



**Funetic Board**  
**Initial Project and Group Identification Document**  
**Group 20**

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## **Motivation:**

Speaking is a tool that is easily taken for granted. Having a child that cannot communicate effectively can be alarming and frustrating. Many children, often labeled as “non-verbal” have so many things they would like to say but they are unable to. Others have an easier time attempting speech, but struggle with specific sounds and enunciation. The Funetic Board concept arose when thinking of a solution to help children with both non-verbal communication and articulation disorders. After delving deeper into the concept, its reach can be expanded to a much more diverse audience, from young children just starting out in sounds to ESL (English as a Second Language) learners needing to hone in on their pronunciation.

Another motivation for Funetic Board is its visual and audio aspects. It will be a fun and interactive experience for adults and children alike. There will be many different colored LEDs and fun sounds to give the overall project a fun and welcoming aesthetic. Adding visual components to sounds is a compelling way to make children feel like they are having fun while learning.

## **Goals and Objectives:**

The main goal of this project is to provide children with many different speech disorders a fun and interactive way of communicating. Funetic Board needs to be easy to use and accurate. Ease of use is particularly important because having a hard time interacting with the device is detrimental to the child having a fun learning experience. Accuracy is another goal, users such as ESL learners need to hone in on very specific sounds without mispronunciation.

## **Project Description:**

The term Alternative and Augmentative Communication (AAC) encompasses the different communication methods used to supplement or replace speech. It describes any means of communication that is not traditional speech, such as speech output devices, gestures, sign language, and visual aids. Many studies have been conducted about Autism and AAC showing that using AAC with children helps them learn to speak. Right now, AAC available comprises of sign language, pictures, and visual boards. Funetic Board is a new and innovative AAC that approaches communication tools in a new way.

Funetic Board will be a CNC machined wood board with a row of aligned sockets. These sockets are placeholders for acrylic spheres to be inserted into. Each acrylic sphere will have a built in RFID module that links that specific ball to a specific phonetic sound. When a sphere is placed into any of the sockets, a colored LED will flash and the sound associated with that sphere will be outputted to a nearby speaker. A programmed timer will move from left to right and the user will hear each sound associated with the spheres in the order they are placed. The Arduino will be used as the central device that will connect all components together. The Arduino will control the LEDs, output sounds, and RFID devices. The RFID's will be interfaced with the Arduino such that when a ball is placed the unique RFID tag will be sent to the Arduino to identify which sound is being placed. A team designed PCB will be used to power the entire device.

Example: The user will look through different index cards with different words, the IPA phonetic spelling of that word will be on the card along with a picture of the object representing the word. This is how the board will look after executing the word “apple”.

