NTID Notification System: MORPHEUS

P11201

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Customer: Gary Behm

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(Left to Right)

Mission Statement:

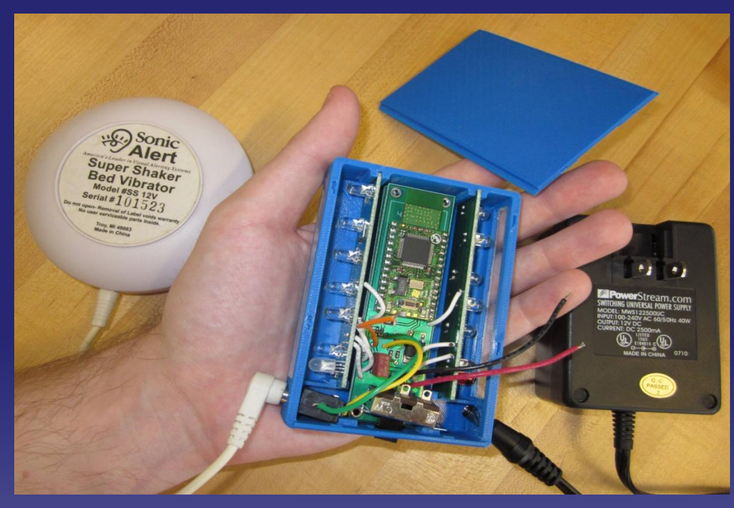
The mission of this project is to advance assistive technologies for the deaf and hard of hearing community by developing a device, controlled via smartphone technology, which will notify with an intense light source and/or bed shaker device through the utilization of Bluetooth technology.

Motivation:

Missing vital information negatively affects quality of life for deaf and hard of hearing people, as it restricts their independence and self-reliability. Most homes and hotel alert systems are audible thus neither convenient nor practical for deaf or hard of hearing persons.

Background:

Currently products exist on the market that include non-audible functions but are cumbersome for travel or may require permanent installation. One benchmark product, the Sonic Boom™ alarm clock requires three large components and is better suited for home usage rather than travel. A lightweight, inexpensive and portable alternative is needed.

