

SONOS  
INTERCOM SYSTEM



Initial Design Review

What are we going to do?

## Product Description

Build a compact device which allows a person to broadcast their voice to a specific room's SONOS devices and control their music.

# Required Functionality

## Communication

Real time voice broadcasting.

Allows user to select which “room” to talk to.

“room” = a group of SONOS devices.

## Music Control

Play/Pause

Next

Previous

Volume



# Design Constraints

## Experience

Minimize audio latency.

Responsive controls.

## Simplicity

## Durability

Product should withstand home environment (drop/water proof).

## Affordability

\$49.99-\$99.99 is acceptable for such a simple device.

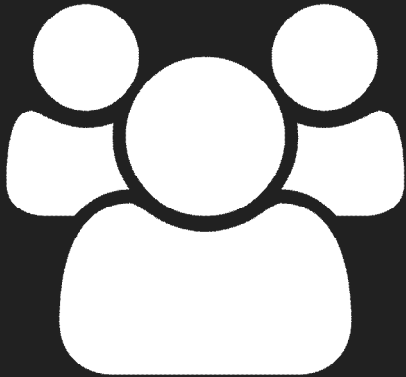
# Target Market

Middle to Upper class people who own SONOS devices.

Young families.

SONOS

Research and Development

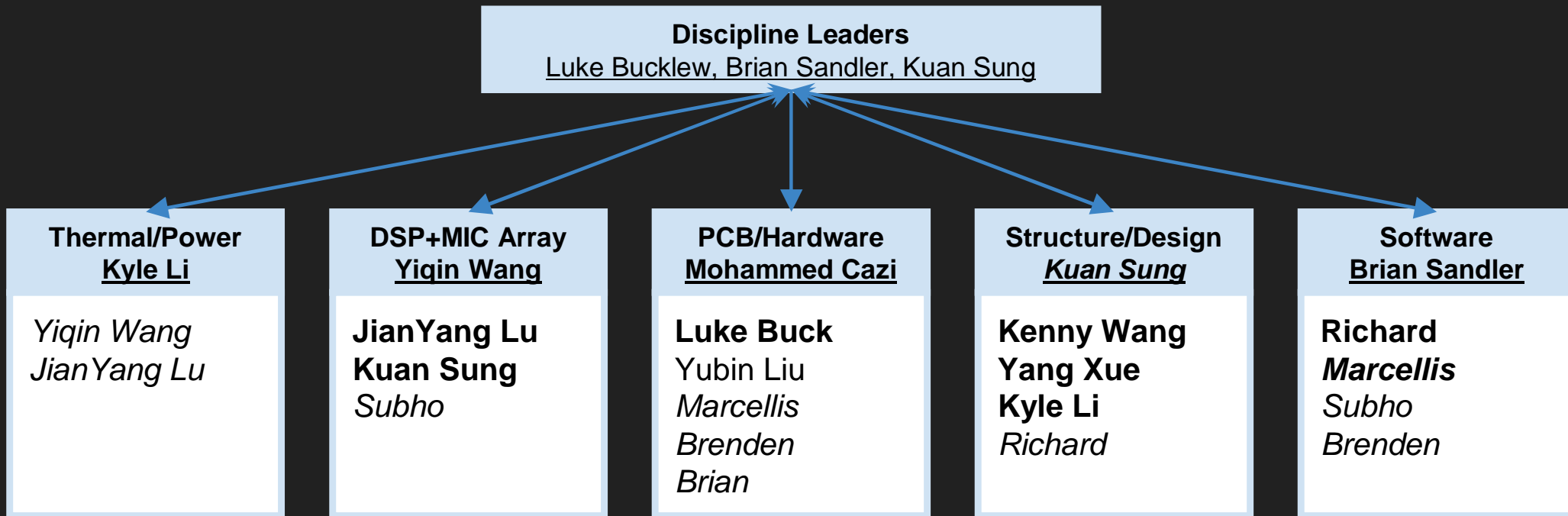


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SONOS

Who's on the team?