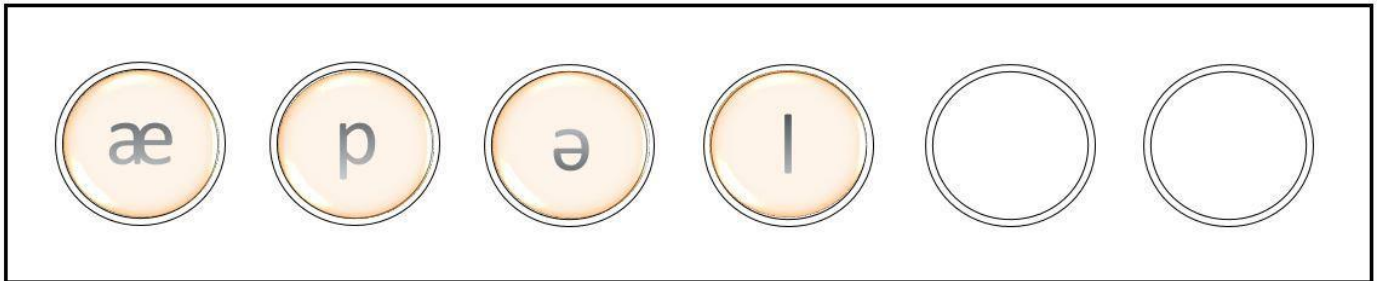


Figure 1

## Requirement specifications:

- **Functionality**
  - The board should be able to distinguish between the 26 English alphabet letters
  - Produce audio at a reasonable volume
  - Correctly pronounce real completed English words
  - Begins to speak the presented word at the push of a button
  - Low power requirement
  - Ability to run on batteries
  - Maximum power usage 10 watts
  - One charge last at least 2 hours
- **Display**
  - Cue cards to display spelling
  - Clear white balls with letters displayed outside and possibly illuminated by LED lights
  - White sturdy board that contains scanners and LEDs
- **Design**
  - Use of Arduino micro controller
  - Durable material to withstand heavy usage
  - Use of RFID chips assigned to letters of alphabet
  - Our board should be kept light weight as it is geared towards kids
  - 16 inches by 14 inches by 8 inches

## House of Quality

When starting a new project, a house of quality is designed to show the tradeoffs between marketing and engineering requirements. This is useful so requirements and concepts can be identified early on in the planning and design phase. The house of quality is displayed in figure 2.

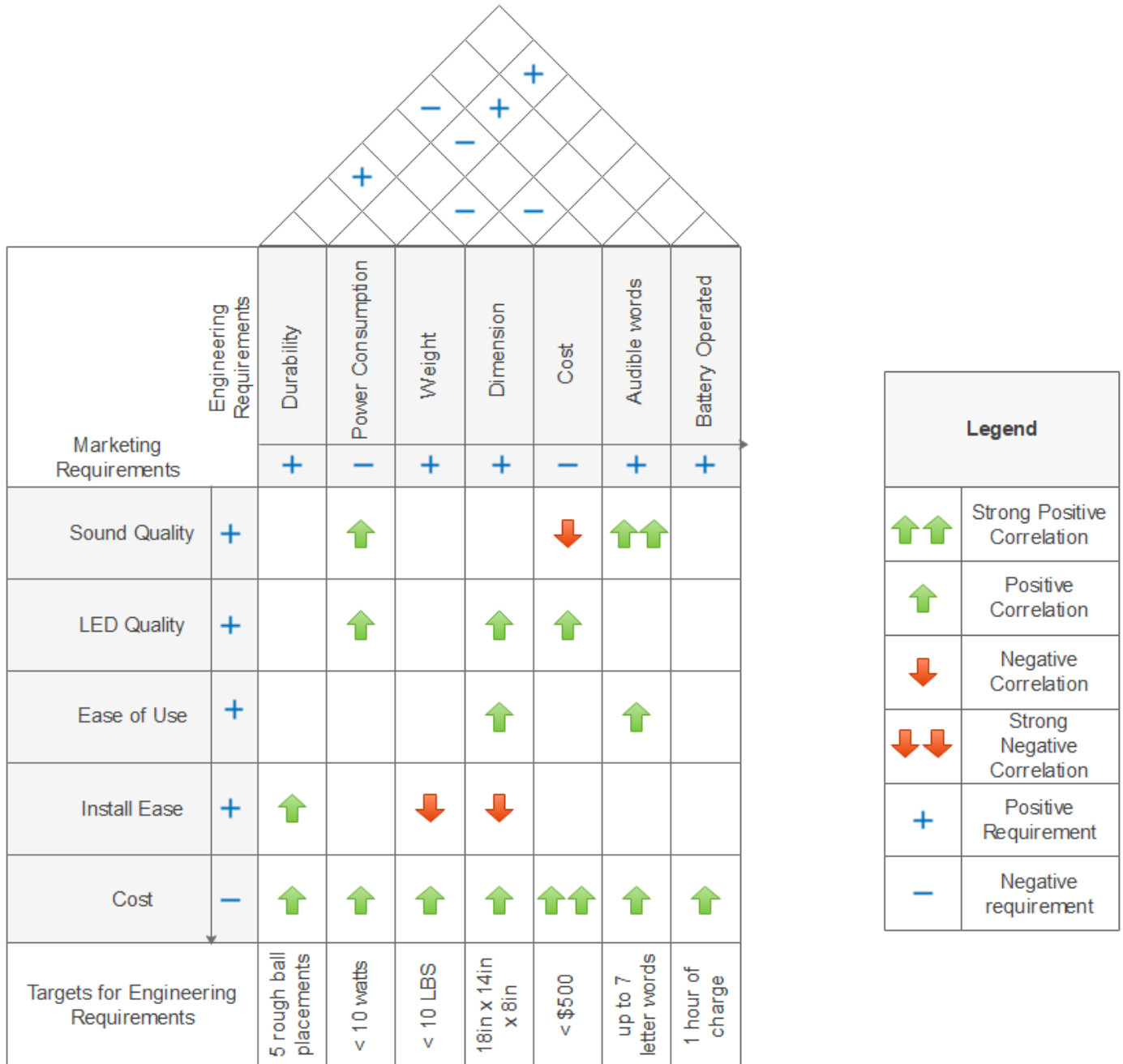
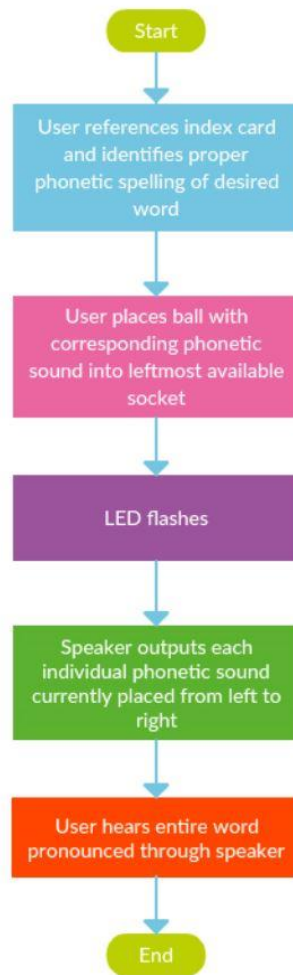


