Travis Libsack's
2020 Portfolio

BaxterOSV – Electronics | 2020

Final Report

Travis Libsack

Objectives

Given the risk COVID-19 poses to under-developed countries, especially the lack of medical equipment and infrastructure needed for ventilators, the Baxter Open Source Ventilator (BaxterOSV) was designed to work in under-developed countries with limited access to medical supply chains

BaxterOSV utilizes **off-the-shelf** components and design that **creates its own pressure** to ventilate patients and does not need expensive hospital infrastructure

BaxterOSV also performed **more consistently** between breaths when compared to industry products

Proof of Concept

BaxterOSV went through **3 iterations** before completing a design that was fully functional

At each stage the ventilator was tested by a ventilator technician to confirm it's performance and test the user experience

V2 of BaxterOSV being tested on a test dummy

Approach

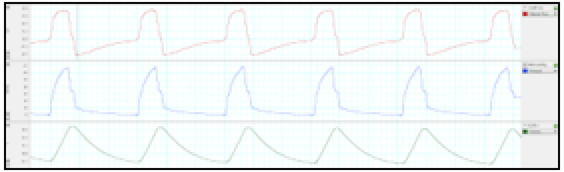
The key design features of our ventilator were:

- **Safety** – using an Open Source Ventilator you need to be confident in safety. The worst failure in our ventilator is one additional breath
- **Manufacturing Speed** – in a crisis time is of the essence. By using "satellite manufacturing" we were able to shift manufacturing to end users to ramp up production in high-need areas much faster
- **Versatile Construction** – using off-the-shelf components means that parts can easily be replaced in other countries if they break or are not available/compatible. For example, our back-pressure regulator was replaced with SCUBA regulator on v2 when the US supply chain was low on regulators

Results

The BaxterOSV was chosen as one of the **Top 7** finalists in the CoVent-19 Challenge

Our final design was able to reliably perform at a range of different settings. It is ready for further testing and manufacturing if needed



Ventilation graph, created with BaxterOSV

V3 of BaxterOSV

Aquadio – Mechanical Design | 2018

Senior Thesis, MIT B.E Mech

Travis Libsack

Objectives

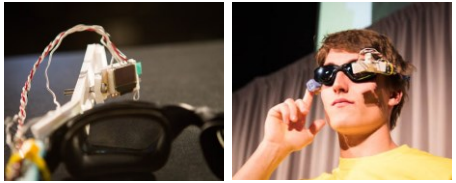
- **Design a product** by conducting market research, interviews, and trials
- **Coordinate** and with a team of 10 engineers across disciplines
- **Complete** mechanical **design thesis** for MIT MechE

Aquadio was organized like a **start-up**. We started with an idea following a product development process and honed our electrical, mechanical, software, and integration skills as a team to produce a final product.

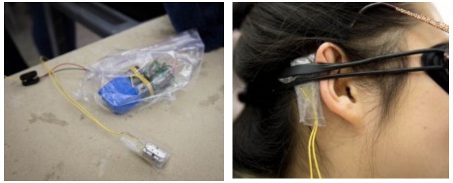
It is **designed to help competitive swim teams** train smarter by providing real time information and feedback to coaches and swimmers.

Proof of Concept

First prototype/mock-up uses a **lens and projector** to display feedback to the user

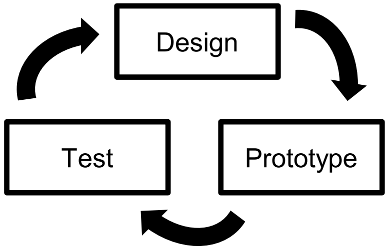


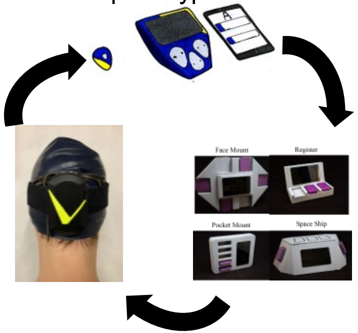
Second prototype/mock-up uses a **bone conducting speaker** to transmit commands to the user



Approach

- We used the **design cycle** to refine out design across 3 prototypes
- Conducted **user interviews and tests** to refine prototypes





Results

Final product integrated across all disciplines and tested in the pool
Completed **design thesis** and **received an offer to continue research**