# Our Team



## Legend

Underline = Leader

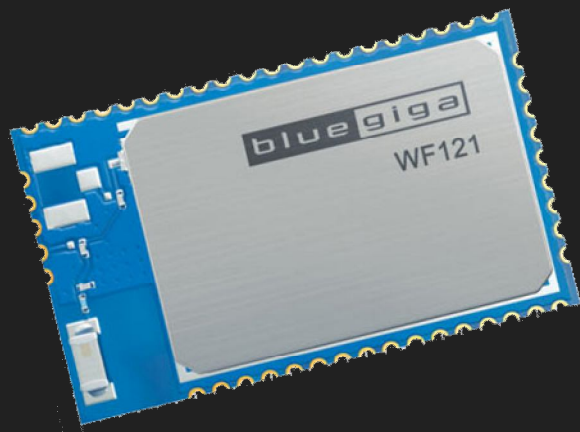
**Bold** = Primary Group Member (1 per person)

*Italics* = Secondary Group Member / Communications

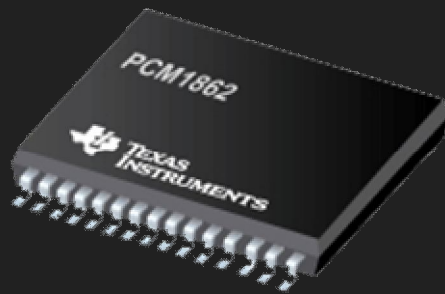


How will it be done?

# Components



WF121 WiFi Module



PCM1862 ADC



1.44" ST7735R

# Components

## Final Version

Capacitive Touch Controllers

AT42-QT1010(x2) Digital Output SOT23 or PCF8883(x2) (NXP)