Figure 2

## Overall Project Block Diagram



## Conceptual Model

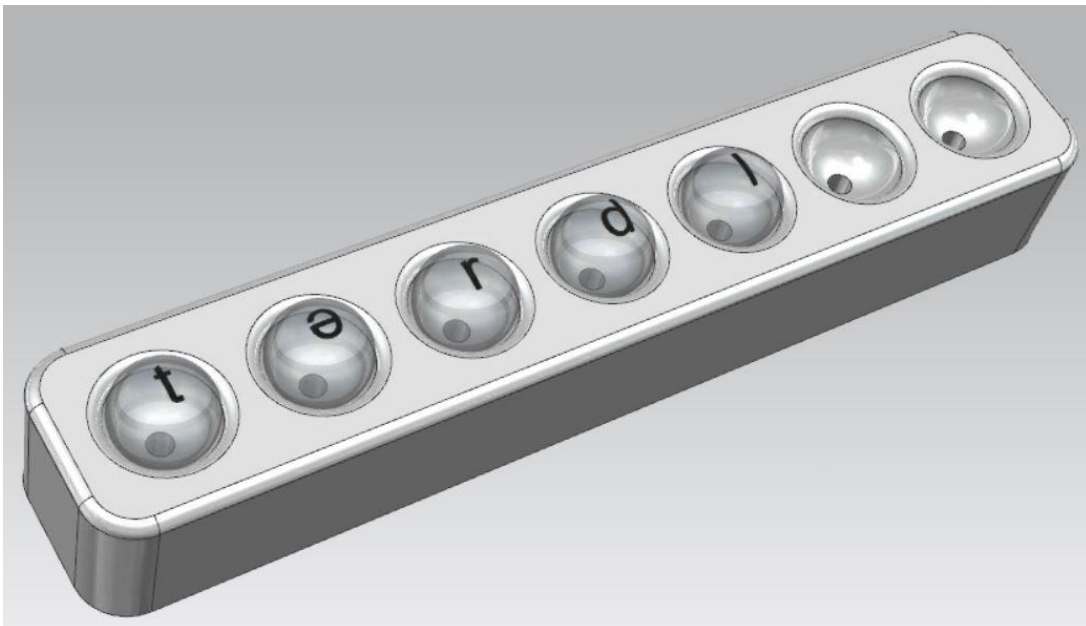
