



HAB-1 Bluetooth Hearing Aid

Audima Team

- ▶ CEO – Jeffrey Lee
- ▶ CTO – Ali Pourghadiri
- ▶ COO – Eric Zhou
- ▶ CFO – Kevin Wong

Presentation Overview

- ▶ Motivation
- ▶ System Overview
- ▶ Hearing Aid
- ▶ Bluetooth
- ▶ Integration
- ▶ User Interface
- ▶ Business Case
- ▶ Project Specifics
- ▶ What Was Learned
- ▶ Future Developments
- ▶ Acknowledgements & References

Presentation Overview

- ▶ *Motivation*
- ▶ System Overview
- ▶ Hearing Aid
- ▶ Bluetooth
- ▶ Integration
- ▶ User Interface
- ▶ Business Case
- ▶ Project Specifics
- ▶ What Was Learned
- ▶ Future Developments
- ▶ Acknowledgements & References

Motivation

- ▶ What is a hearing aid?
- ▶ Who uses this device?



Motivation

- ▶ Analog Hearing Aid vs. Digital Hearing Aid



Motivation

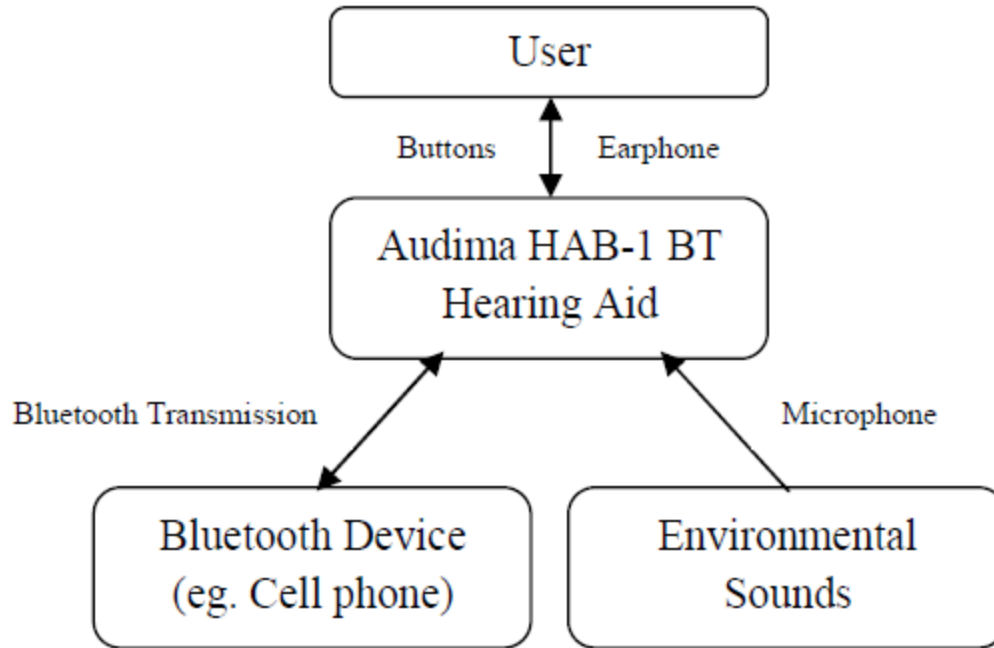
Accessories needed to connect today's technologies to hearing aids



Presentation Overview

- ▶ Motivation
- ▶ *System Overview*
- ▶ Hearing Aid
- ▶ Bluetooth
- ▶ Integration
- ▶ User Interface
- ▶ Business Case
- ▶ Project Specifics
- ▶ What Was Learned
- ▶ Future Developments
- ▶ Acknowledgements & References

System Overview



Presentation Overview

- ▶ Motivation
- ▶ System Overview
- ▶ *Hearing Aid*
- ▶ Bluetooth
- ▶ Integration
- ▶ User Interface
- ▶ Business Case
- ▶ Project Specifics
- ▶ What Was Learned
- ▶ Future Developments
- ▶ Acknowledgements & References

