

ECE 480 Design Team 2

AHEAD

Accessible Home Energy Audio Dashboard

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Sponsored By:



RCPD

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Progress Report 2

1. Introduction

The AHEAD module has been nearing its completion in the past few weeks. Although there are still a few problems left to be worked out, it is almost ready to be put in its final housing. The prototype stage has nearly been completed and will be completed in the next week. The sponsor has recently stopped by to see the progress of the project. He was very excited with what has been completed and how the team will finish it up. He also wants to help the team with the enclosure design process and production.

2. Switch Access

The way in which people with motoric devices will interact with the device has been completed. A method of single switch scanning has been implemented into the project. The interface itself is going to be designed around this feature in the sense that it must be a possibility to interact with the use of only one switch or button. The different onscreen buttons will be navigated through a with the use of a timer. When the switch is first hit, the program will repeat the menu choice and if the switch is hit a second time with in a designated period the program will then take this as the user's choice and press that button.

3. Modes of Operation

The different modes that the AHEAD module will use as presets have been programmed in and are almost able to be used. The idea is that the module will control the home automation with out needed further input from the user, only the initial mode select. The only problem now is getting the

timing right so that the RF signals sent through the firecracker unit do not try to overlap each other causing the packets to be corrupt. Although the first timer ticks every 100ms and an entire packet of 40 bits should only take 20ms there seems to still be an underlying problem.

4. Program Mobility

A lot of the code has been packed up into modules to allow easier access to features and give way to much better mobility. This was a great benefit from going from the prototype design to the final design. They still need to be further documented to explain what each module is there for, as well as how to use them. However, they are fully functional and have been made to work on their own with any future projects if desired.

5. Smart Meter

Originally, the team decided to test the P3 Kill-A-Watt Power Meter to supplement the simulated smart meter. The AHEAD device was to get the voltage and current reading through the Xbee RF modules to produce the current power consumption. Other information such as price per kilowatt hour and important utility messages were to be programmed into the GUI. Upon testing the Kill-A-Watt Power Meter, the team encountered problems retrieving accurate data. The current waveform when viewed with an oscilloscope showed irregularities in the sinusoid like it was composed of two frequencies rather than just the single 60 Hertz signal from the 120 Volt wall outlet. As a team, we decided to not use the Kill-A-Watt Power Meter but instead assign power ratings to appliances in the Visual Basic code. We will get the current power consumption based on what is turned on from the AHEAD device. We feel that this decision still works within the design specifications since we are to only “simulate” the smart meter. However, we will use the team’s laptop PC to send data such as price per kilowatt hour and power utility messages through the Xbee RF modules. Visual Basic code will perform the calculations before displaying the information on the GUI. This second method for simulating the

smart meter has already been implemented into the Visual Basic code and wireless serial communication for PC to PC has been achieved.

6. Audio Amplifier

Some improvements have been made to the audio amplifier circuit. The mechanical potentiometer has been replaced with a digital potentiometer, and the microcontroller has been programmed to communicate with the digital pot. This will enable the user to change the resistance of the pot (which in turn changes the volume) through the touch screen.

There was a problem with the speaker we used to test the amplifier. It was making a lot of noise when the volume was high. We suspected that this was because the speaker is rated at 0.25 w, and the calculated RMS power at the speaker output is about 1.125 w when the volume is at max. Therefore, that speaker has been replaced with a newer speaker with a higher wattage rating (about 2.5 w). However, this did not solve the problem! Another problem with the speaker is that it picks up radio signals even though the magnet of the speaker is shielded. This might be a problem because an RF receiver will be placed nearby the speaker in the final product.

Finally, the LM741 op-amp that we are using in the circuit is a dual supply IC chip. We need to supply ± 5 V to the op-amp from the PC. We can get +5 V from the USB port, but we are not sure how to get a -5 V. We looked into some circuits or IC chips that convert positive voltage to negative. We found out that these chips cannot solve the problem completely. This is because they do not provide enough current to drive the speaker. We are currently researching for solutions to solve these problems.

7. Conclusion

Design Team 2 has been hard at work getting everything working in the past few weeks. At this time they are on time with their schedule and will have a working project when design day comes. The final thing left to do is to get everything into one working package. The next weeks will be all about getting the AHEAD module packaged and getting setup for demonstration at design day.