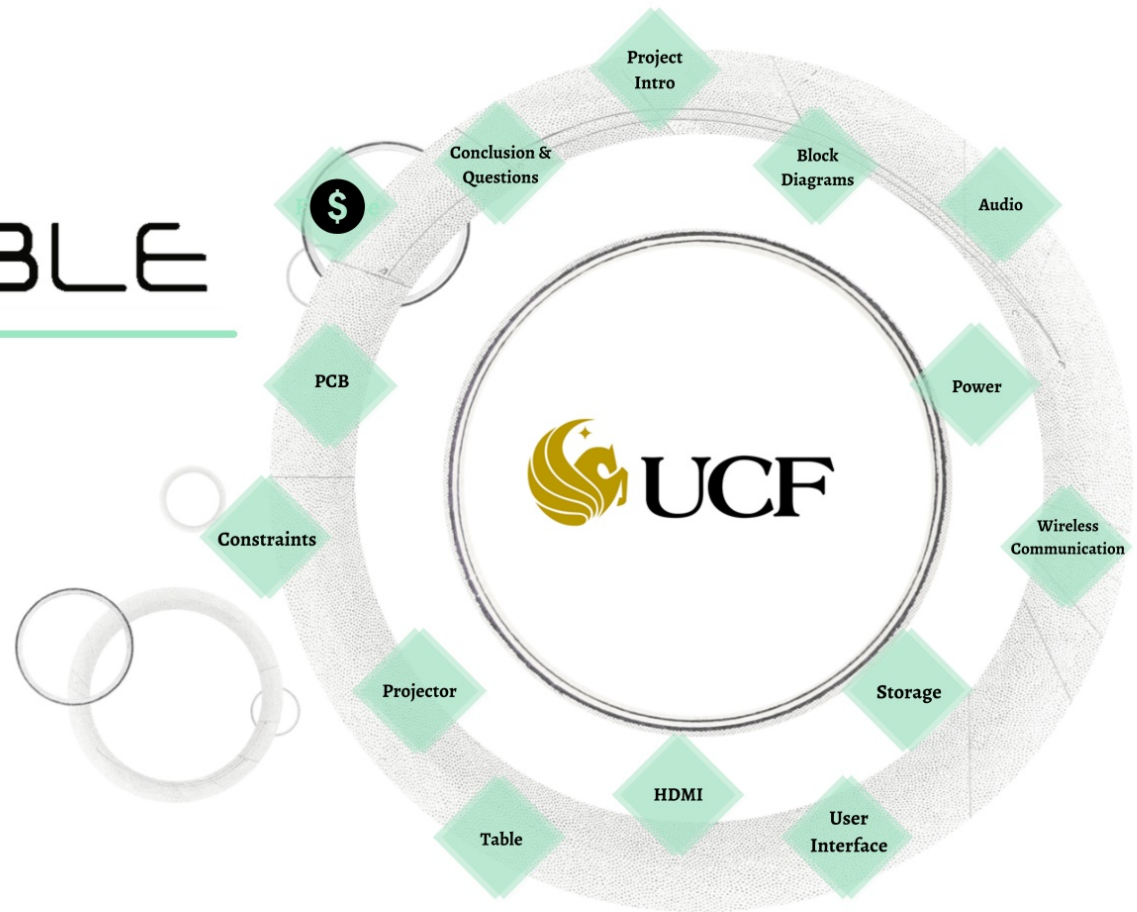
- Potentiometer to add a DC offset to the sinewave so that the audio signal is submerged within the triangle wave.
- Volume too low



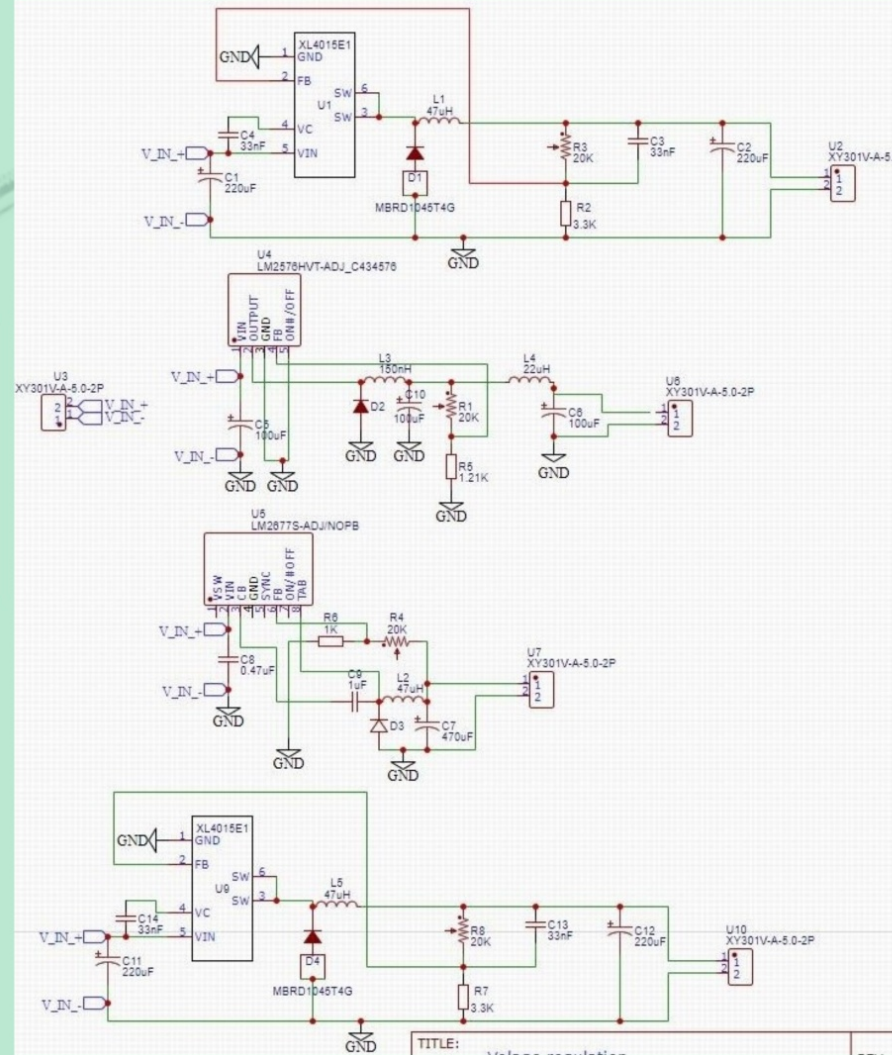
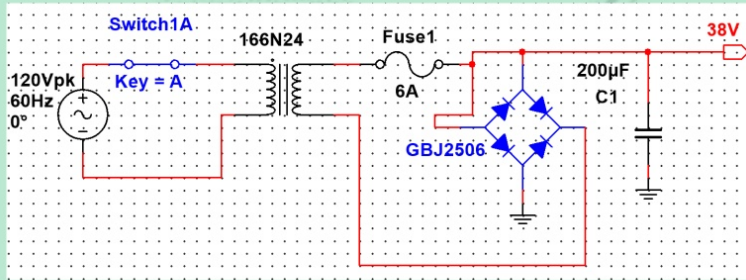
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Power Supply



YOUSAF AUSAF
Speaking



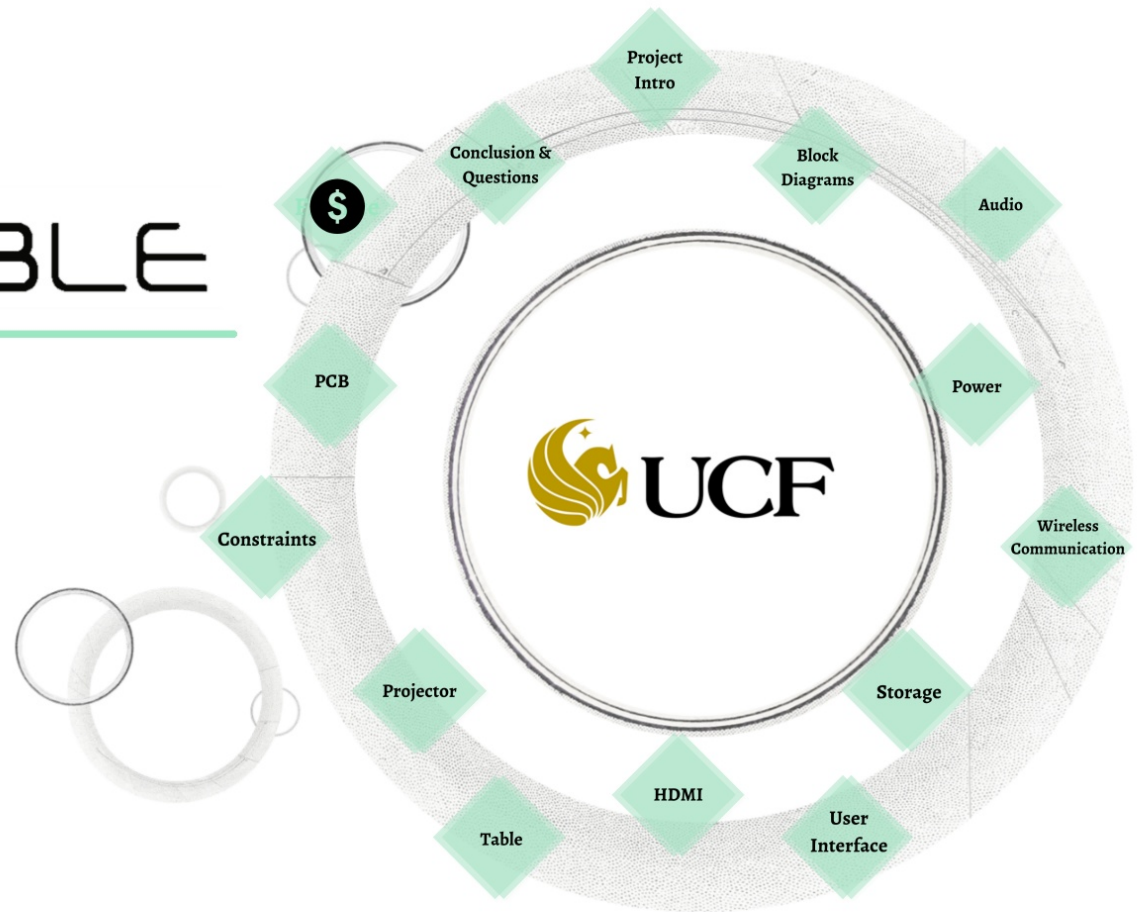
Lists of Components

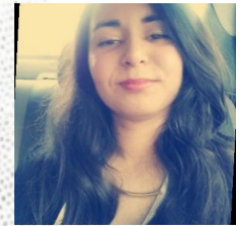
Components	Type	Manufacturer	Quantity
Transformers	166N24	Hammond	1
Diode	MBR745G	ON Semiconductors	4
Switching regulator	XL4015	XLSEMI	2
Switching regulator	LM2576-ADJ	Texas Instruments	1
Switching regulator	LM2677-ADJ	Texas Instruments	1
Fuse	6A	Texas Instruments	2
Full bridge Rectifier	GBJ2506	Diodes INC	2
Potentiometer	TRIMMER 30K OHM 0.5W	Bourns Inc.	4