Hearing Aid

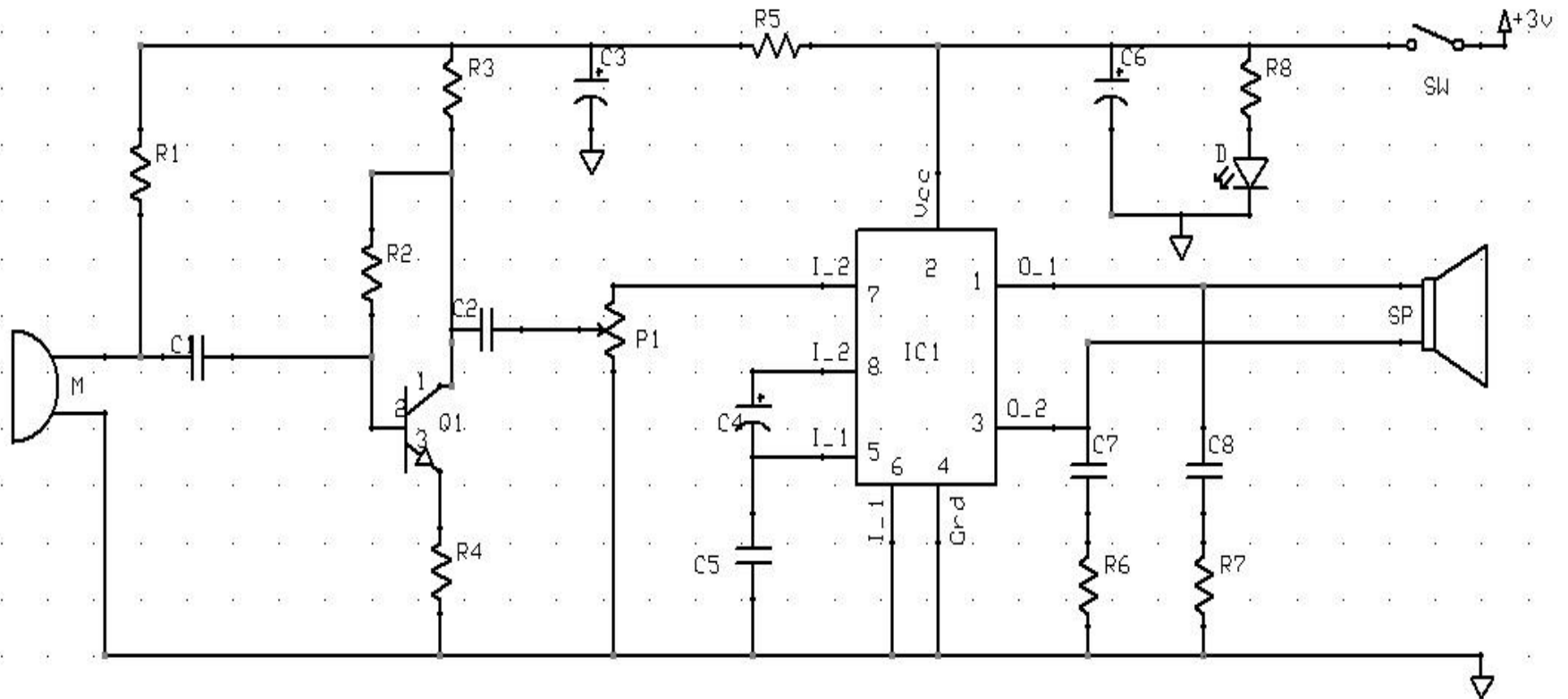
Mechanical Specification

- ▶ Dimension: 2.4"x0.65"
- ▶ Weight: 30g

Electrical Specification

- ▶ Voltage: 3.7 V
- ▶ Current: 30 mA
- ▶ Power: 0.111 W

Hearing Aid Schematic



Presentation Overview

- ▶ Motivation
- ▶ System Overview
- ▶ Hearing Aid
- ▶ **Bluetooth**
- ▶ Integration
- ▶ User Interface
- ▶ Business Case
- ▶ Project Specifics
- ▶ What Was Learned
- ▶ Future Developments
- ▶ Acknowledgements & References