Coordinate – Mechanical Design | 2017

Coordinate Brochure

Travis Libsack

Objectives

Coordinate was designed to **help search and rescue (SAR) teams** coordinate resources

Designed **to increase the efficiency** of early search coverage, helping with over 50,000+ SAR missions that happen in the US each year

Example a SAR team

Using a combination of **GPS** and **radio** it allows SAR teams coordinate across geographies

Proof of Concept

As the mechanical lead I focused on the **usability** and **design** for search and rescue teams

Our device needed to be **rugged**, **simple to use,** and **work with the gear used by SAR teams**

Early drawing, Credit: L Gulland

Table of design iterations and parts

Approach

As one of **18** undergraduates we worked together on this project in three main teams: **mechanical, software,** and **electrical**

The mechanical team's focus was to develop a robust mechanical design for use outdoors. It involved and **IP67 seal**, **large pushbuttons**, and a simple **UX** for easy use in the field

Coordinate – use in the field

2.009 Yellow Team – Fall 2017

Results

The project concluded with final products we were able to demo to SAR members. Final products photos are below:

Carrying Case

Entire system

"Scout" unit

ClamClock – Electronics & Design | 2016

www.clamclock.com

Travis Libsack

Objectives

Design and manufacture an electronics kit to teach middle schoolers how to solder & program

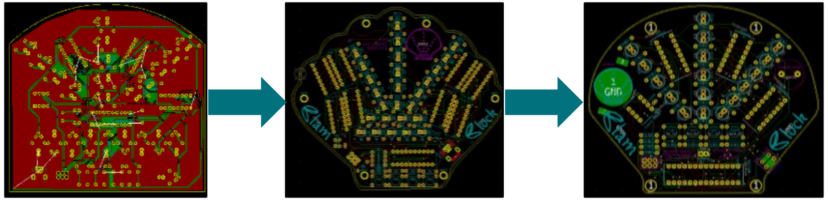
Complete a **fully funded** Kickstarter campaign through successful marketing

Specifications
- Hand solderable with through-hole components to teach soldering
- Compatible with Arduino to teach programming to kids
- Design instructions and kit for that was understandable enough to ship around to world to funders

Proof of Concept

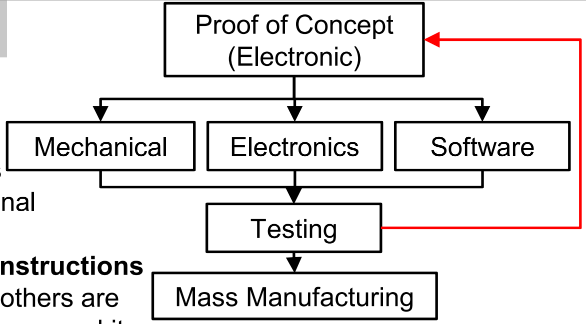
Meticulously **designed** and **tested** each version PCB, improving it each time

Collaborated with the programming and mechanical team to design the clock with the correct physical dimensions and system architecture



Approach

- Split into 3 teams after working on the proof of concept
- Iterated testing **3 times** until we arrived at the final product
- Completed **assembly instructions** in the testing phase so others are able to re-produce and use our kits



Instructables:
- https://www.instructables.com/id/ClamClock-a-Binary-Timekeeper/

Results

Fully **funded** Kickstarter, reaching 51 people and $3,108 in funding
- https://www.kickstarter.com/projects/1773610279/clamclock-a-diy-binary-timekeeper

Completely **marketed** product including photos and promotional video

East Campus Fort – Construction | 2017

Travis Libsack

Objectives

Design and **build** a “fort” to host activities on and show off my living community at MIT

Complete construction in **3 days after ground-break**, a record construction time

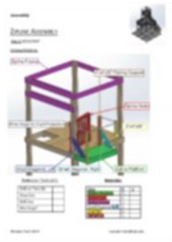
Develop a **design booklet** to guide best practices for a construction project