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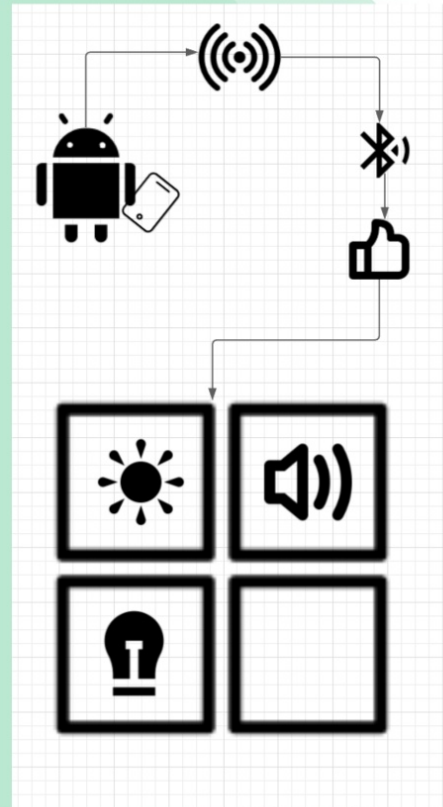
Group 2





Bluetooth:

- Connects the Smart Table to an Android device
- Popularity, availability, easier implementation, less power consumption, performance, size, and cost

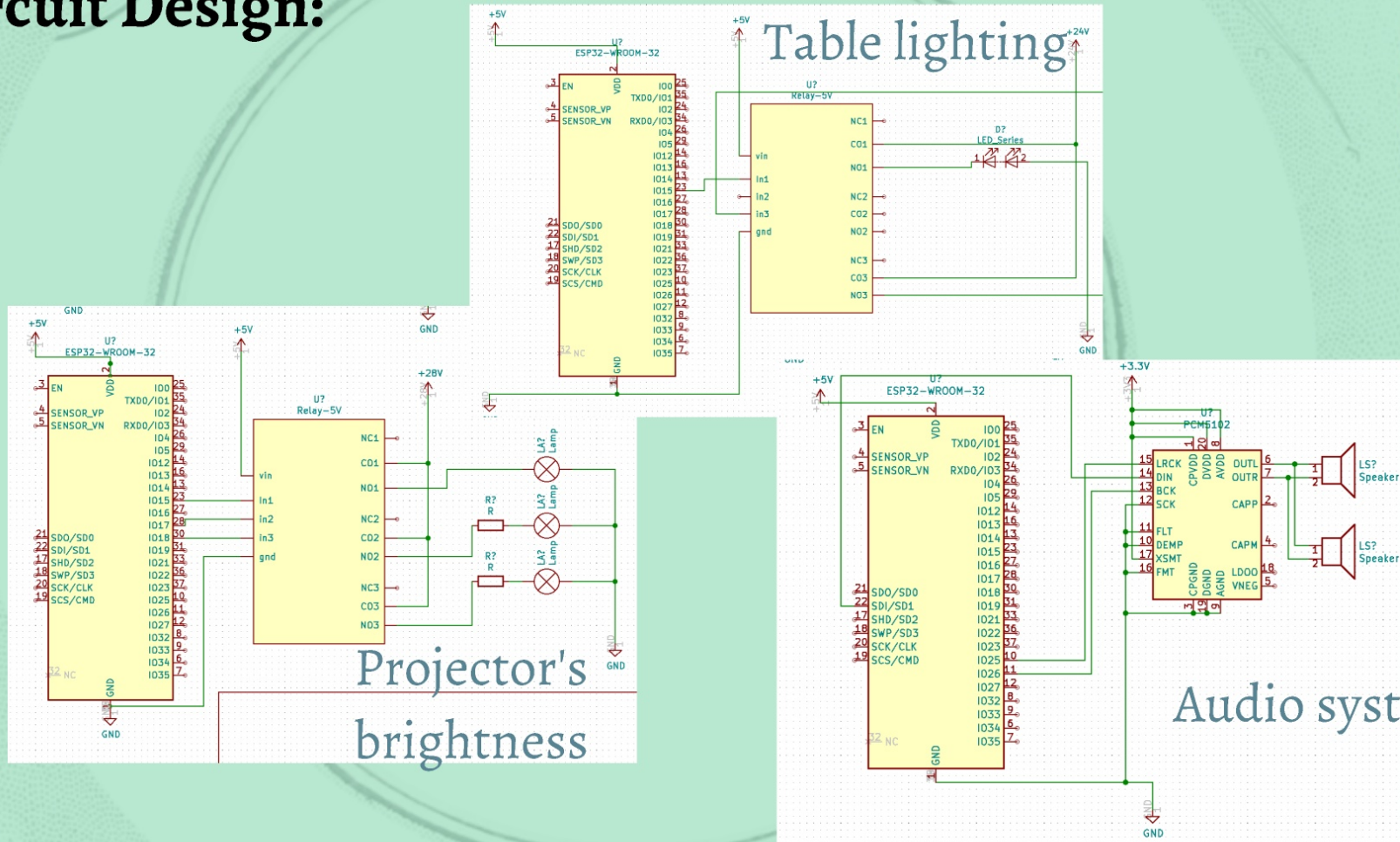
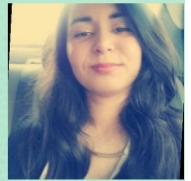


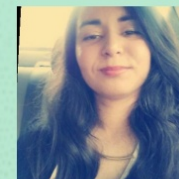
Circuit Design /
PCB Schematic

specifications

Testing &
Issues

Circuit Design:

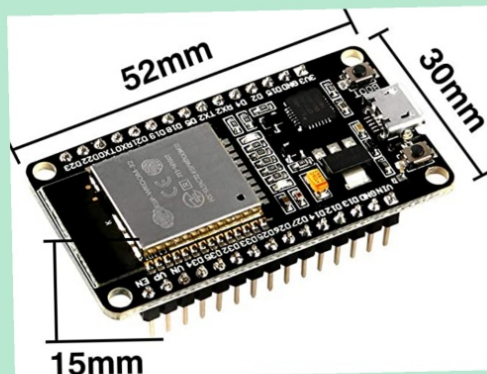
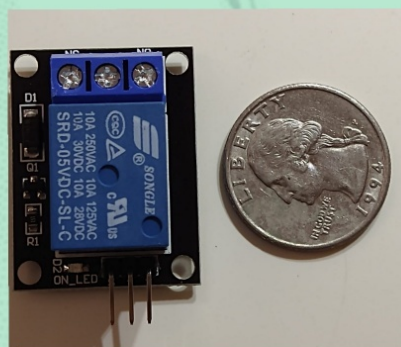




Specifications used:

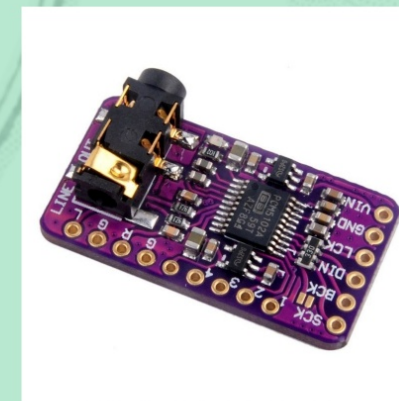
Wireless communication	LED strip	1	\$26.99	\$26.99	\$26.99
	ESP32	1	\$10.57	\$10.57	\$10.57
	PCM module	1	\$13.99	\$13.99	\$13.99
	Relay	1	\$5.99	\$5.99	\$5.99

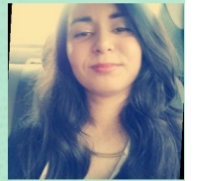
Relay 28VDC module



ESP32-wroom module

PCM5201 Module





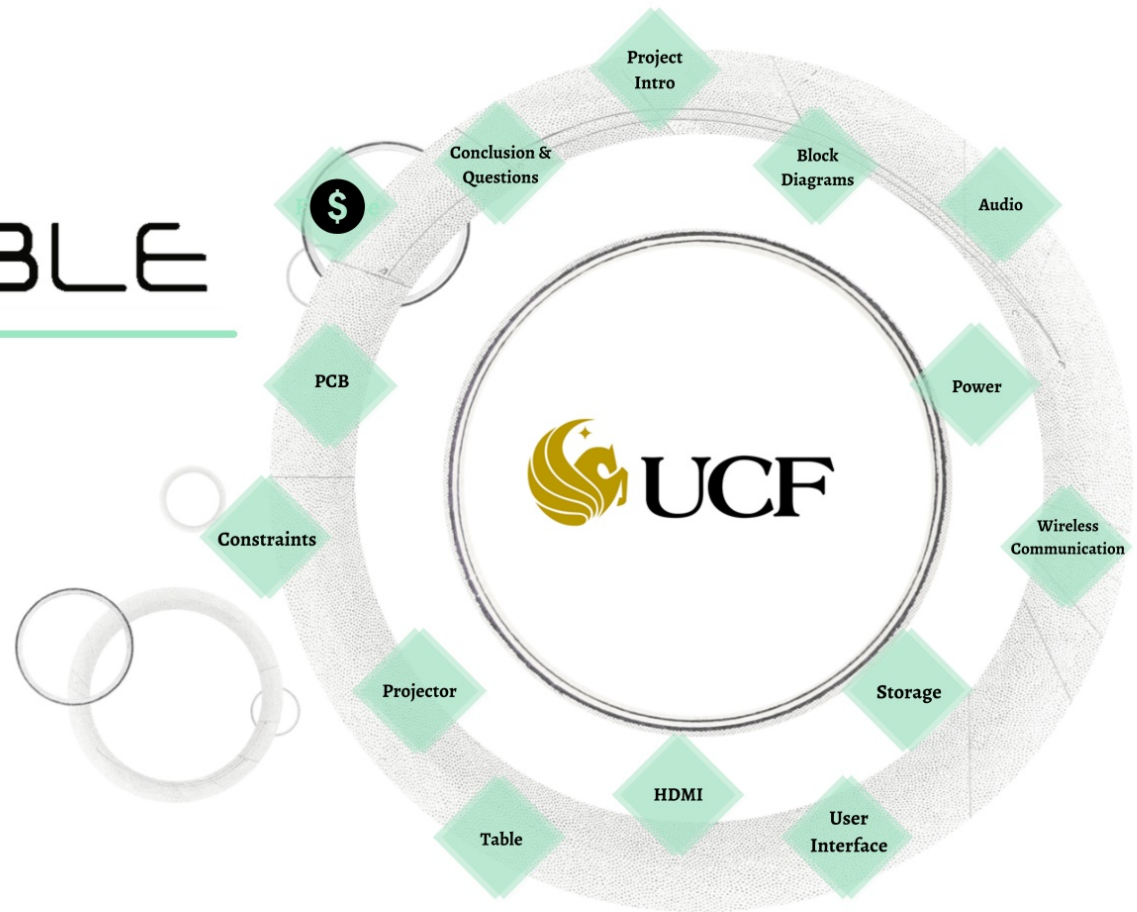
Testing HW&SW:

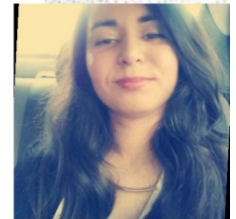
- Bluetooth Mode Modifications
ESP32= Bluetooth Mode
- Baud rate configuration
ESP32 to Baud rate= 115200 baud
- Build in PCM low quality (external PCM module)
- software issues

SMARTTABLE

Presented by:

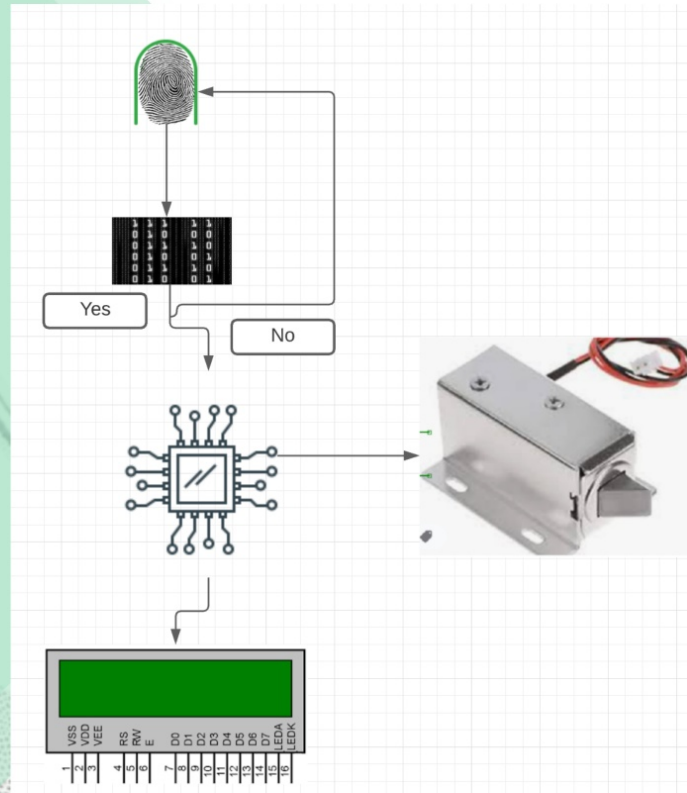
Group 2





Secured drawer storage:

- Store valuable belongings for different purposes (professional, security, safety...)
- High Biometric security, key-less access, difficulties to override, weight convenience, and cost effective.



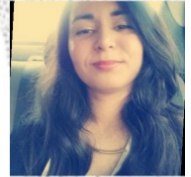
Circuit design

Part List

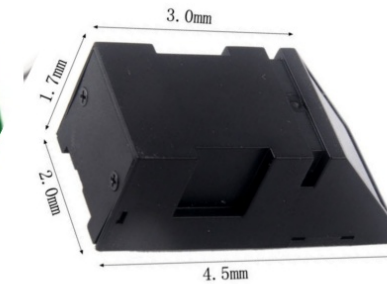
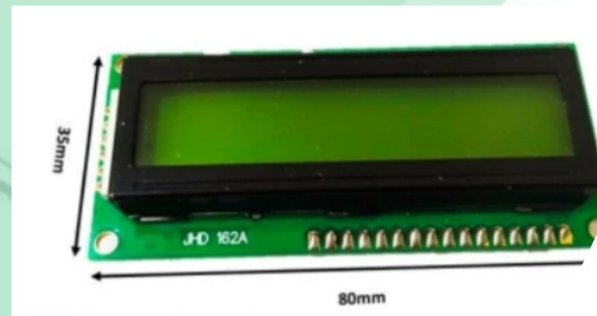
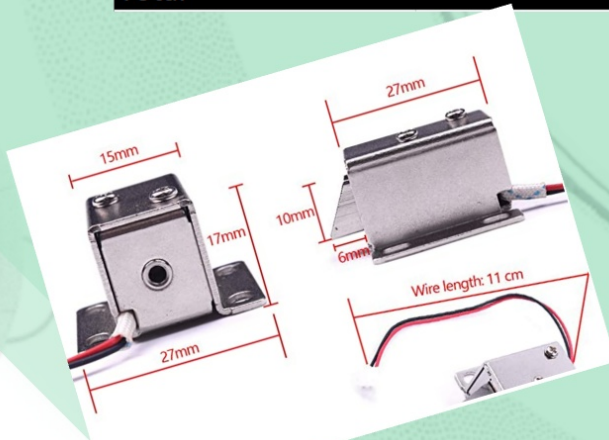
Testing & Issues

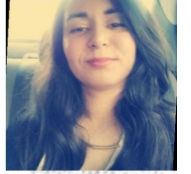
Specifications:

HOUDA ALAAFYA
Speaking



Fingerprint Storage Parts				
Components	Name (Type)		Quantity	Cost (\$)
Relay module	Single Pole Double Throw (SPDT)	---	1	5.99
LOCK	Solenoid door lock (mini)	---	1	9.99
LCD	16x2 RGB	---	1	7.99
Fingerprint sensor	Adafruit optical sensor		1	19.99
Total				43.96