Bluetooth

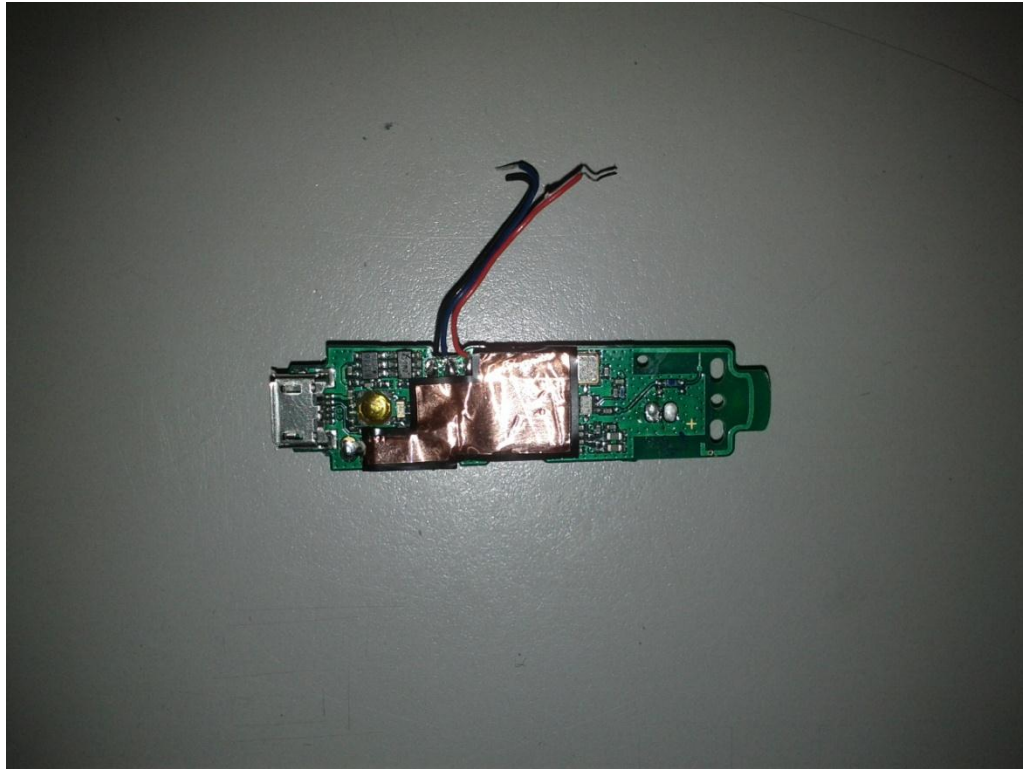
- ▶ Jabra BT2043
 - Talk Time - 8 hours
 - Standby Time - 10 days
 - Current - 17mA
 - Buttons - 1



Sony Ericsson HBH-PV705 PCBA



Jabra BT2043 PCBA



Presentation Overview

- ▶ Motivation
- ▶ System Overview
- ▶ Hearing Aid
- ▶ Bluetooth
- ▶ *Integration*
- ▶ User Interface
- ▶ Business Case
- ▶ Project Specifics
- ▶ What Was Learned
- ▶ Future Developments
- ▶ Acknowledgements & References