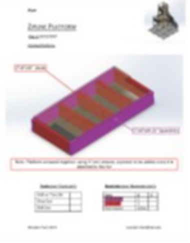
EAST CAMPUS

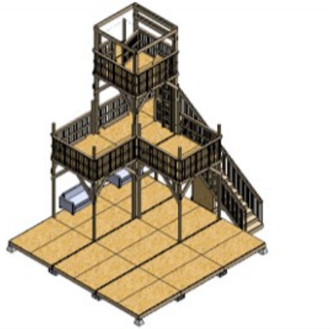
Proof of Concept

Used SolidWorks to **model** the structure and **stresses** of key supports

Design was **reviewed and approved** by MIT’s in-house architects (example drawings below)



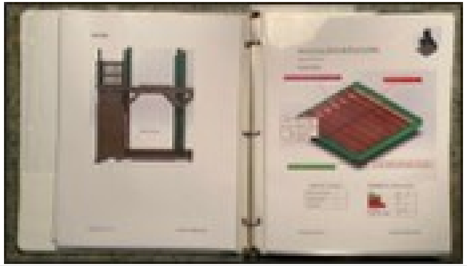




Approach

Worked with a team of **three** others to design the fort and **10+** others to build it

Used the design booklet to align the close team (3 members) and to guide the 10 others who helped construct it



Results

Completed construction in 3 days with the team, breaking the record

Successfully developed and used the instruction booklet

Passed on best practice of using construction book for future projects

Luminate – Electronics | 2017

Travis Libsack

Objectives

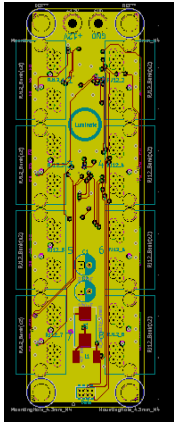
Design a surface mount PCB to control lighting strips in my dorm room and practice my PCB design skills

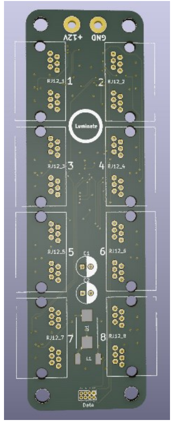
Create an **interface** to control the lighting strips easily from my laptop. Map different colors, patterns, and brightness for different programs & settings

Proof of Concept

KiCAD PCB software used to design both boards used in the project

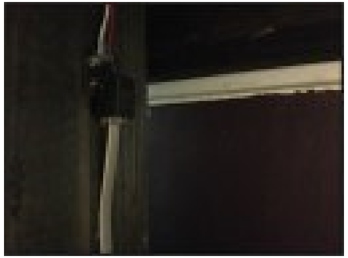
A **Raspberry Pi** (RPi) was used as the centralized controller for the system which allowed me to control settings from my laptop





Approach

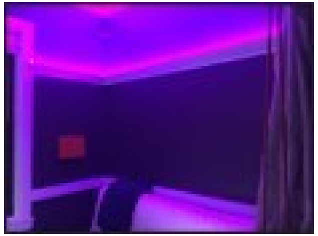
I made adding light strips as **easy as possible** by using phone connectors to connect the lights to the centralized boards. This also meant the system was modular and the cables could be physically disconnected from the LEDs

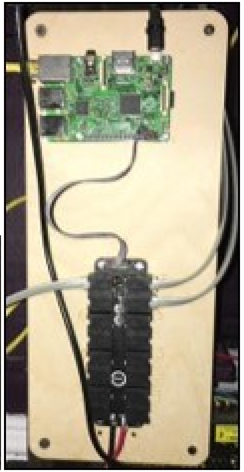


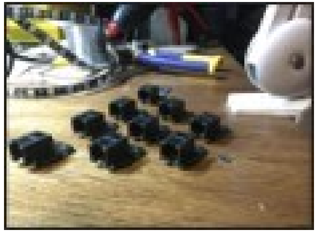
Example of satellite connects used in different parts of my room

Results

Final boards integrated and used in my room, controlled off a centralized RPi







MASLAB – Robotics | 2015

Travis Libsack

Objectives

Mobile **A**utonomous **S**ystems **L**a**B**oratory (MASLAB) is a robotics class offered during MIT's winter intersession (IAP)