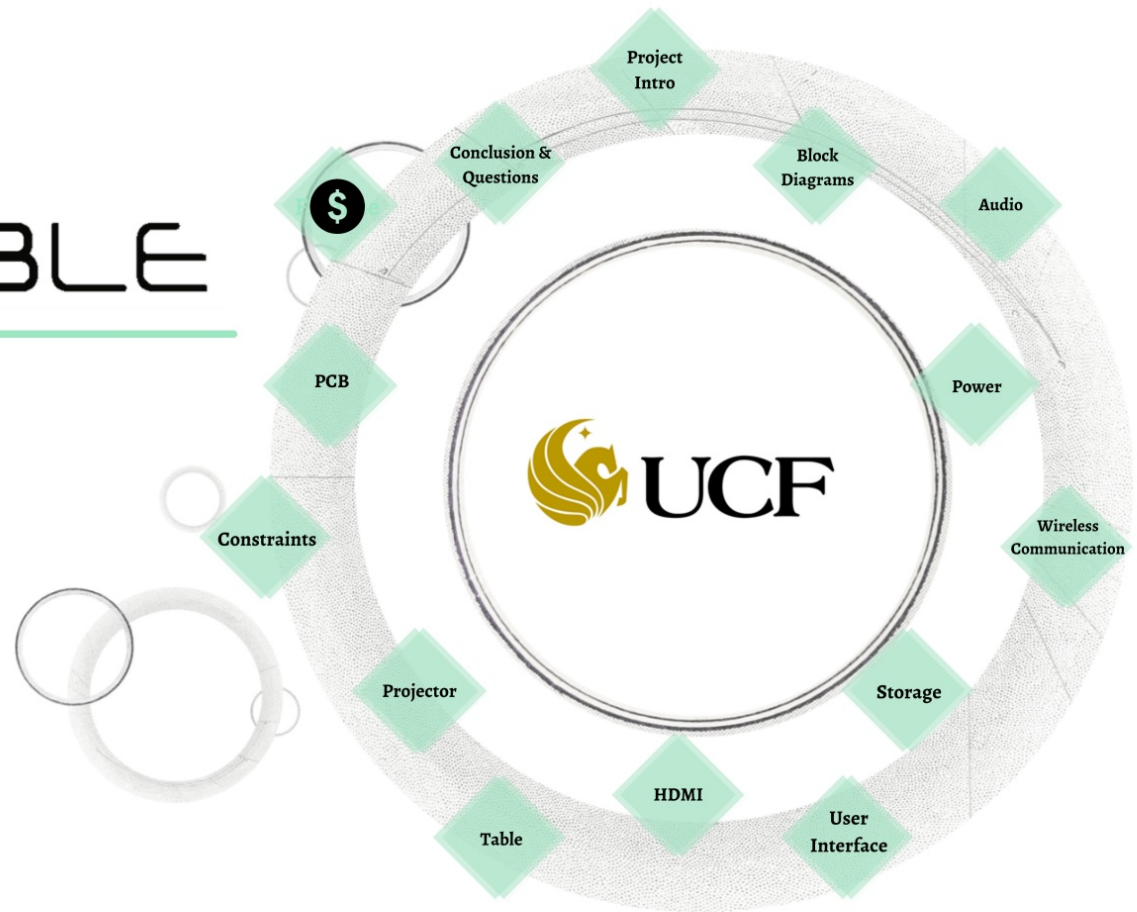
Testing & Issues

- LCD serial interface
Adapter
- Optical sensor
- Programing

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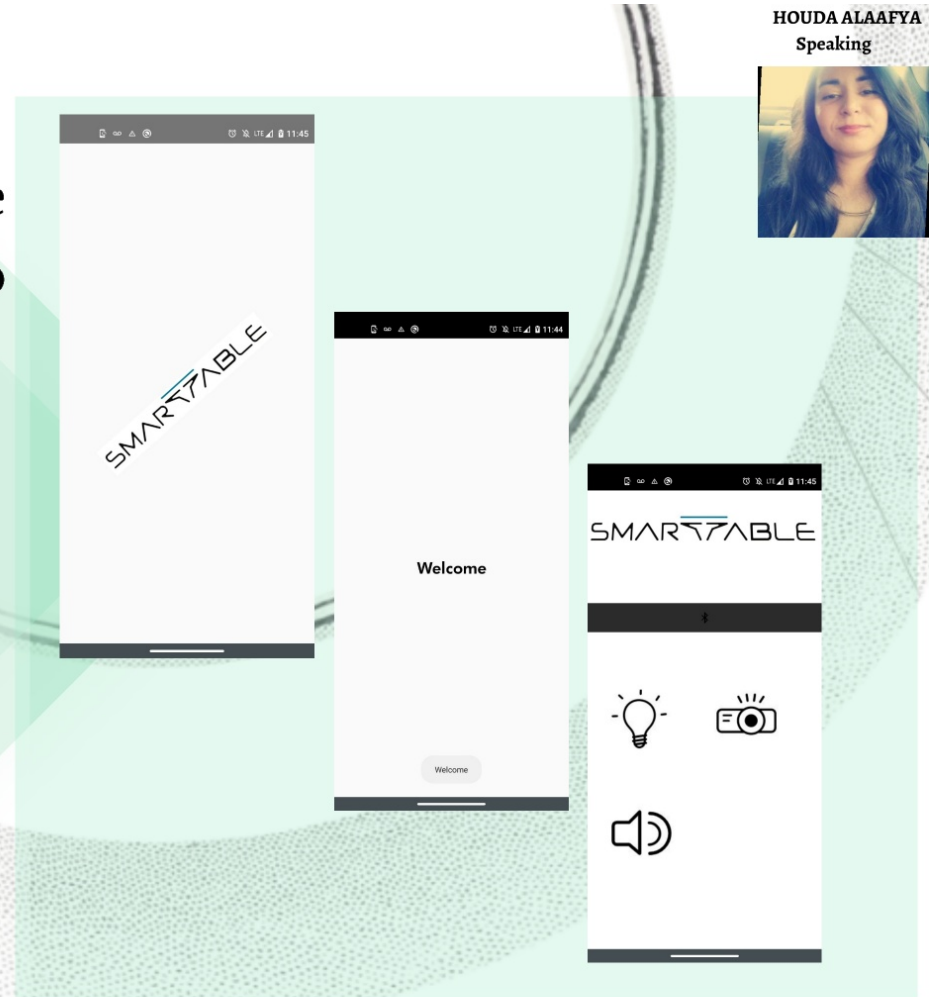
Presented by:

Group 2



Android App:

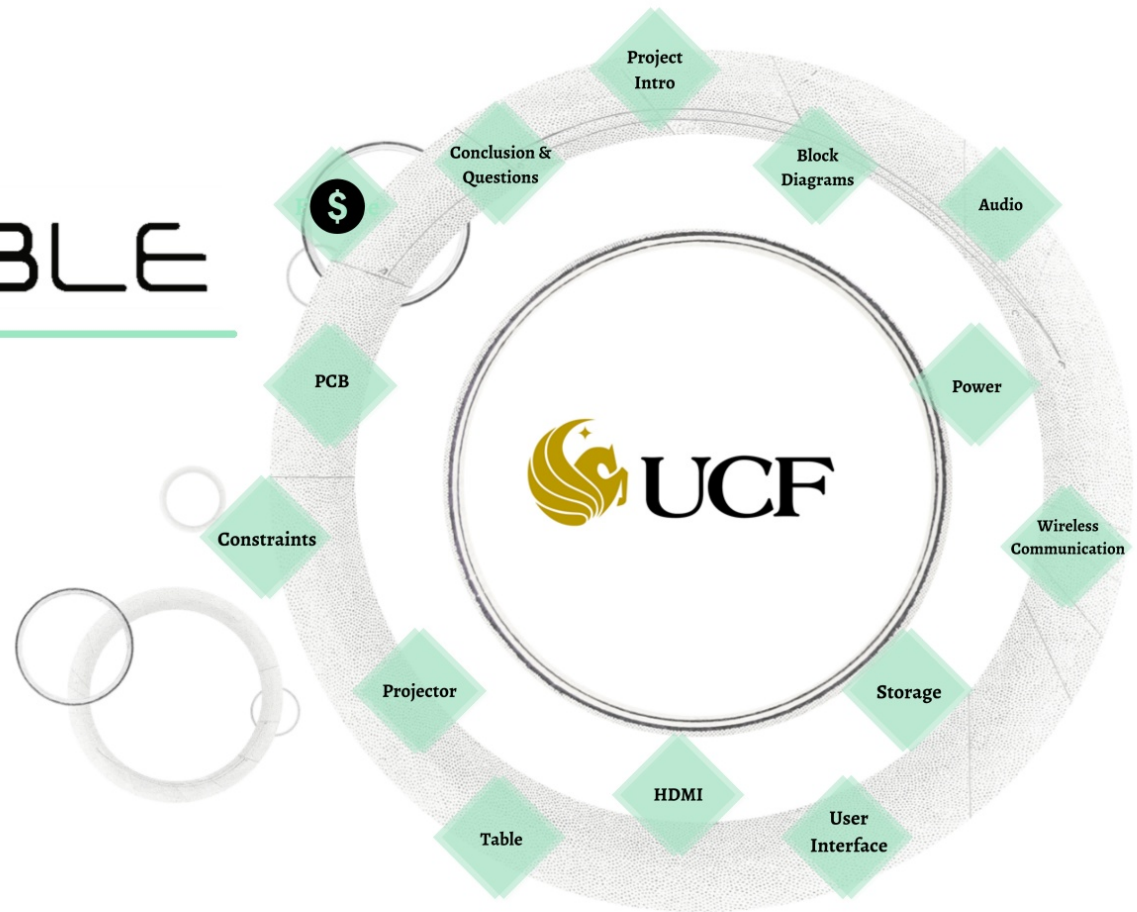
- Establish user interaction with the Smart Table using Android Studio IDE (kotlin)
- Universally used in the mobile technology and electronics industry
- Compatible with mostly every Mobile, Tablet, PC... and with the hardware used in the project.
- Simple Layout design.
- Performance stability (Less bugs)
- Android Studio V6.5

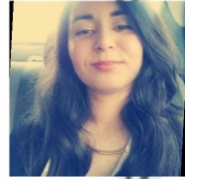


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Presented by:

Group 2



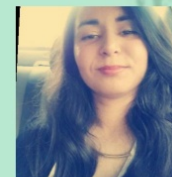


HDMI/DVI

- Display the screen of a device to an LCD
- TI (TFP401 chip)

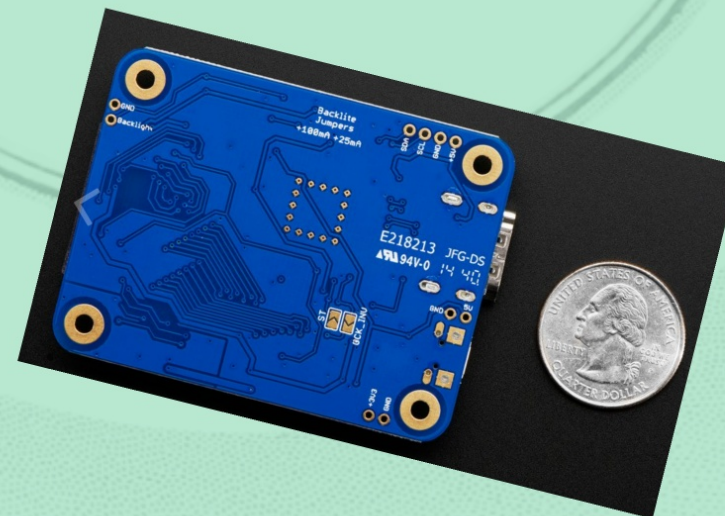
Specifications

Testing &
Issues



Component List:

Components	Quantity	Dimension	Cost
HDMI /DVI Board	1	51 mm x 68mm x 8.5mm	\$25.95
40-pin FPC Extension	1	200mm	\$4.50



Testing & Issues:

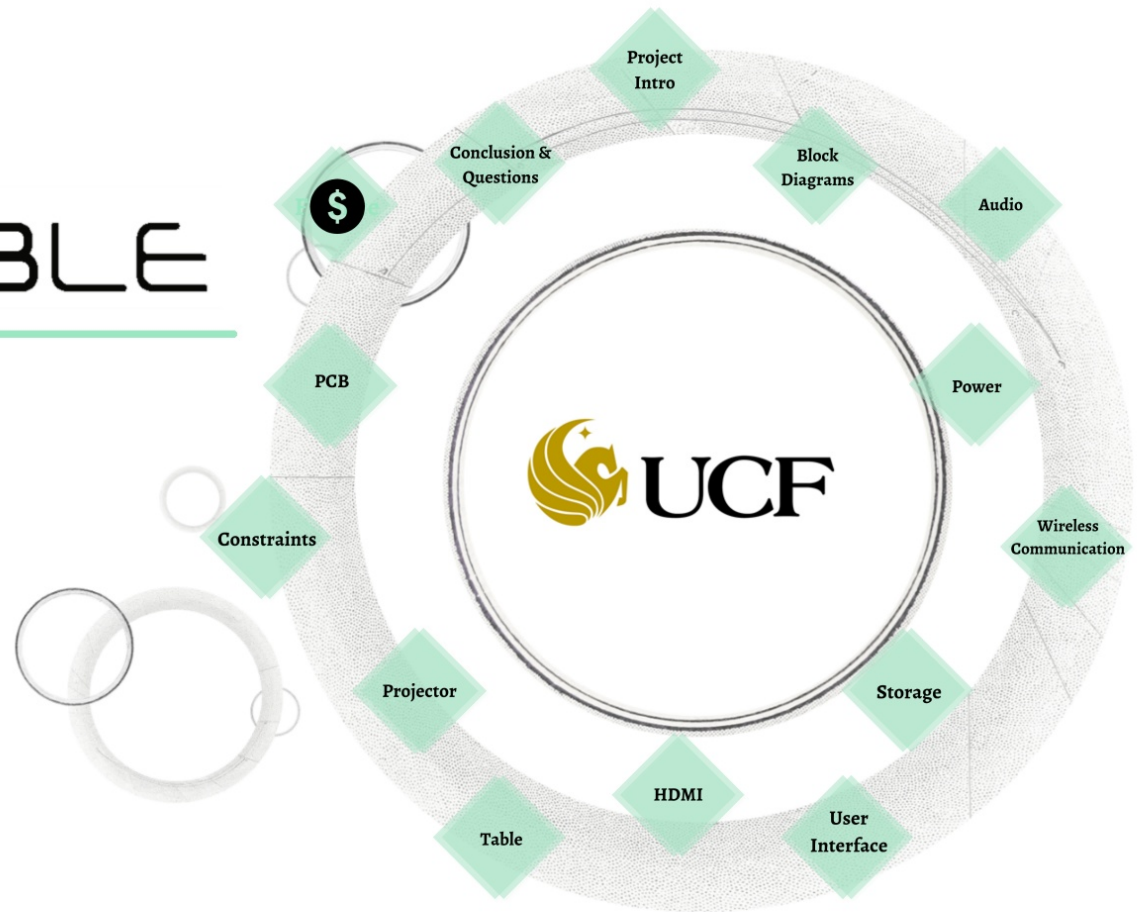
- Resolution 800x480
- EDID is modified (EEPROM is rewritten)
- Backlight removed