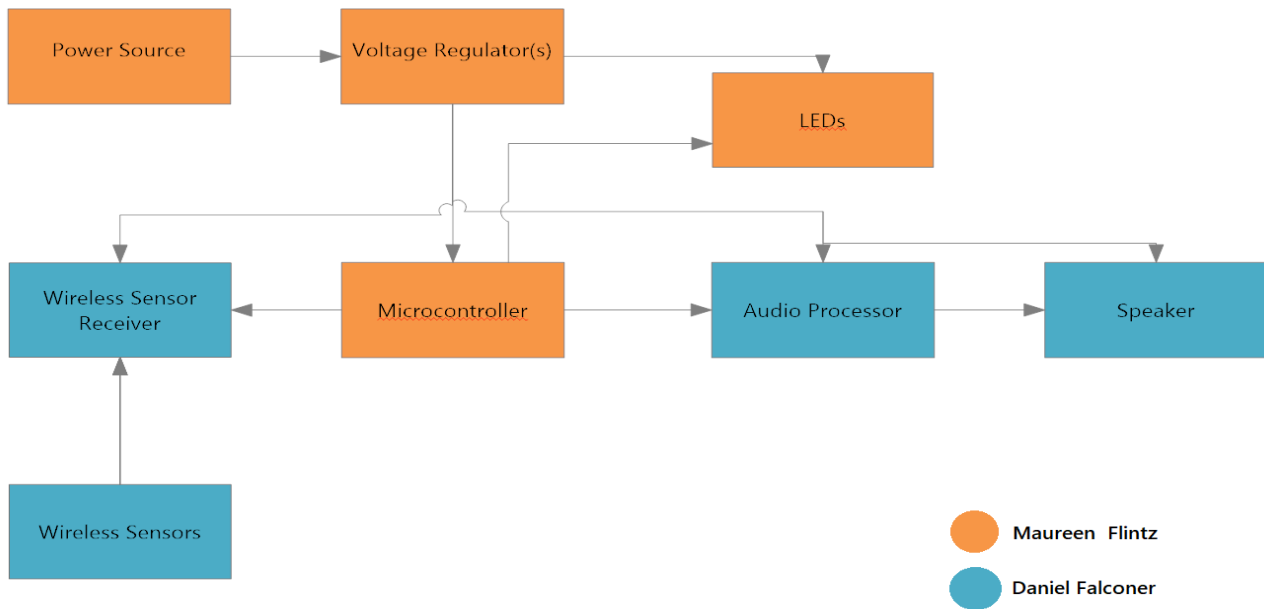
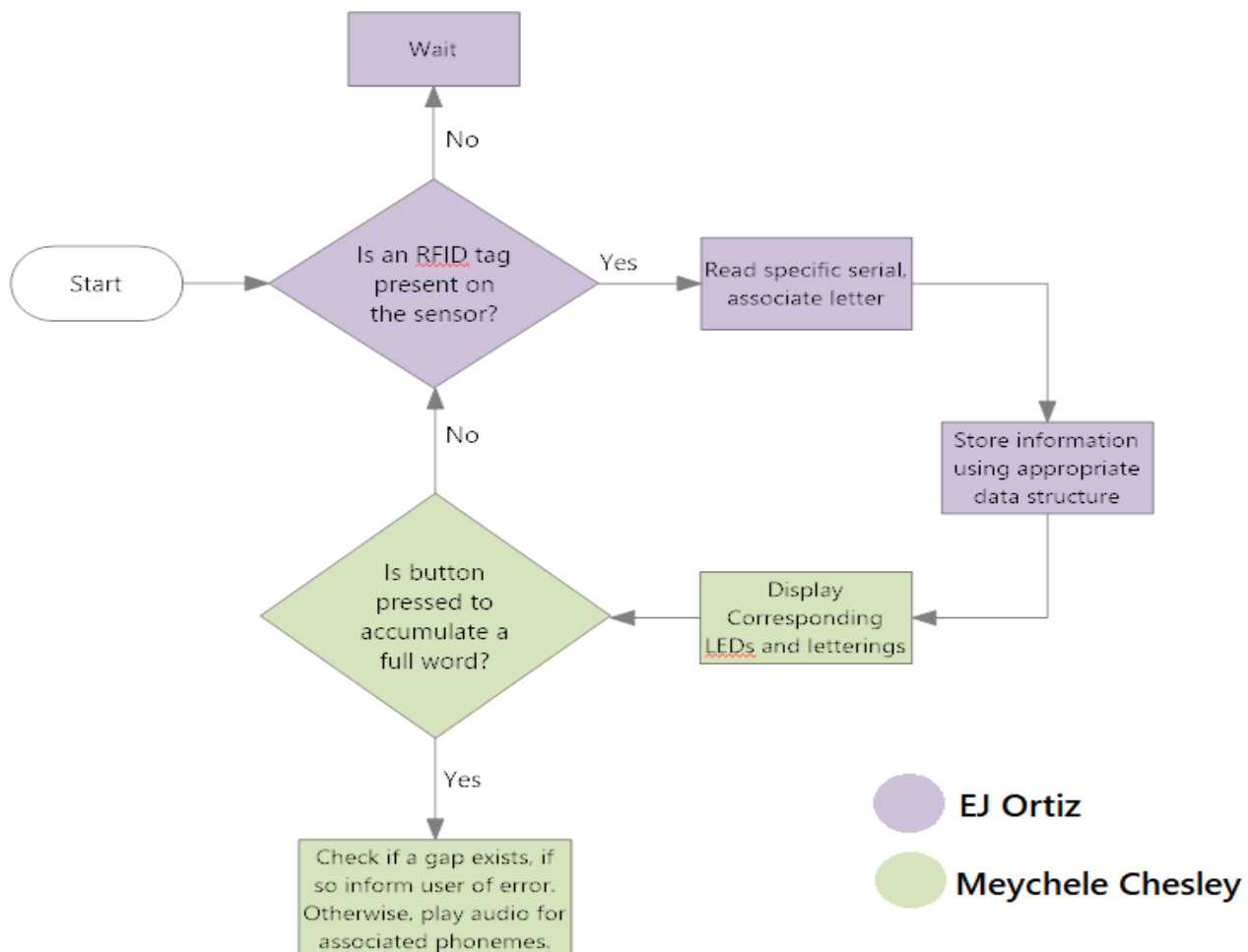