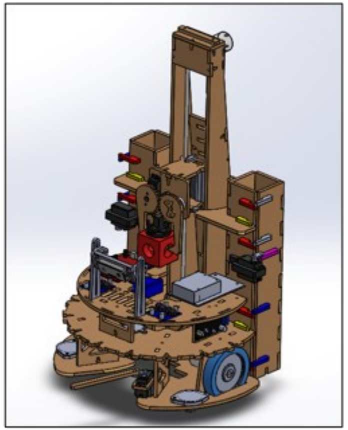
It is a month-long event the culminates in single-elimination competition of 10 teams where robots face off autonomously head to head

As the **mechanical lead** of my 5-member team my job was to design the mechanical systems on the robot

Proof of Concept

The robot was designed in SolidWorks and included all parts of the design, including electrical components and parts for the wiring harness

The design used **rapid prototyping** materials and equipment including laser cutting and 3D printing



Approach

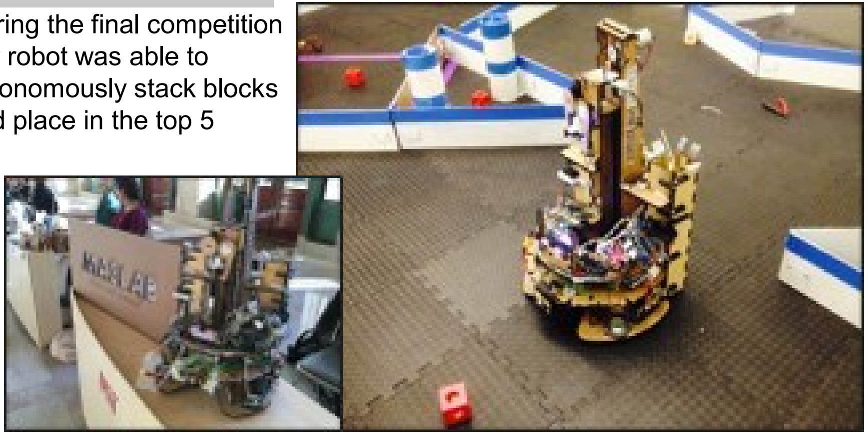
The mechanical design of the robot was complete **early** in the competition in order to allow time for software testing of the computer vision (CV) autonomous aspects of the robot

After the first version, we continued to iterate on the mechanical design as potential improvements became clear rom testing. These included:

- **Collecting mechanism** – use a funnel to more effectively capture blocks
- **Centering mechanism** – use a cone to center in a circular hole for better accuracy

Results

During the final competition our robot was able to autonomously stack blocks and place in the top 5



RoboGoby V2 – Robotics | 2014 - 2015 https://robogoby.blogspot.com **Travis Libsack**

Objectives

Project RoboGoby is a robotics project started to create an inexpensive submersible for local researchers, dam builders, and shipyards

It was a project started in 2013. In 2015, along with two of my friends, we upgraded our first design to be more user-friendly and robust

This project was intended create a 5 degree of freedom submersible capable of live video streaming for damn inspections and autonomous monitoring of fisheries

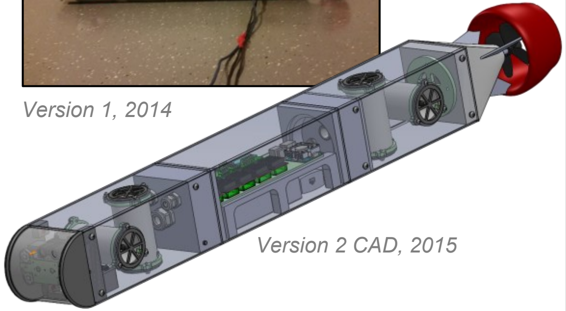
Project RoboGoby Logo

Proof of Concept

The design went through numerous iterations using CAD to design and then building out the concept

Pictured on the left is V1 of the submersible along with V2 CAD from 2015

Version 1, 2014



Version 2 CAD, 2015

Approach

In order to gain funding and understand of the market for our submersible we spent time talking with local professionals who might use our product and applying for local and state grants

Institutions we talked with regarding our design were: *Bigelow Labs*, and *The Gulf of Maine Research Institute*

We also were apart of a few funding grants & challenges including: *Princeton's TigerLaunch*, *Maine Technology Initiative's (MTI) SEED Grant*, and *UMaine's Business Challenge*

Results

Video of final design: https://www.youtube.com/watch?v=cow2FCg7Kqk

Our final design was able to complete all the maneuvers outlined in the design phase of the robot