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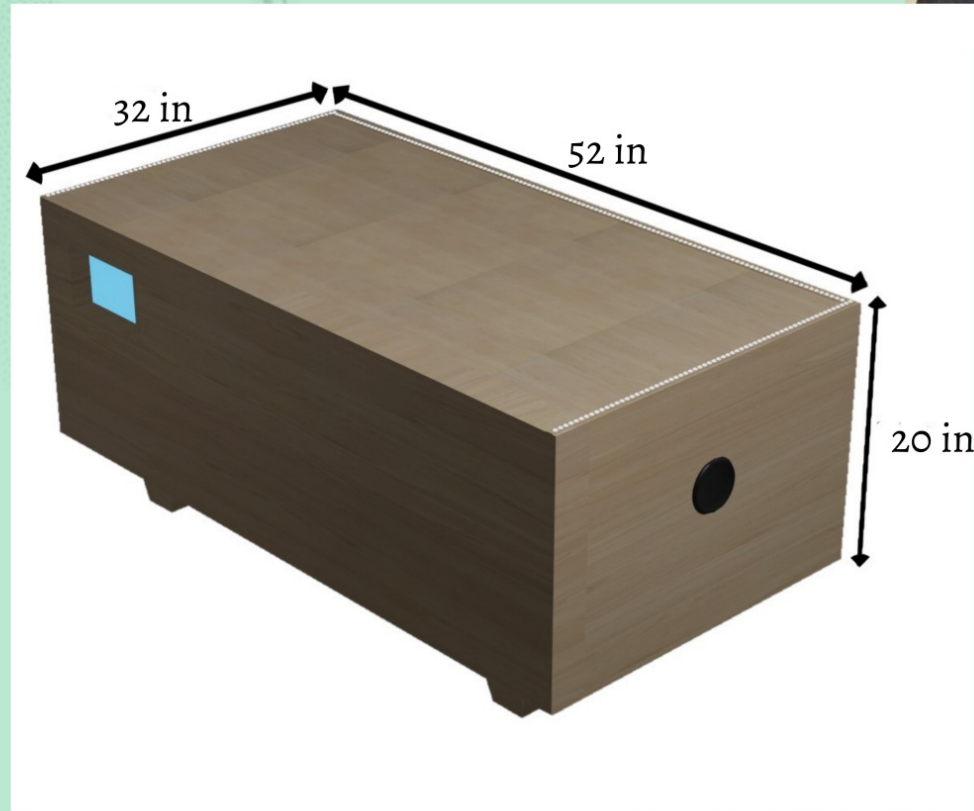
Group 2





Physical Design

- The physical table will be constructed completely out of wood
- Measurements - 20" x 32" x 52"
- Storage Drawer Size - 16" x 20"
- Opens and extends from the middle

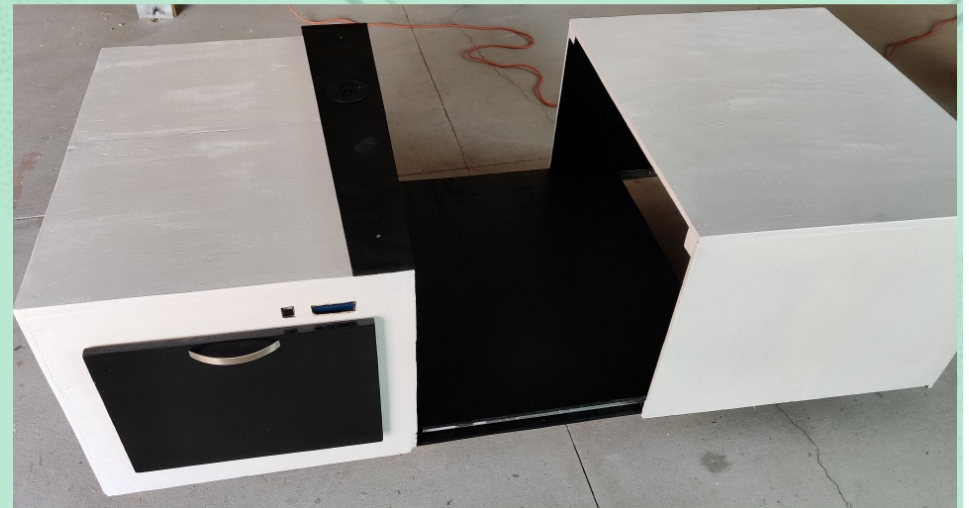


- Audio speakers
- Storage
- Fingerprint reader
- HDMI Port
- USB charging port
- Projector lens
- LED strip



SERGIO PADILLA

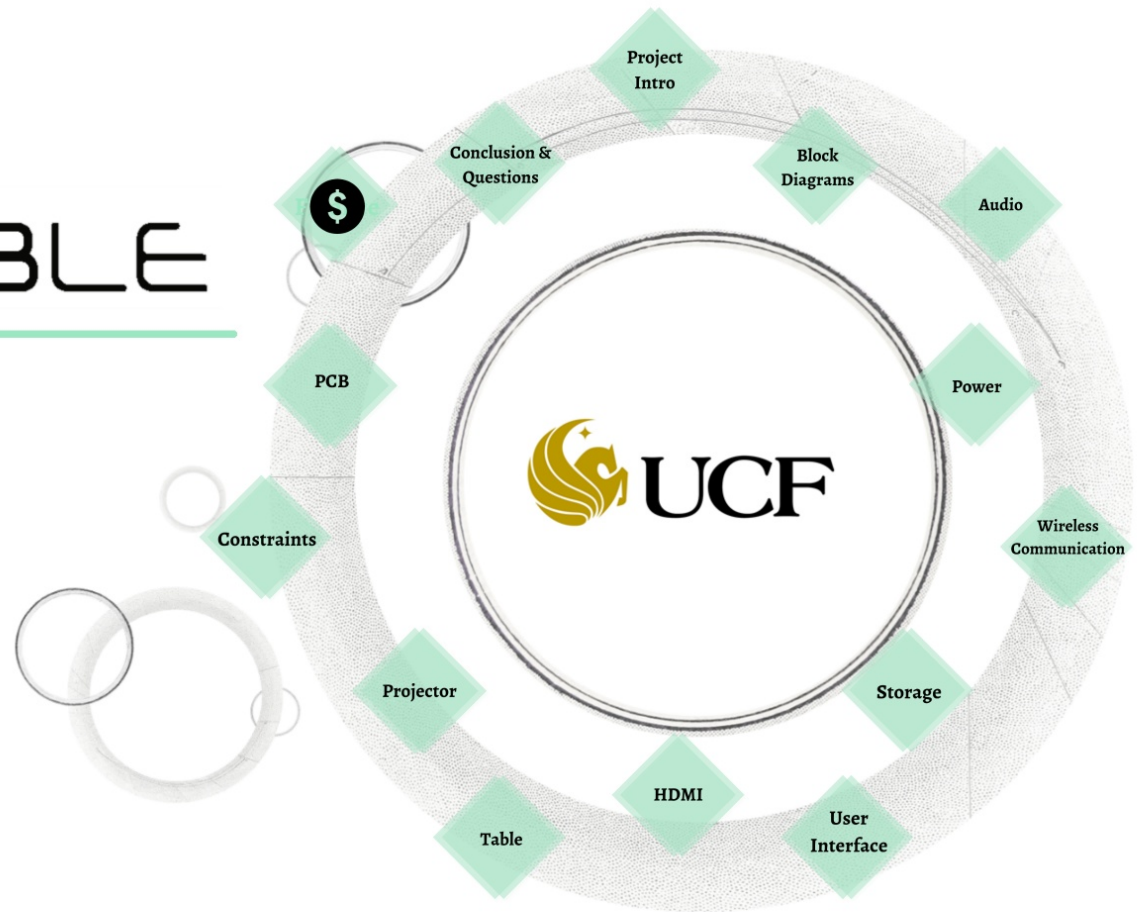
Speaking



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Video Projector Subsystem

- The purpose of the video projector is to provide a visual entertainment system for the SmartTable's user.
- Elements of the system:
 1. Light Source
 2. Light Control
 3. Image Source

1

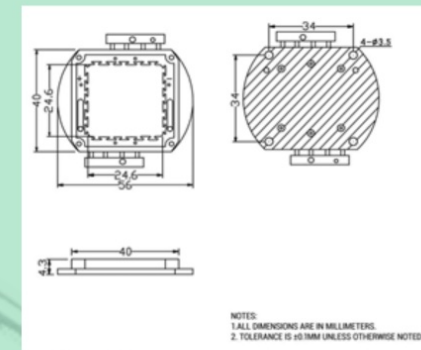
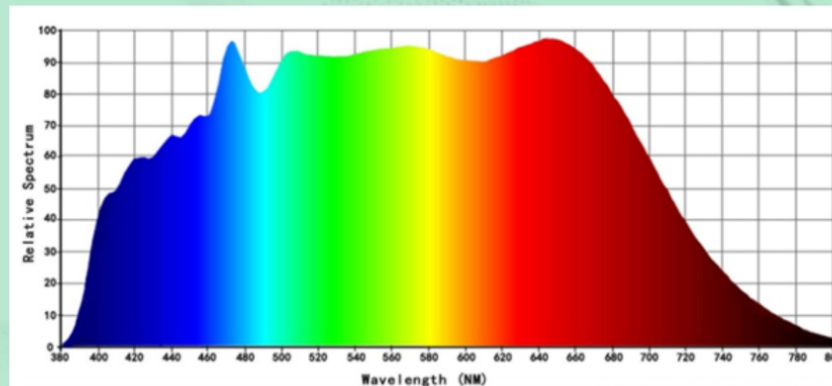
2