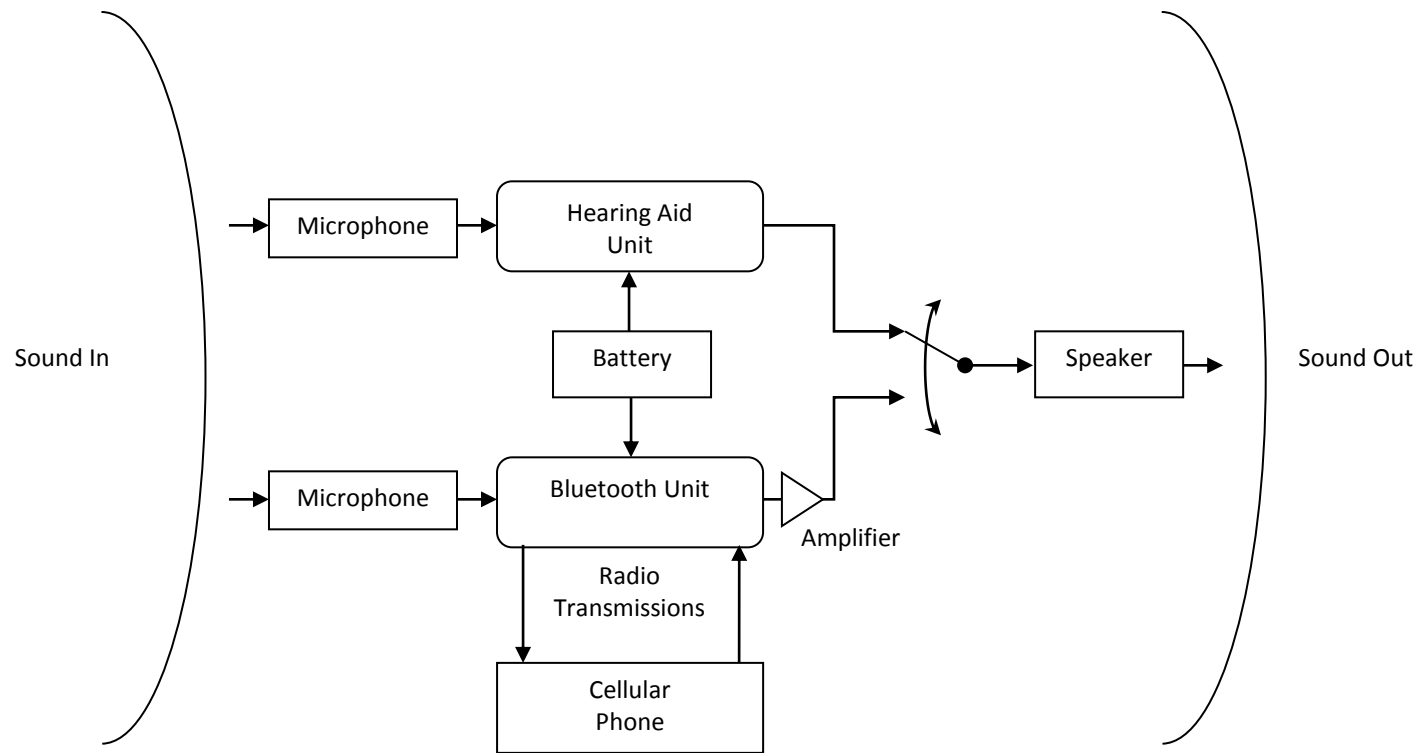
Integration

- ▶ Bluetooth and hearing aid work in parallel
- ▶ Individual status is controlled by a switch
- ▶ On-off switch is controlled by individual switch
- ▶ Both powered by a 3.7 V battery

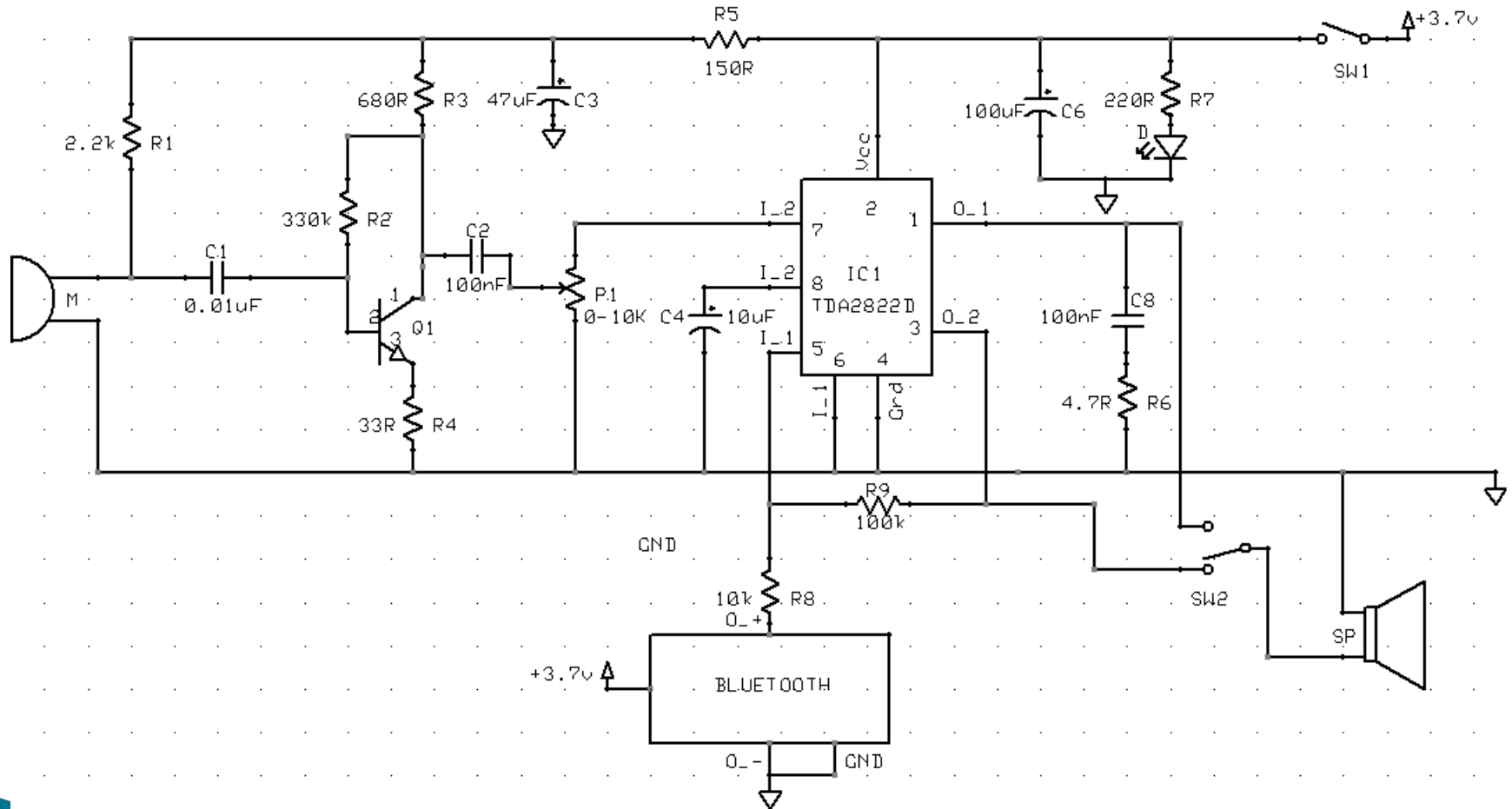
Integration

- ▶ Common Battery
 - Current capacity – 300 mAh
 - 3.7V
- ▶ Common Speaker
 - Control: SPDT switch
- ▶ Separate Microphones
- ▶ Amplification of Bluetooth signal
 - Gain: 50

