DISTRIBUTED AUDIO SYSTEM CONTROLLER

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ABSTRACT

The project was to design and implement a software interface to control a network of intelligent speakers that the Electrical Engineering team was responsible for. The master controller is a Raspberry Pi 2 which runs a web server built in GoLang and maintains a SQL database that tracks information, settings, and other data about the microcontrollers. To communicate with the network, a protocol was developed in collaboration with the EE team to talk to a massive array of microcontrollers over a custom serial communication bus. The positions of the microcontrollers within the network are found by analyzing a given map using an image processing algorithm. The system then makes use of a hop-count relative addressing technique, which allows the microcontrollers to be fully versatile in terms of their position and reference within the system as a whole.

ARCHITECTURE

![Architecture Diagram]

IMPACT

The system allows for a large network of speakers to be controlled in an intuitive way, which is unmatched in the current market. The interface, designed to be easy to use, allows non-technical users to simply make changes to the network from any device with a web browser. Tiered permissions allow for the ability to restrict control for individual speakers as well as zones, which are groups of speakers that have been combined into a single representative area where they can be controlled en masse but still retain their individual controllability. These features form a system that has the potential to make a big impact in the current market.

RESULTS

Desktop Screenshot

![Desktop Screenshot]

iPhone Screenshots

![iPhone Screenshots]

SUMMARY

The system makes creating a complex network of controllable speakers intuitive. To setup the software, an installer simply needs to upload an image of the layout with speakers designated as blue circles, and the system then uses image processing to automatically construct a digital layout of the space. Users can then use a simple web interface from any device with a web browser to control the speakers, create groups of speakers, and assign permissions to control which speakers a user can control. This was all made possible by using a collection of technologies to do what they each do best such as GoLang and SQLite for the web server, Python and OpenCV for the image processing, and JavaScript, HTML, and CSS for the front-end. Furthermore, the versatility and usability of the system were fundamental design principles. When addressing the microcontrollers, it was critical to make it as seamless and easy as possible to replace and set up, thus a relative addressing system based on the hop-count of the speakers was implemented. This allows the speakers to be installed in any order in no specific position, as well as being able to be switched out and swapped without impacting the system.