3



Light Source

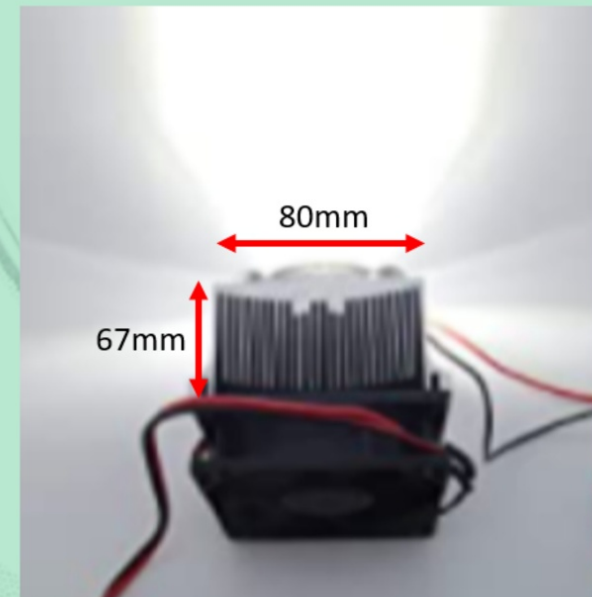
- LED Specifications
 - CRI 95+, 4700-5200K color temperature (Natural White)
 - 24.6mm emitting surface area
 - Power Consumption: 64 W
 - Spectral range: 380nm-800nm





Cooling System for LED

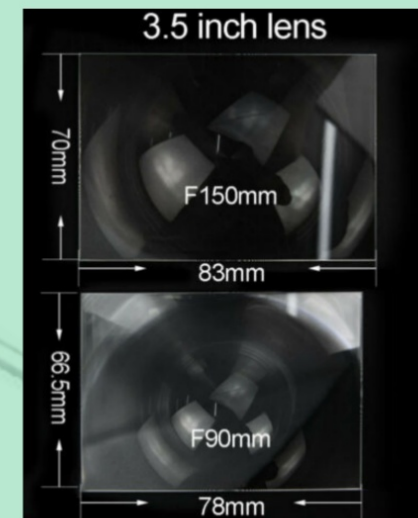
- Aluminium Heatsink Cooling Fan
 - Rated for 20W-100W High Power LED
 - Copper core radiator
 - Fan voltage of 24V DC
- Dimensions
 - Heasink: 80mm by 67mm
 - Fan: 79mm by 79mm by 29mm





Light Control

- Controlling light generated from LED
 - Lens 1 & 2: Fresnel Lenses
 - Collimation lens (lens 1): 90 mm focal length
 - Converging lens (lens 2): 150 mm focal length
 - Lens 3: Projecting lens
 - Large format lens: 135 mm focal length, $f/5.6$
 - Radius of lens (35.4mm) must be larger than LED radius (24.6mm) to avoid image clipping





Light Control

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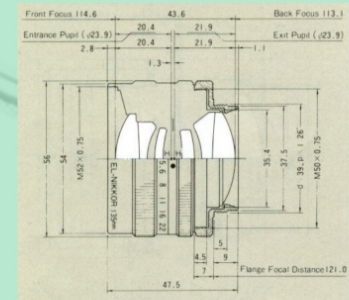




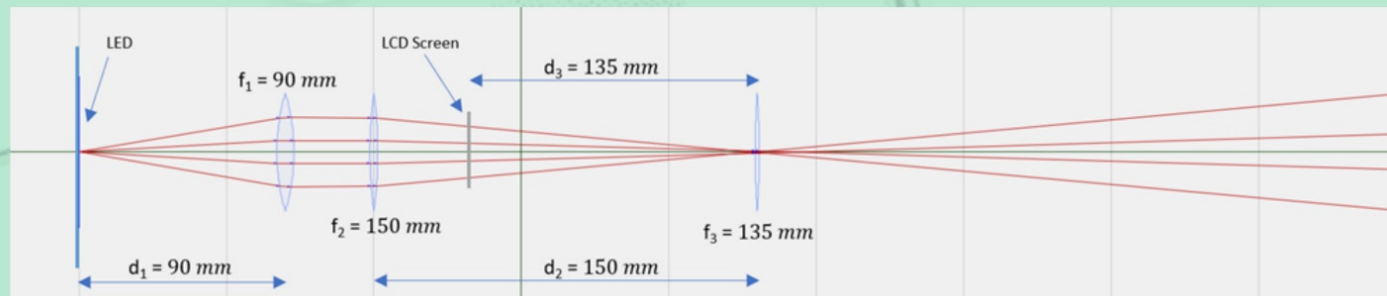
Image Source

- LCD screen features
 - 5.0" screen display
 - Resolution: 800x480
 - Transmissive after LCD back-light is removed





Optical Projector Schematic



- d_1 – distance from LED to first lens
- d_2 - distance from second lens to projecting lens
- d_3 - distance from LCD screen to projecting lens
- f_1 - first fresnel lens focal length
- f_2 - second fresnel lens focal length
- f_3 - projecting lens focal length



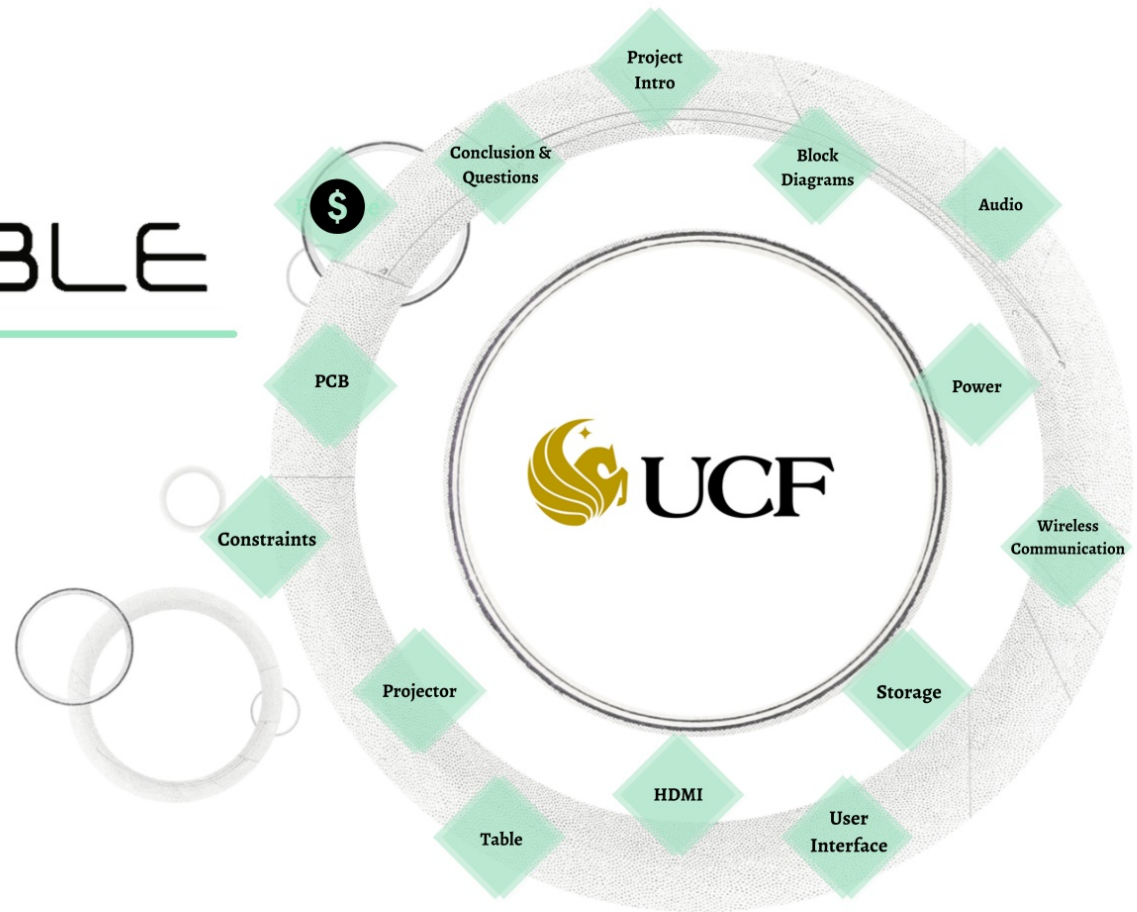
Design Notes

- Fresnel lenses clipped incoming LED light resulting in small area of illumination on the LCD screen.
Consequently, only a small are of the LCD screen can be projected.
- Cooling system must be developed to cool the LCD screen and prevent the heat from developing thermal damage on the LCD screen.

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Group 2



Constraints

Constraints to consider:

- Economic
- Environmental
- Legal
- Health and Safety
- Maneuverability
- Ethical

1

2

ISRAEL CASTILLO
Speaking



ISRAEL CASTILLO
Speaking



Economic

- Our project did not have any sponsorships and was self-funded.
- Each team member managed their own budget.

Environment

- Avoiding waste production by recycling components.

Legal

- No legal constraints found.



Health and Safety

- Electrical components must be handled by individual who is electrically grounded.
- Optical components must be handled with care, as they are extremely sensitive to mechanical and thermal stress.
- Fires caused by electrical components must be prevented.

Manufacturability

- Our table must have air ventilation to allow cooling.
- Electrical wiring must be controlled for ease of access.