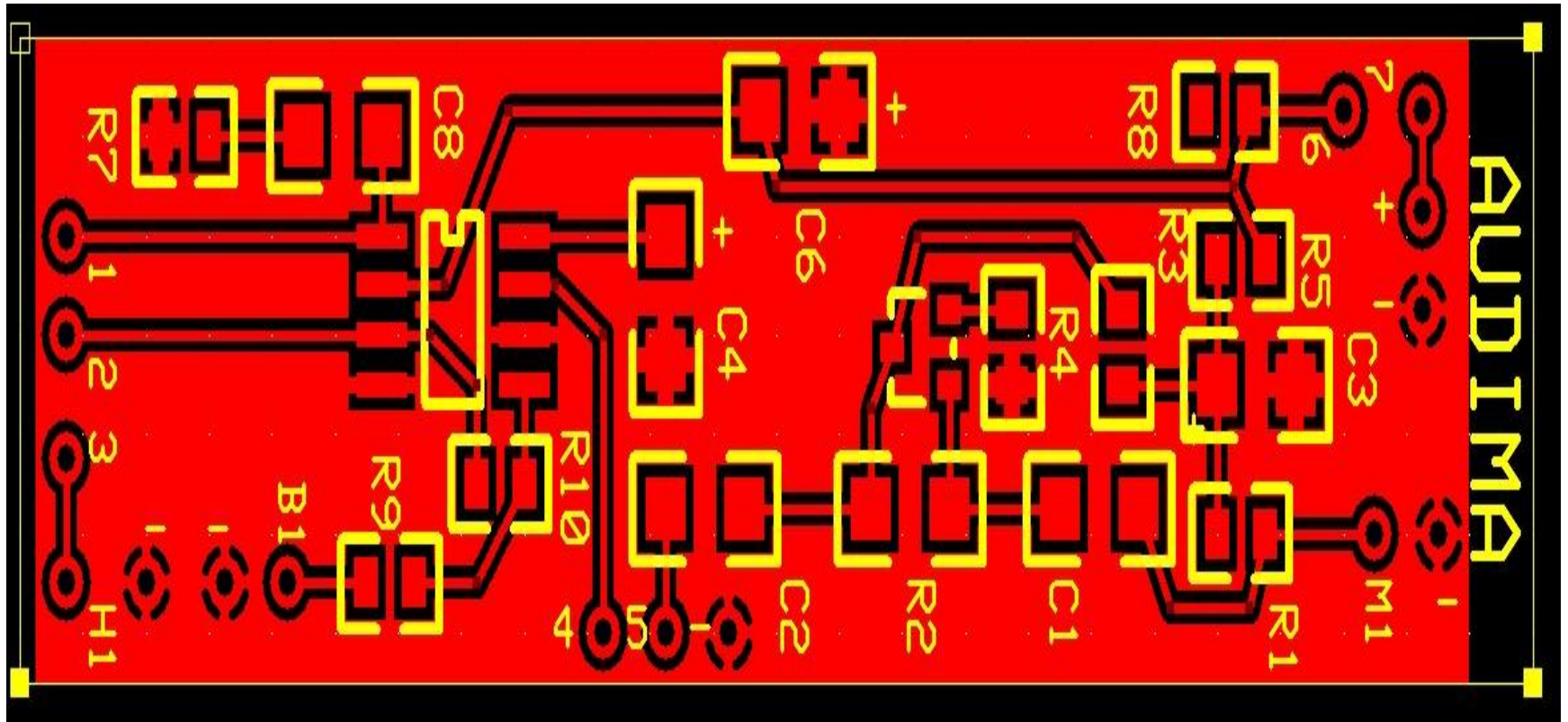
Block Diagram of Integration



Integration Schematic



Integrated PCB



Battery Life

- ▶ Hearing aid: 30 mA
- ▶ Bluetooth: 17 mA
- ▶ Fully charged battery: 300mAh
 $(300\text{mAh} / (30 + 17)\text{mA}) * 0.7 = 6.38$
hours
- ▶ Battery Life: 6.38 hours