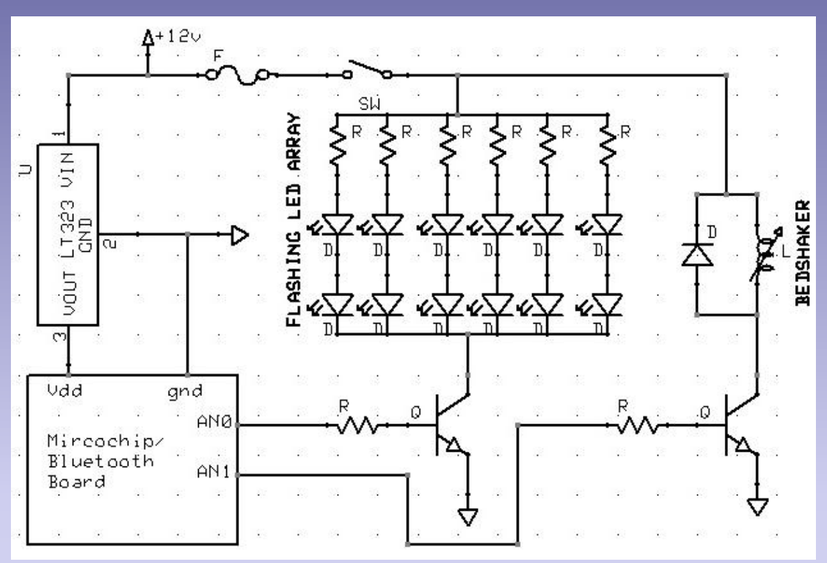


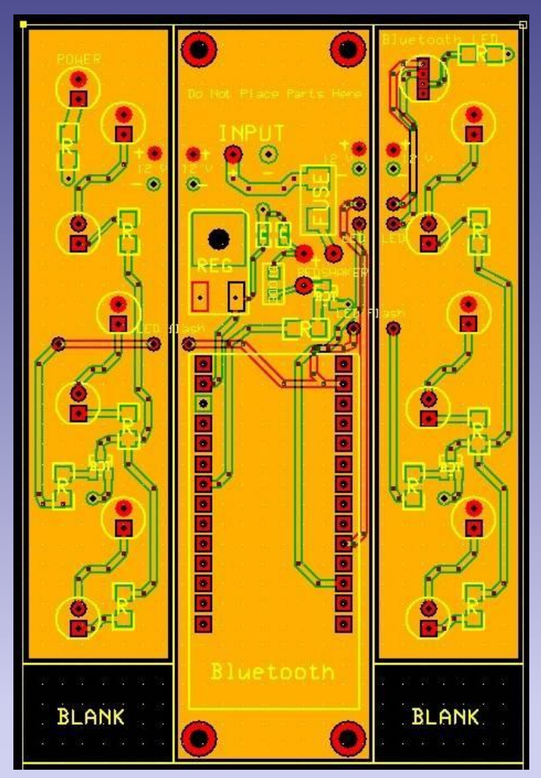
Needs:

Customer Need #	Importance	Description
CN1	2	Lightweight
CN2	1	Small (compact) size for travel/easy to carry
CN3	1	Indicate power is on the entire time power is received
CN4	1	Indicate the alarm is set until the alarm is triggered
CN5	1	Indicate that it is communicating with Bluetooth technology
CN6	1	Activates a bed shaker and/or light
CN7	1	Light must flash not just turn on
CN8	3	Different flashing patterns for the light source
CN9	3	Different shaking intensities for different level sleepers
CN10	2	Quality product
CN14	2	Keep the product inexpensive (20-30$)
CN16	1	Alarm must activate even if interface is no longer communicating
CN17	3	Attractive shell/external design
CN18	2	Long Lifetime (roughly 10 years)
CN19	2	User-friendly
CN20	3	Output will deactivate after a reasonable amount of time
CN21	2	PDA will be able to communicate with device within a given range
CN22	1	Be able to terminate alarm
CN23	2	Switch to turn off alarm manually

Detailed Design:

Circuit



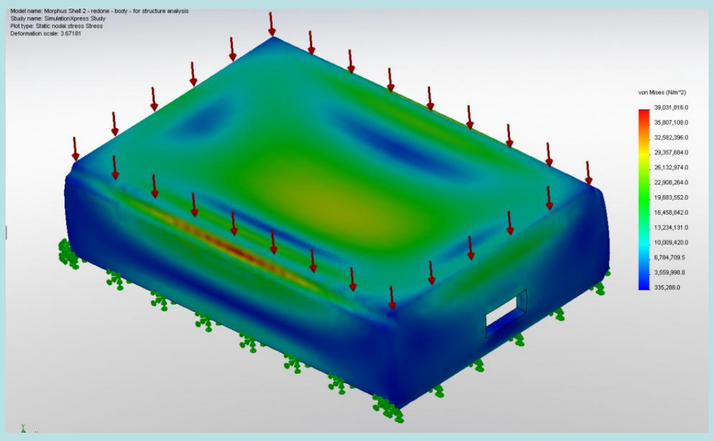


Analysis/Testing/Validation:

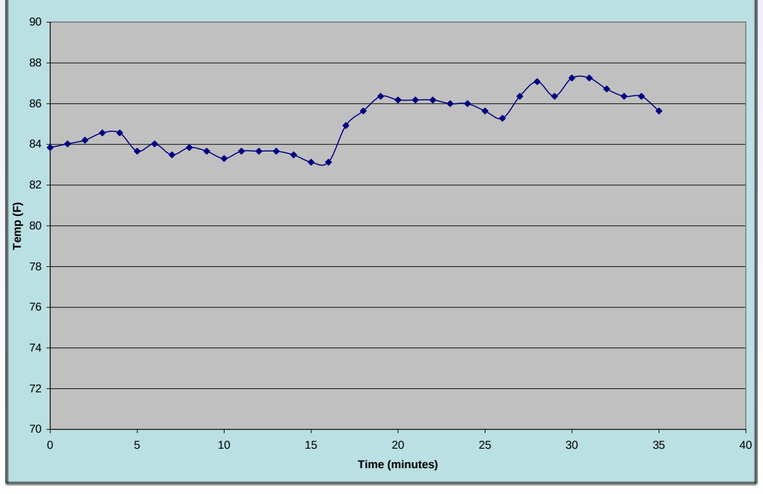
Structural Analysis

Material: ABS Plastic
Flexural Strength = 53 MPa

σ_{max} = 39.03 MPa
σ_{center} = 27 Mpa
δ = 2.76 mm



Surface Temperature over Time

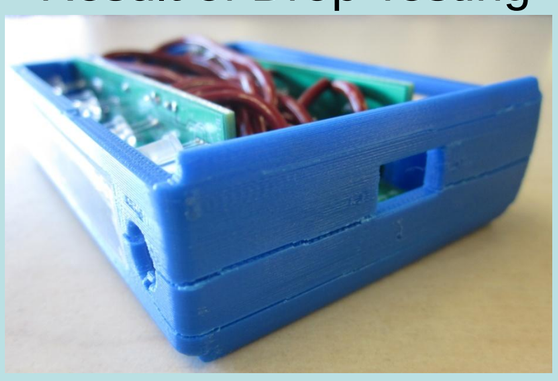


Future Work:

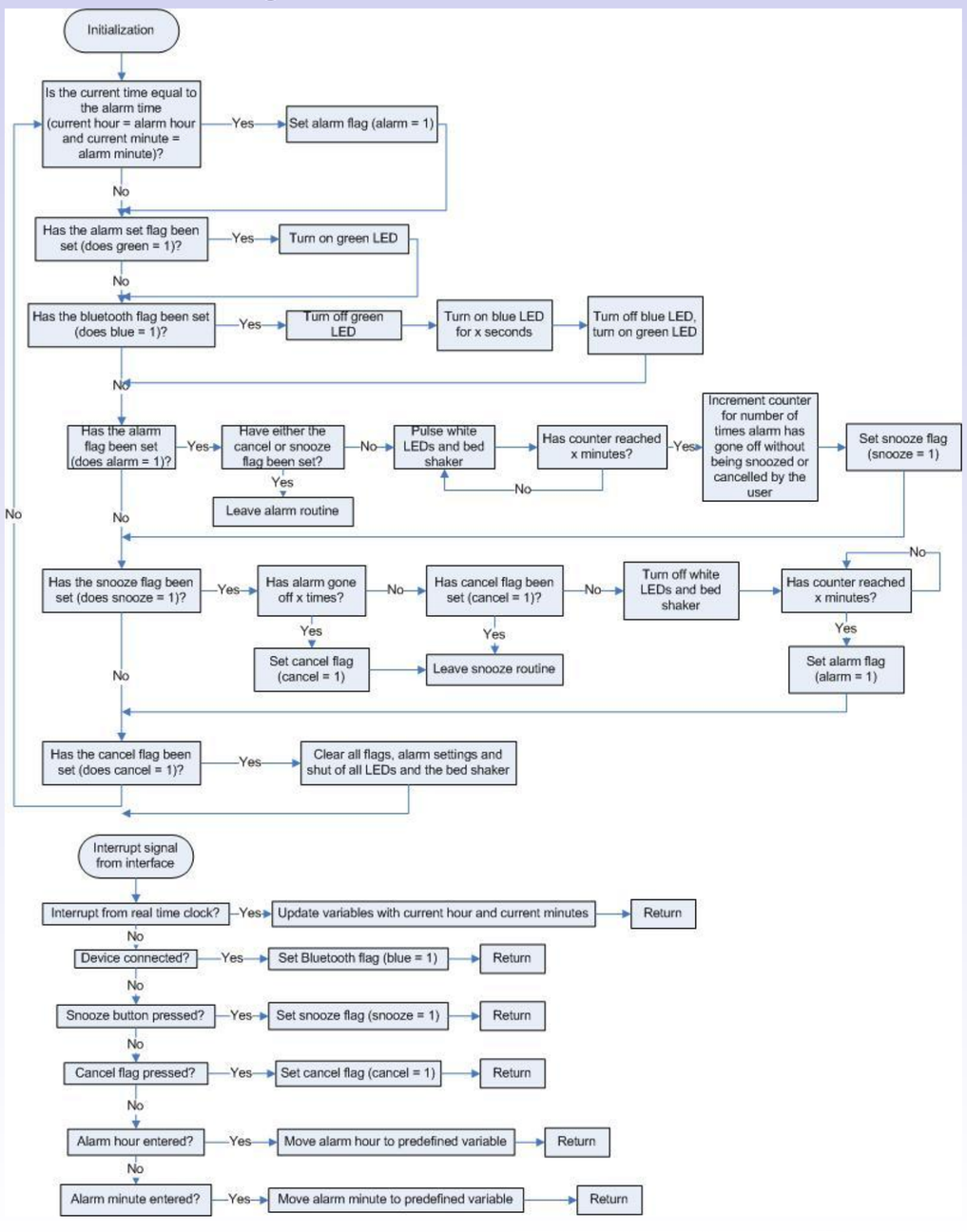
- Minimization of external power supply
- Bluetooth Application for smartphone
- Reverse engineering of Microchip
- Standalone Bluetooth chip
- Injection Molding of Thermoforming for mass production