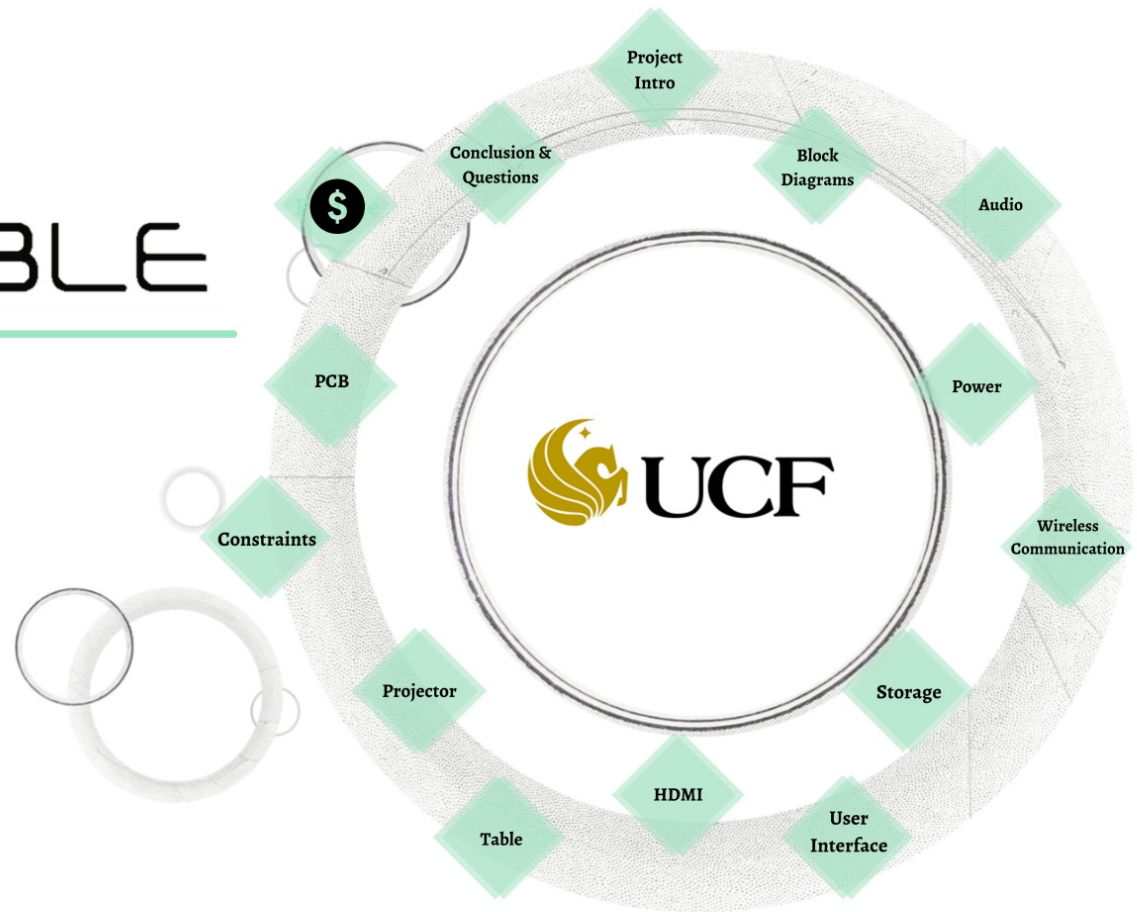
Ethical

- No ethical constraints found.

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Presented by:

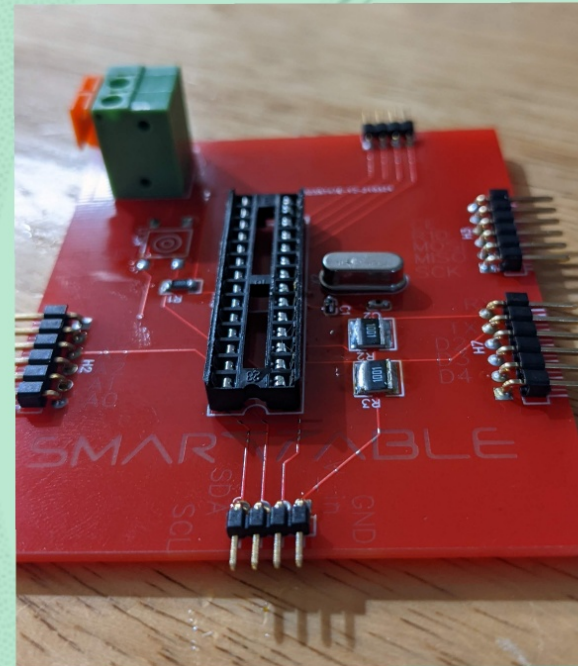
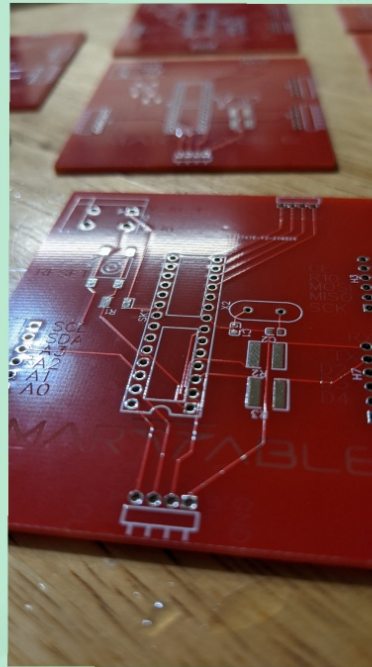
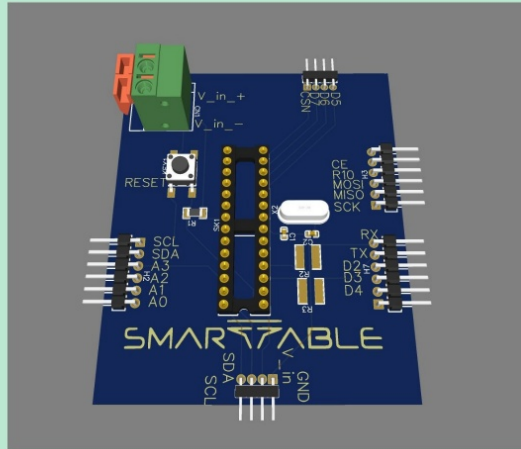
Group 2





PCB Development

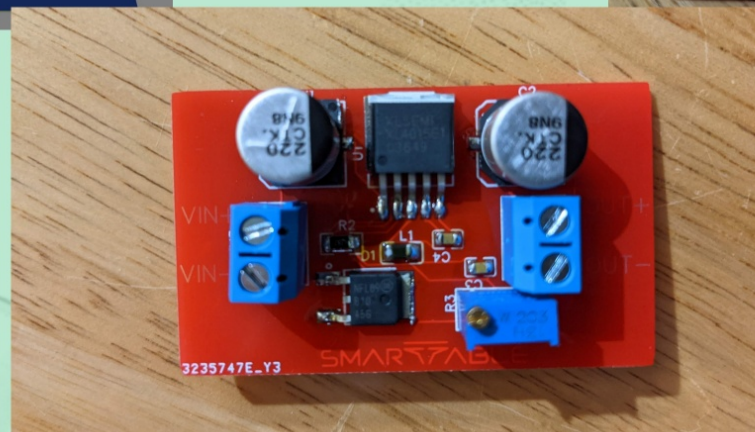
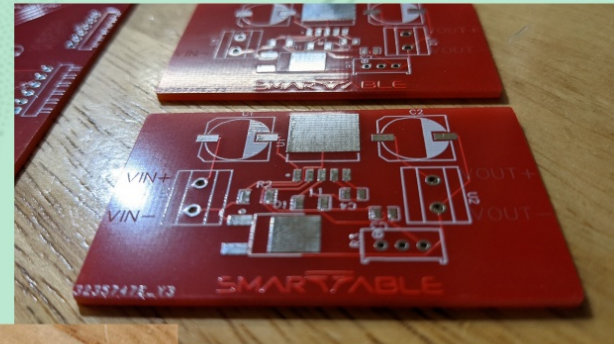
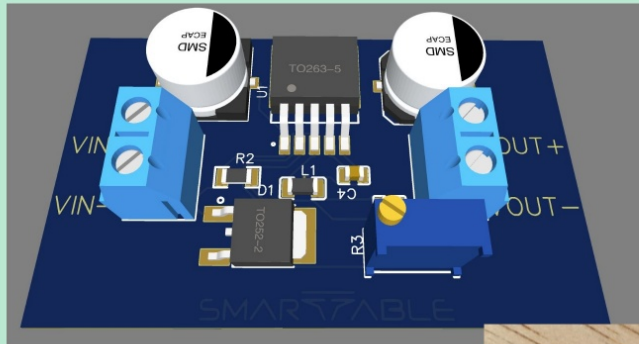
Host MCU (ATMEGA) Board

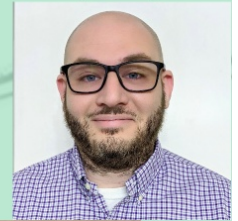




PCB Development

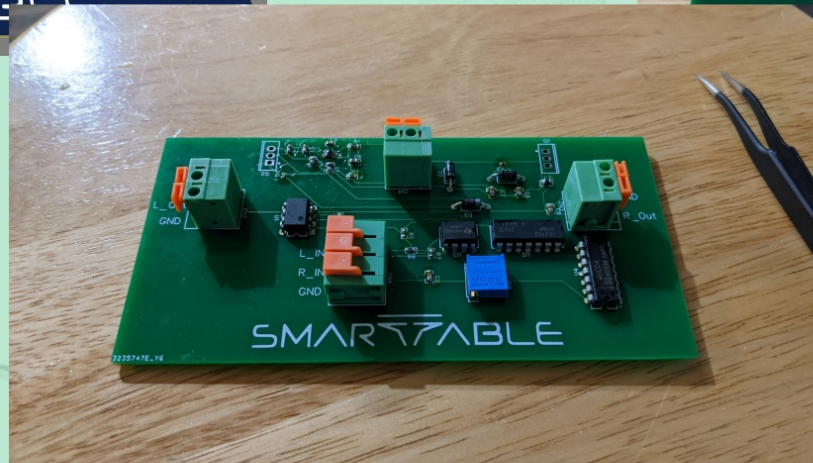
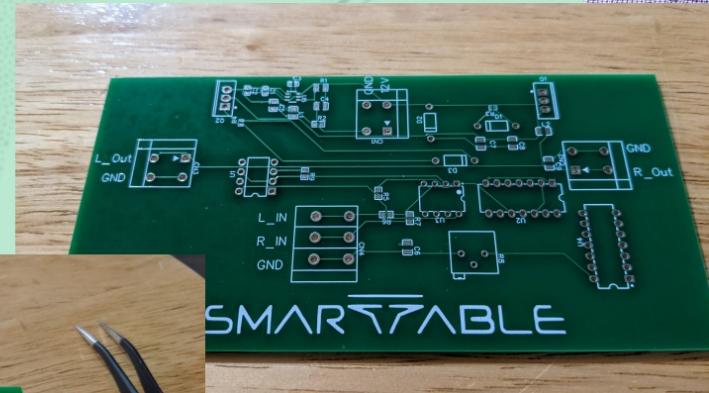
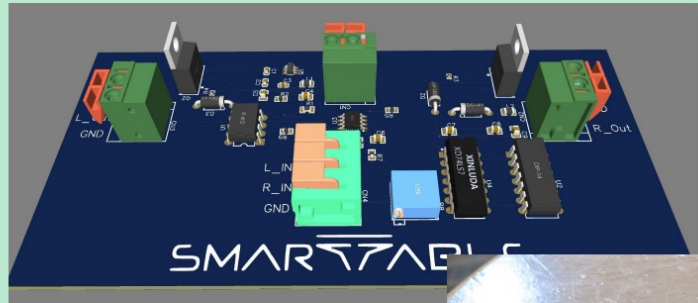
Voltage Regulation