Integration

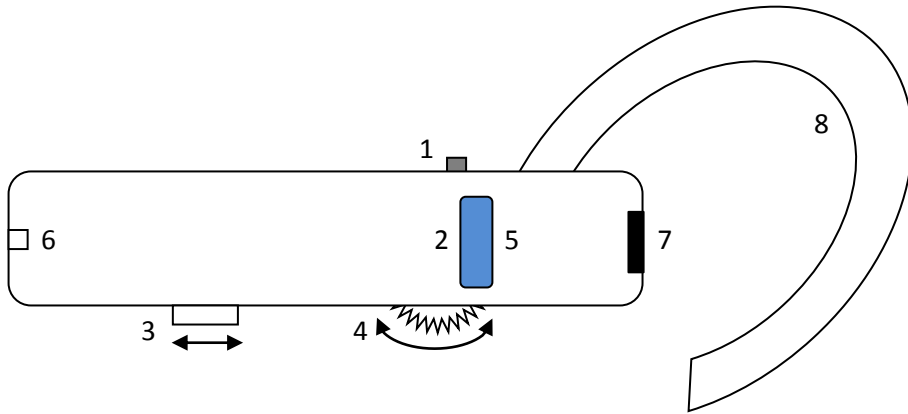


Presentation Overview

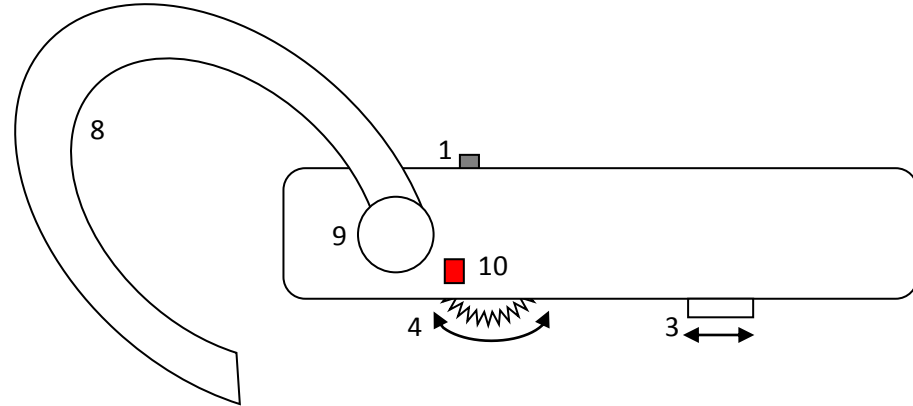
- ▶ Motivation
- ▶ System Overview
- ▶ Hearing Aid
- ▶ Bluetooth
- ▶ Integration
- ▶ *User Interface*
- ▶ Business Case
- ▶ Project Specifics
- ▶ What Was Learned
- ▶ Future Developments
- ▶ Acknowledgements & References

Diagram

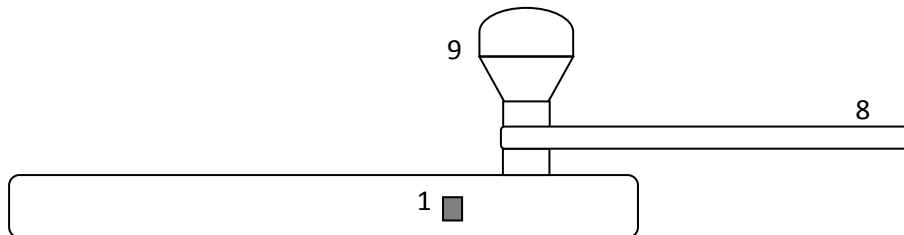
Front View:



Back View:



Top View:



Number	Function
1	Power Button for Hearing Aid
2	Power Button for Bluetooth
3	Hearing Aid/Bluetooth Switch
4	Volume Control for Hearing Aid
5	LED for Bluetooth
6	Microphone
7	Charging Port
8	Ear Hook
9	Speaker
10	LED for Hearing Aid

User Interface

Component	Desired Outcome	Action
Hearing Aid	Power On/Off Hearing Aid	Press 1
	Adjust Hearing Aid Volume	Turn 4
Bluetooth	Power On/Off Bluetooth	Press and hold 2 for two seconds
	Pair Device with Cellphone	Ensure headset is turned off Press and hold 2 for at least five seconds LED 5 should be solid blue Headset becomes discoverable with 10m Passcode is 0000 LED 5 flashes blue when successfully paired
	Answer a Call	Press 2
	End a Call	Press 2 (while in call)
	Reject a Call	Press and hold 2 for two seconds
General	Switch Speaker Output	Slide 3
	Recharge Battery	LED 5 flashes repeatedly: battery is low Plug charger into port 7 If LED 5 is solid blue, the headset is charging When LED turns off, the headset is fully charged

Presentation Overview

- ▶ Motivation
- ▶ System Overview
- ▶ Hearing Aid
- ▶ Bluetooth
- ▶ Integration
- ▶ User Interface
- ▶ **Business Case**
- ▶ Project Specifics
- ▶ What Was Learned
- ▶ Future Developments
- ▶ Acknowledgements & References

Business Case

	Number of Units	Sub-Total
PCB	2	\$120
Bluetooth Headset	3	\$50
Surface Mount	42	\$60
Soldering Tools	1	\$20
Breadboard Component		Free
	Total	\$250