Capacitive Surface

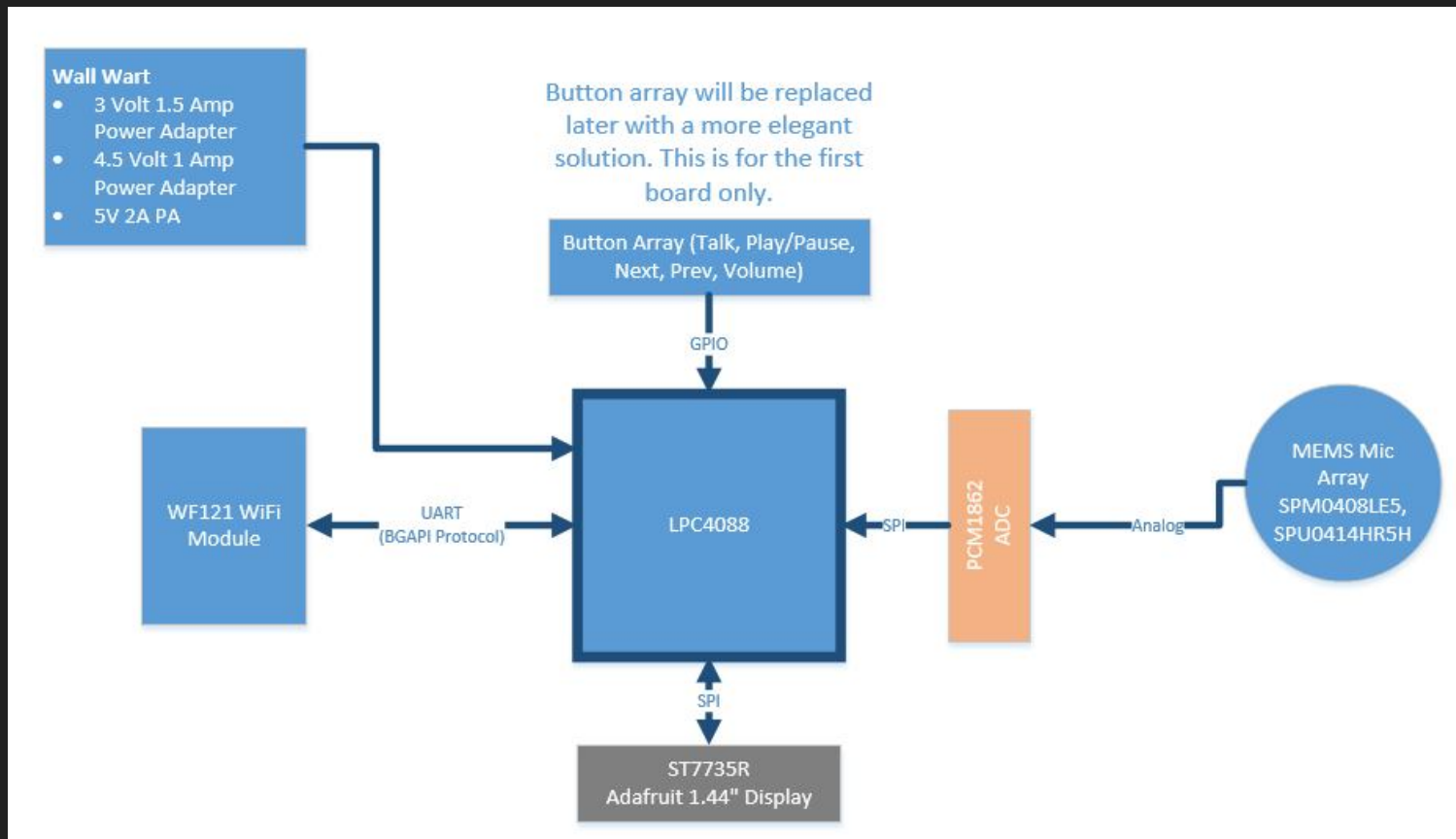
## Prototype Version

Push Buttons 519PB-ND(x5)