Compression Testing

Result of Drop Testing



Software Algorithm



Results/Conclusions:

Engr. Spec. #	Specification (description)	Unit of Measure	Marginal Value	Ideal Value	Results	Pass/Waived
ES1	Weight	Pounds	< 267 g	< 133.5 g	100 g	Pass
ES2	Size	in^3	< 22 in^3	< 11 in^3	11.00 in^3	Pass
ES3	Indication System	binary	n/a	n/a	yes	Pass
ES4	Activation System (Light source, and Bed Shaker)	binary	n/a	n/a	yes	Pass
ES5	Variable flashing frequencies	frequency	2 settings	3 settings	no	Waived
ES6	Variable shaking frequencies	frequency	2 settings	3 settings	no	Waived
ES9	Low Cost	Unit Manufacturing Cost (US dollars) per 500 units	$40	$20	$152.62	Wavied
ES10	Alarm Activation (self-sustaining clock)	accuracy	± 5 minutes actual time	± 1 minute actual time	± 1 second	Pass
ES12	Drop Standard	G's	272 G's	300 G's	365 G's	Pass
ES13	Vibration Standards	Hz	100 Hz	150 Hz	200 Hz	Pass
ES14	Housing Material Selection	lbs force	200 lbs	300 lbs	341 lbs	Pass
ES16	Signal Testing	meters	10 m	20 m	100 m	Pass
ES17	Manufacturability	hours to assemble	5 hrs	2 hrs	3 hrs	Pass
ES18	Distance that Bluetooth works	meters	50 m	100 m	100 m	Pass
ES19	% reliability	#of successful trials/ #of trials	90/100	100/100	30/30	Pass
ES20	Alarm is able to self-deactivate and self-reactivate	binary	n/a	n/a	yes	Pass
ES21	Deactivation system	seconds	5 sec	2 sec	0.6 sec	Pass
ES22	Device temperature	Fahrenheit	100 F	90 F	87.26 F	Pass

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