Arimus Audio

Progress Report

WIRELESS SPEAKER MODULE

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Issued date : March 24, 2014
Revision : 1.0

1.0 Introduction

The SoundHub is a discreet speaker attachment that allows music streaming through Wi-Fi, while maintaining a price point much lower than existing competition. The end users will gain the benefits of wireless streaming without having to upgrade their existing audio systems. Our development of the SoundHub proof of concept model has focused on three major components, the progress of each will be further explained in the document:

- Hardware development aimed to provide high quality audio transmission through the design and implementation of a customized Digital-to-Analog Converter (DAC) system
- Firmware development on the evaluation board to achieve audio streaming through a Wi-Fi network to multiple speaker systems
- Software development aimed to develop an Android application which is capable of controlling playback over a mobile device

2.0 Progress Summary

2.1 Hardware Progress

Through the term our hardware team has been working to design and implement a high performance DAC circuit. The main components of our design include a SPDIF to I2S decoder, an audio DAC, and a differential amplifying stage; there are also separate minor circuits on the PCB including the rotary encoder and LED status lights. Schematic and layouts for the board designs have been created using Eagle PCB design software. Several attempts were made on fabricating PCB with our own copper boards and etching chemicals using the ironing toner transfer method. However the results are not promising and thus the PCBs have been fabricated by professional manufacturers instead. All components have been soldered onto the PCB and we are currently in the testing phase where we are verifying the power, inter-chips communication, and analog output from the DAC. Figure 1 below shows the current state of the PCB.

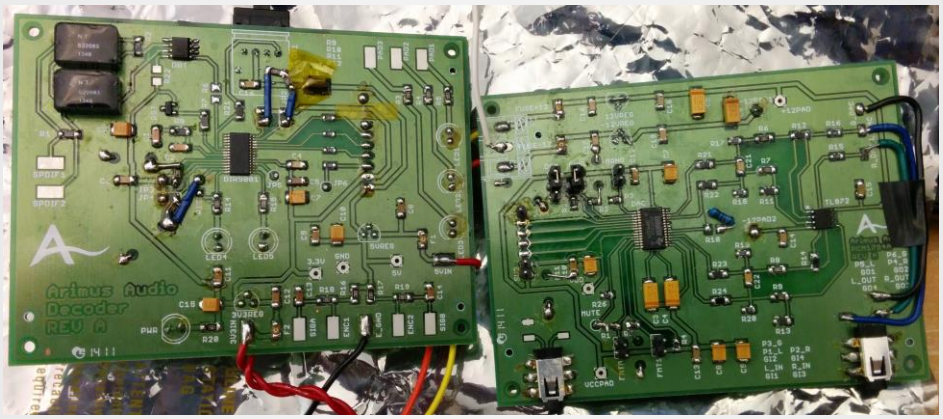

Figure 1: Hardware Decoder and DAC PCB

2.2 Firmware Progress

The firmware team has been working on the evaluation board to set up an embedded Linux system which is able to connect to Wi-Fi networks and stream music wirelessly. We have implemented the network handling and status light control on the board however our team is the furthest behind schedule. We have now successfully ported the AllJoyn framework to the development board but are still running into many bugs as the framework is still in development. The major bug we are seeing is related to the timing where the frames in the FIFO buffer are given a time which is incorrect making the song play too fast. We have also run into trouble with rotary encoder algorithm, which when tested with the hardware, was found to be too slow to achieve accurate results.

2.3 Software Progress

The software development planned to include minor changes to an open source application which implemented the AllJoyn framework. However after development started we realized that the open source application was not in the best of shape and did not implement the generic AllJoyn framework. More serious development is required to get this up to a point where it will work with our system.

3.0 Remediation

3.1 Hardware Remediation

Compared to our initial hardware schedule, we are in the correct phase (testing and debug) but have lost approximately two weeks of time. We expected problems to arise with our first iteration of the board, thus extra components and protoboards have been acquired so that minor changes and additions are achievable. If major modifications are necessary, April 1st is an approximate cut-off date for a second PCB run, considering the additional time required for soldering and testing. In the worst case scenario that our custom DAC circuit does not work, we are still able to demo the rest of our product using the development board's lower quality codec.

3.2 Firmware / Software Remediation

To fix the rotary encoder problem we have plans to improve response times by writing a custom driver. In the worst case we can cut this feature. The fix for the AllJoyn problems is not so clear and still requires debugging. If no progress has been made on this or on the Software by April 1, we are planning on changing direction and adopting a different communication protocol. We have demonstrated that open source implementations of AirPlay and UPnP are able to run on the development board with no modifications. These protocols were initially decided against due to their lack of support for synchronization across multiple sinks however have the benefits of not requiring a custom app on the mobile device. As there is so little time left, going this route would likely mean dropping support for the multiple sink feature.

4.0 Finances

Currently, we have spent approximately 92% ($1080) of our estimated budget ($1177) for the project. Initially, we planning on making our own PCB boards, but as we ran into difficulties due to fine trace sizes on our board, we have opted to have them professionally manufactured instead. The actual costs are compared in Table 1 below:

Item	Estimated Cost	Actual Cost	Difference
Evaluation Boards	$300	$228.86	+$71.14
Test Speakers	$40	$23.28	+$16.72
Major Components (IC's, Transformers, etc.)	$171	$331.17	-$160.17
Minor Components (Resistors, Capacitors, etc.)	$150	$164.18	-$14.18
Soldering Tools and PCB Etching Materials	No Estimate	$101.27	-$101.27
Enclosure	$50	-	+$50.00
Shipping (15%)	$114	$31.36	+$82.64
Contingency (20%)	$152	-	+$152.00
PCB Manufacturing	$150	$199.93	-$49.93
Totals	**$1127**	**$1080.05**	**+$46.95**

Table 1: Project Estimated and Actual Costs

If our team is able to allocate our estimated cost of $50 to purchasing materials to construct an enclosure and don't run into any unexpected expenses, then the project will end extremely close to the estimated total budget. We've acquired $500 of funding from the ESSEF and intend on applying to the Wighton Fund at the end of the term. Any extra costs not covered by funding will be split evenly amongst the team members.

5.0 Conclusion

In summary, we have made considerable progress during the term but still have some way to go before the demo. While there was a number of changes to the scope of the project, the overall budget estimates were very close to our predictions. The overall development progress is slightly behind our predicted schedule; however with our detailed remediation plans we are optimistic that we will have a functional project to show on demo day.