Marketing

- ▶ Target Audience: People Hard of Hearing
- ▶ Pricing
 - MSRP: \$250
 - Retailer Price: \$200
 - Average Profit per Unit: \$50

Competition

	Audima HAB-1	Telecoil Wire	Oticon ConnectLine
Wires Required	No	Yes	Yes
Price	\$250	\$200	\$500
Size	6.0x1.0x1.0cm	3 metre cable	Multiple Large Devices
Weight	30g	10g	1 kg+
Range	10m	3m	10m
Drawbacks	No filter (analogue hearing aid)	Limited range	Cables still required
Comfort	Regular headset	Long wires	Device worn around neck External transceiver

Presentation Overview

- ▶ Motivation
- ▶ System Overview
- ▶ Hearing Aid
- ▶ Bluetooth
- ▶ Integration
- ▶ User Interface
- ▶ Business Case
- ▶ ***Project Specifics***
- ▶ What Was Learned
- ▶ Future Developments
- ▶ Acknowledgements & References

Budget

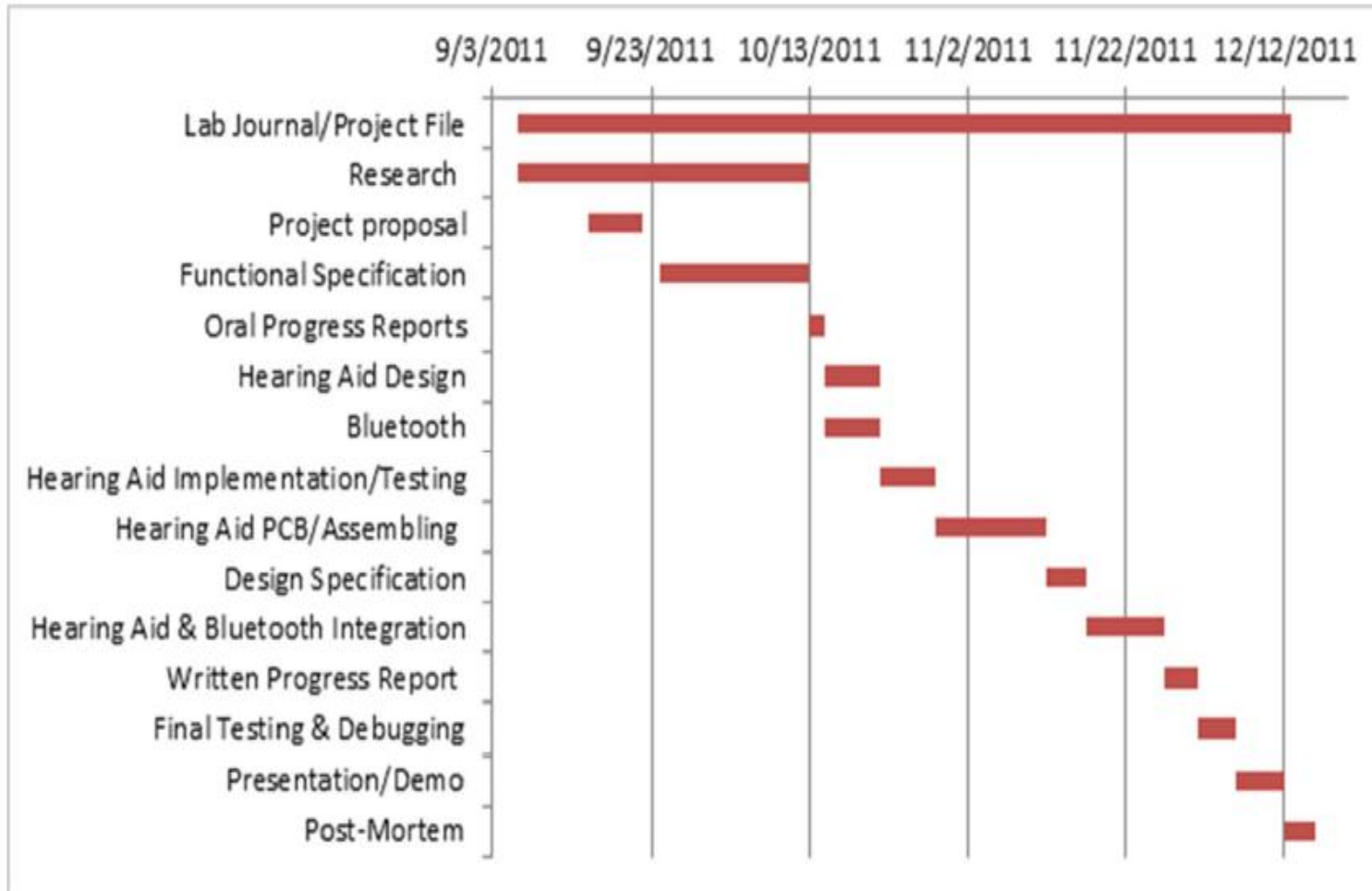
Parts	Cost
Audio Amp IC	\$5
Microphone	\$5
Earphone	\$5
R, C, wires, etc.	Free
Switch/Vol control	\$5
Testing Bluetooth	\$25
Demo Bluetooth	\$80
PCB	\$50
Total	\$175

