

## **SONOS Intercom – SONOS (Multidisciplinary Project)**

*This project is available for interested EE, CE, and ME students. This project is intended as a multi-disciplinary project that will include 1 ME team, 1 EE team, and 1 CE team. Students must also enroll in ENGR 195 for 1 additional unit of credit each quarter.*

This project is in cooperation and partnership under a gift with SONOS located in Santa Barbara. SONOS Project Lead – Vicki Chen

**Sonos** is a local consumer electronics company founded in 2002 and is a world-wide leader and innovator with variety of wireless audio products. Sonos is a smart system of HiFi wireless speakers and audio components. It unites your digital music collection in one app that you control from any device.



### **Objective**

Build an Intercom hardware that connects to Sonos players through UPnP API.

### **Description**

#### ME focus

Students build a hardware module that contains a microcontroller, wifi module, and microphones with basic DSP for voice input. The system should use API to connect to Sonos players. The students should optimize the design to achieve clarity on different types of voices, in different type of environments and optimizing the processor loading. The final product should be attractive and compact, and pass Sonos' design criteria.

#### EE/CE focus

The intercom hardware should communicate with Sonos device through the UPnP API. When someone speaks to the intercom, the device saves the voice as an audio file to a URL, and the device communicates with Sonos device to play the audio file. This work can be divided into two groups:

Microphone and Voice DSP

- Explore different microphone strategy – microphone array size, near or far field, or focus on single microphone characterization.
- DSP: this project should focus on reducing processor capacity, achieving voice clarity under different circumstances, and avoid echo during playback.

Integrate with Sonos system through API

- The final product should include a WiFi module to connect to the wireless router, and a CPU that can create a URL for Sonos household to connect to.
- The final product should pass the audio from intercom to the chosen Sonos device(s) in the household.
- The effort should be well documented to provide valid feedback and debug for Sonos.

### **Mechanical Focus:**

1. Thermal requirements
2. Explore ID
  - Final design should fit into Sonos product family.
  - Size, shape, color/material/finish
3. UX
  - Button placement/feel/experience
  - Notification (lights, sounds)
4. Mechanical stability
  - Weight
  - Structural rigidity
  - Drop test
5. Acoustic requirements
  - Integrate with chip microphone
6. EE requirements
  - Incorporate EE components
  - Power supply
7. Antenna
  - Integrated with wifi antenna.

8. Design for factory assembly/cost

9. Safety consideration

Students are encouraged to explore the followings:

- Power supply strategy: battery power or plug-in.
- Different audio format (wave, compressed, etc.).
- Latency.
- Set up: How to pair intercom with a specific player, choose player(s) to speak to, and adjust volume.
- User interface: How to interrupt music and resume playback during the intercom playback.
- Other application: baby monitor mode, door bell, etc.
- Other control aspects.

#### Student Requirements

Students will be required to sign a Confidentiality Agreement and Invention Agreement

#### Student Qualifications

Students interested in the fast-paced and challenging consumer products electronics industry will find this project interesting and challenging. This is an opportunity to work with industry engineers, scientists and marketing executives.

Website: <http://www.sonos.com/system>