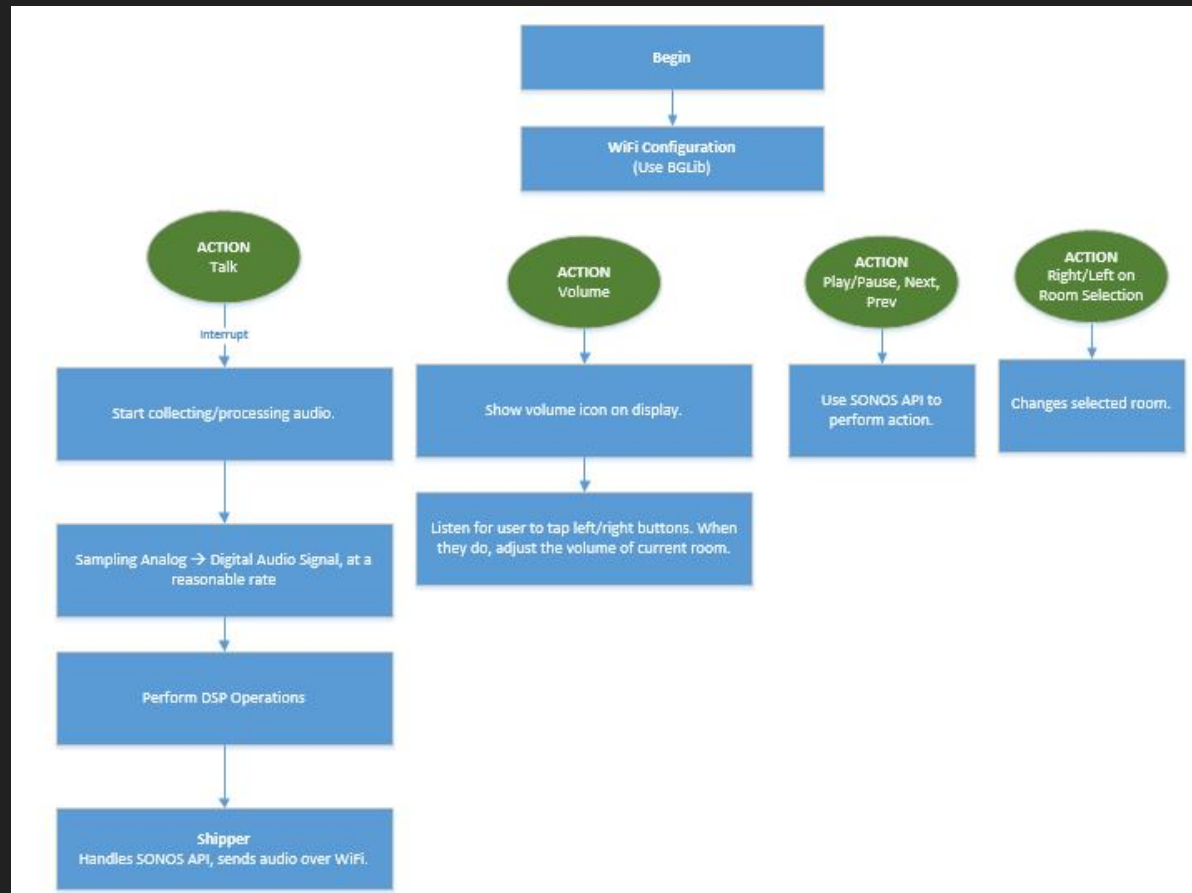
# Interfaces

Symbol	Choice	Description	Purpose
<b>P0[0:31]</b>			
P0[0]			
P0[1]			
P0[2]	U0_TXD	UART 0 TX	ISP
P0[3]	U0_RXD	UART 0 RX	ISP
P0[4]			
P0[5]			
P0[6]	SSP1-SSEL	SPI 1 CHIP SELECT	PCM1862 PIN 25
P0[7]	SSP1_SCL	SPI 1 SERIAL CLK	PCM1862 PIN 24
P0[8]	SSP1_MISO	SPI 1 MASTER IN/ SLAVE OUT	PCM1862 PIN 22
P0[9]	SSP1_MOSI	SPI 1 MASTER OUT/ SLAVE IN	PCM1862 PIN 23
P0[14]			
P0[15]	U1_TXD	UART 1 TX	WF121 WIFI MODULE
P0[16]	U1_RXD	UART 1 RX	WF121 WIFI MODULE
P0[17]	U1_CTS	UART 1 CTS	WF121 WIFI MODULE
P0[22]	U1_RTS	UART 1 RTS	WF121 WIFI MODULE
P1[0]	SSP2_SCK	SPI 2 Serial Clock	COLOR TFT CLK
P1[1]	SSP2_MOSI	SPI 2 MASTER OUT/ SLAVE IN	COLOR TFT MOSI
P1[2]			
P1[3]	PWM0[2]	PWM INPUT	COLOR TFT LITE
P1[4]	SSP2_MISO	SPI 2 MASTER IN/ SLAVE OUT	COLOR TFT MISO
P1[5]			
P1[6]			
P1[7]			
P1[8]	SSP2_SSEL	SPI 2 CHIP SELECT	COLOR TFT TFT_CS

# Hardware Block Diagram



# Software Block Diagram



# The Microcontroller

Processor: NXP LPC4088

Manufacturer: NXP Semiconductors

Part Number: LPC4088FBD208

Used to connect and control all peripherals through the SPI/UART interfaces on the ARM Cortex-M4 processor.

Cost:\$11.30

# The WiFi Module

WF121 WiFi Module:

Will be used to join a network that has other Sonos products

2.4 GHz 802.11 b/g/n

BlueGiga's Wi-Fi Software

Cost: \$28.71



# The ADC

PCM1872DBTR from Texas Instruments.

24 bit resolution ADC converter.

2 channels

Allows the microcontroller to process the inputs from the mic array.

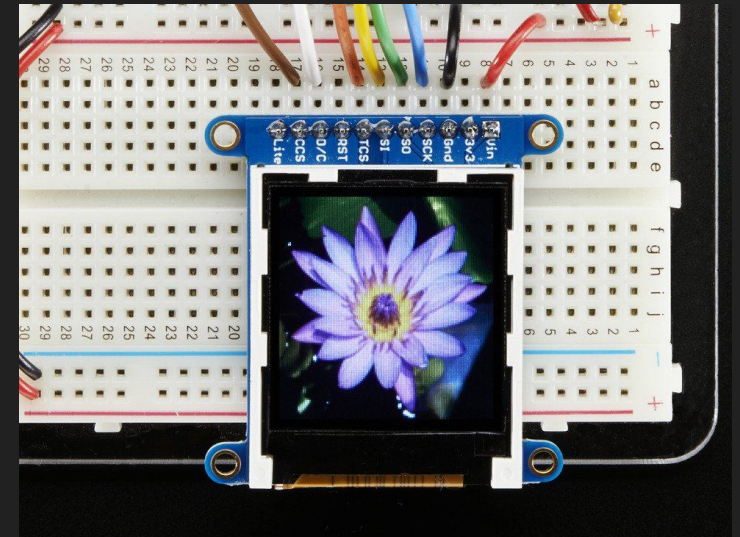
Cost: \$3.79

# The Screen

## Adafruit 1.44" Diagonal Color TFT LCD Display

- 128 x 128 resolution, 18 bit color
- SPI Digital Interface
- Built in MicroSD slot
- 3.3V or 5V compatibility
- ~25mA max current draw for LCD and Backlight
- 10g weight
- 33 mm x 45mm x 7mm total size

Cost: \$14.95



# Critical Elements

Minimize latency when broadcasting real time audio using the SONOS API.