Proposed Budget

Parts	Cost
PCB	\$120
3 Bluetooth	\$50
Surface Mount	\$60
Soldering Tools	\$20
Breadboard Comp	Free
Total	\$250

Actual Budget

Timeline



Timeline

Task Name	Start Date	Duration (days)	End Date
Lab Journal/Project File	9/6/2011	98	12/13/2011
Research	9/6/2011	37	10/13/2011
Project proposal	9/15/2011	7	9/22/2011
Functional Specification	9/24/2011	19	10/13/2011
Oral Progress Reports	10/13/2011	2	10/15/2011
Hearing Aid Design	10/15/2011	7	10/22/2011
Bluetooth	10/15/2011	7	10/22/2011
Hearing Aid Implementation/Testing	10/22/2011	7	10/29/2011
Hearing Aid PCB/Assembling	10/29/2011	14	11/12/2011
Design Specification	11/12/2011	5	11/17/2011
Hearing Aid & Bluetooth Integration	11/17/2011	10	11/27/2011
Written Progress Report	11/27/2011	4	12/1/2011
Final Testing & Debugging	12/1/2011	5	12/6/2011
Presentation/Demo	12/6/2011	6	12/12/2011
Post-Mortem	12/12/2011	4	12/16/2011

Presentation Overview

- ▶ Motivation
- ▶ System Overview
- ▶ Hearing Aid
- ▶ Bluetooth
- ▶ Integration
- ▶ User Interface
- ▶ Business Case
- ▶ Project Specifics
- ▶ *What Was Learned*
- ▶ Future Developments
- ▶ Acknowledgements & References

What Was Learned

- ▶ **Technical Aspects**
 - Build PCB assembly
 - Soldering techniques
 - Control feedback
 - Modify existing PCBAs
 - Debugging
- ▶ **Business Aspects**
 - Budgeting
 - Project management
 - Timeline management
 - Team Dynamics

Presentation Overview

- ▶ Motivation
- ▶ System Overview
- ▶ Hearing Aid
- ▶ Bluetooth
- ▶ Integration
- ▶ User Interface
- ▶ Business Case
- ▶ Project Specifics
- ▶ What Was Learned
- ▶ *Future Developments*
- ▶ Acknowledgements & References

Future Developments

- ▶ Conversion to digital hearing aid
- ▶ Decrease size and weight
- ▶ Improve speaker and microphone quality
- ▶ Improve filtering
- ▶ Improve design (more stylish)
- ▶ Increase range

Demo

Presentation Overview

- ▶ Motivation
- ▶ System Overview
- ▶ Hearing Aid
- ▶ Bluetooth
- ▶ Integration
- ▶ User Interface
- ▶ Business Case
- ▶ Project Specifics
- ▶ What Was Learned
- ▶ Future Developments
- ▶ *Acknowledgements & References*

Acknowledgements

- ▶ SFU Faculty of Engineering Science

Dr. Andrew Rawicz

Mike Sjoerdsma

Jamal Bahari

Ali Ostadfar

Moein Shayegannia

Fred Heep

- ▶ ESSEF(Funding)

References

- ▶ From Discovery Health (n.d). *Hearing Aid History*. Retrieved from <http://health.howstuffworks.com/medicine/modern/hearing-aid6.htm>
- ▶ From Deafness in Disguise (n.d). *Concealed Hearing Devices of the 19th Century*. Retrieved from <http://beckerexhibits.wustl.edu/did/19thcent/index.htm>
- ▶ From How Hearing Aids Work (n.d). *How Hearing Aids Work*. Retrieved from <http://www.hearingaids101.com/how-hearing-aids-work.aspx>
- ▶ From eHow (n.d). *How Does a Jawbone Bluetooth Headset Work?* Retrieved from http://www.ehow.com/how-does_4673191_jawbone-bluetooth-headset-work.html

References

- ▶ From Hearing Aids 101 (n.d). *Digital Hearing Aids vs. Analog Hearing Aids. Retrieved from*
http://www.hearingaids101.com/digital_vs_analog.aspx
- ▶ From Healthy Hearing (n.d). *Hearing Aids Reviews: Oticon ConnectLine with Bluetooth. Retrieved from*
<http://www.healthyhearing.com/content/articles/Accessories/Equipment/47643-Hearings-aids-with-bluetooth>

Questions?