PCB Development

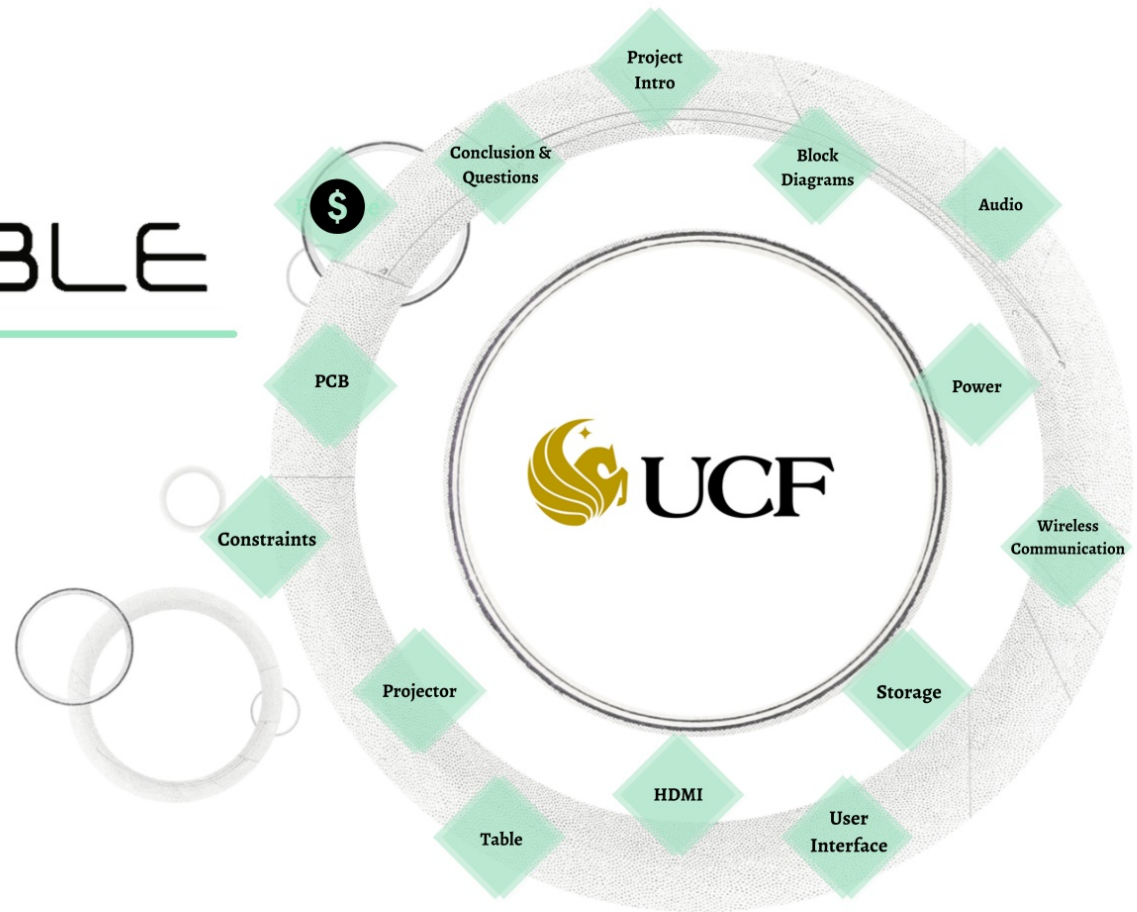
Audio



SMARTTABLE

Presented by:

Group 2



Budget & Financing

ISRAEL CASTILLO
Speaking

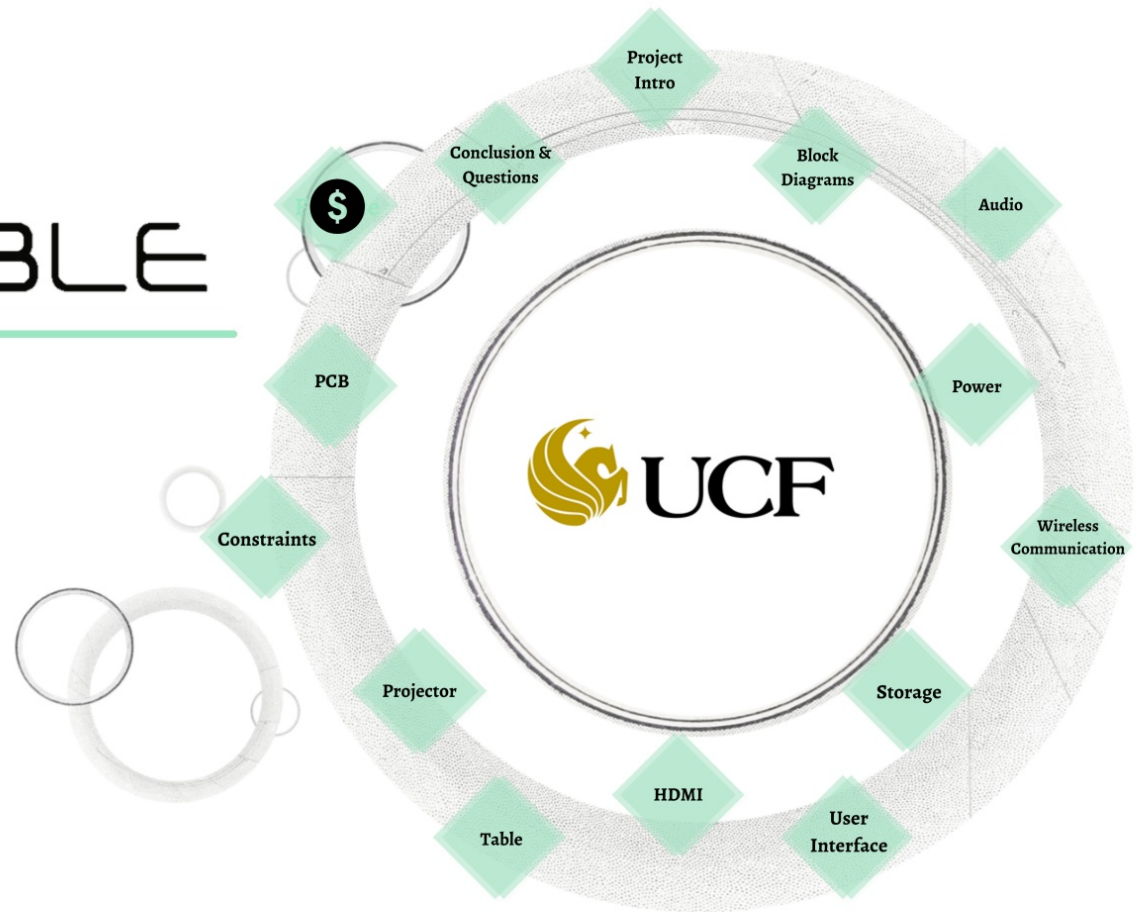


Cost of Smart Table						
	Items/Parts	Quantity	Prices (\$)	Projected Cost (\$)	Current Cost (\$)	
Audio System	LM555 Timer	1	\$0.56	\$0.56	\$0.00	
	Comparator	1	\$0.45	\$0.45	\$0.00	
	HEX Inverter	1	\$0.57	\$0.57	\$0.57	
	MOSFET Driver	1	\$4.23	\$4.23	\$4.23	
	MOSFETS	2	\$1.96	\$3.92	\$0.00	
	Diode	6	\$2.04	\$12.24	\$0.00	
Projector System	Light Source	1	\$24.00	\$24.00	\$24.00	
	Cool System	1	\$23.50	\$23.50	\$23.50	
	Fresnel Lens	2	\$15.45	\$30.90	\$15.45	
	LCD Object	1	\$45.00	\$45.00	\$45.00	
HDMI Control System	Large Format Lens	1	\$100.00	\$100.00	\$100.00	
	HDMI/DVI board	1	\$25.00	\$25.00	\$25.00	
	40-pin FPC Extension	1	\$4.50	\$4.50	\$4.50	
Power System	XL4015E1	2	\$1.33	\$2.66	\$0.00	
	MBRD1045T4G	2	\$0.41	\$0.82	\$36.13	
	LM2576 - ADJ	1	\$4.12	\$4.12	\$4.12	
	LM2677S - ADJ	1	\$3.70	\$3.70	\$5.00	
	Full Bridge Rectifier	1	\$1.32	\$1.32	\$1.32	
	Transformer	1	\$26.13	\$26.13	\$26.13	
	Capacitors	1	\$5.68	\$5.68	\$1.50	
	Fuses	2	\$1.25	\$2.50	\$0.00	
	Switch	1	\$0.68	\$0.68	\$0.68	
	MCU Control Board	ATMEGA 328 B	1	\$1.34	\$1.34	\$1.34
	ATMEGA 328 P	1	\$2.06	\$2.06	\$2.06	
Wireless communication	Micro USB	1	\$1.25	\$1.25	\$1.25	
	LED strip	1	\$26.99	\$26.99	\$26.99	
	ESP32	1	\$10.57	\$10.57	\$10.57	
	PCM module	1	\$13.99	\$13.99	\$13.99	
	Relay	1	\$5.99	\$5.99	\$5.99	
Storage	fingerprint sensor	1	\$19.99	\$19.99	\$19.99	
	LCD Screen	1	\$7.99	\$7.99	\$0.00	
	Relay	1	\$5.99	\$5.99	\$0.00	
	Lock	1	\$9.99	\$9.99	\$9.99	
Table Construction	Wood	1	\$53	\$53.00	\$0	
	Drawer sliders	2	\$9.99	\$19.98	\$0	
	Wooden Legs	6	\$2.23	\$13.38	\$13	
PCB	Handle	1	\$3.14	\$3.14	\$3.14	
	All Broads	6	\$18.60	\$112	\$112	
TOTAL COST					\$630.13	\$537.82

SMARTTABLE

Presented by:

Group 2





Questions?

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