Same MCU will be performing DSP as well as interacting with the API on the network.

# Schedule

For this project the ECE 189A Gantt Chart was followed:

Task Name	Duration	Start	Finish	Predecessors	Team	Notes
<b>IDR Prep: Basic Product Definition and Coordination</b>	<b>11 days</b>	<b>Mon 9/26/16</b>	<b>Mon 10/10/16</b>			"We will do this product, and this i
Project Idea and Team Formation	6 days	Mon 9/26/16	Mon 10/3/16		General	See in drive ECE189A>Milestone 1 F
Behavioral Specification	5 days	Tue 10/4/16	Mon 10/10/16	2	General	See in drive ECE189A>Milestone 2 F
Simple Block Diagram	5 days	Tue 10/4/16	Mon 10/10/16	2	PCB/Hardware	See in drive ECE189A>Milestone 2 f
Organizational Chart	2 days	Thu 10/6/16	Fri 10/7/16	2	General	See in drive "Org Chart".
Initial Design Review (IDR)	0 days	Mon 10/17/16	Mon 10/17/16	1	PCB/Hardware	Will happen in ECE189A.
Executive Summary	15 days	Thu 10/20/16	Wed 11/9/16	3	General	ENGR195A
Prototype Plan	10 days	Mon 10/17/16	Fri 10/28/16	6	General	ENGR195A
Preliminary Project Plan and Design Specs Report	23 days	Thu 10/13/16	Mon 11/14/16	5FF,7FF,8FF,20F	General	ENGR195A
<b>Board Spin 1</b>	<b>71 days</b>	<b>Mon 10/10/16</b>	<b>Mon 1/16/17</b>		<b>PCB/Hardware</b>	
<b>PDR Prep: System Level Design</b>	<b>10 days</b>	<b>Tue 10/11/16</b>	<b>Mon 10/24/16</b>		<b>PCB/Hardware</b>	
Component Selection	5 days	Tue 10/11/16	Mon 10/17/16	3,4	PCB/Hardware	
Complete Block Diagram	5 days	Tue 10/18/16	Mon 10/24/16	4,12	PCB/Hardware	
PDR: Preliminary Design Review	0 days	Mon 10/24/16	Mon 10/24/16	11	PCB/Hardware	
Hardware Prototype (Dev Boards)	28 days	Mon 10/31/16	Wed 12/7/16	14,8	PCB/Hardware	
DSP Programming	28 days	Tue 10/25/16	Thu 12/1/16	14	DSP	
Software Dev and Prototype (Dev Boards)	28 days	Mon 10/31/16	Wed 12/7/16	14,8	Software	
<b>CDR Prep: Board Design and Layout</b>	<b>30 days</b>	<b>Tue 10/25/16</b>	<b>Mon 12/5/16</b>	<b>14</b>	<b>PCB/Hardware</b>	
Schematic Diagram	15 days	Tue 10/25/16	Mon 11/14/16	6	PCB/Hardware	
BOM	15 days	Tue 10/25/16	Mon 11/14/16	6	PCB/Hardware	
PCB Layout	15 days	Tue 11/15/16	Mon 12/5/16	19	PCB/Hardware	
CDR: Critical Design Review + Artwork Review	0 days	Tue 12/6/16	Tue 12/6/16	18	PCB/Hardware	
PCB Fabrication Submittal	0 days	Tue 12/6/16	Tue 12/6/16	22	PCB/Hardware	
PCB Fabrication Fab + Assembly	30 days	Tue 12/6/16	Mon 1/16/17	23	PCB/Hardware	
Prototype Demo	0 days	Wed 12/7/16	Wed 12/7/16	15,17	General	ENGR195A