Figure 3 phonetic spelling of the word “turtle”.

## Hardware Block Diagram



## Software Block Diagram



## Project Budget and Financing

Table 1. List of items and cost of the items

<b>Item</b>	<b>Part Number/ Vendor</b>	<b>Quantity</b>	<b>Cost</b>
Arduino	TBA	1	\$50
Wood Board	TBA	1	\$50
CNC Machining	TBA	1	\$150
RFID system	TBA	1	\$50
PCB manufacturing	TBA	1	\$150
Wires and components	TBA	1	\$50
Acrylic Balls	TBA	20	\$50
LEDs	TBA	10	\$10
Speaker	TBA	1	\$20
Structure materials	TBA	1	\$100
Equipment	TBA	Solder, tools, etc	\$0
Documentation printing	TBA	1	\$50
		<b>Total</b>	<b>\$730</b>

## Project Milestones

Listed in Table 2 and Table 3 are the Milestones with their tentative due dates. These dates are crucial to follow to meet expectations in a reasonable time period. Table 2 is the description of the goals with start and end date for Senior Design 1 which ends the first week of December. Table 3 is for Senior Design 2. Senior Design 2 starts in January and ends in May. The goals for SD1 and SD2 are significantly different since in SD1 the idea is to research plan and prepare for SD2 where then we put the research to test and implement the design to get a working prototype.

Table 2. Timeline for task that need to be completed in Senior Design 1.

Description	Status	Start Date	End date
Brainstorming ideas	Completed	08/21/2017	08/31/2017
Project selection	Completed	08/31/2017	08/31/2017
Initial research	Completed	08/31/2017	09/08/2017
Choosing Microcontroller	Completed	08/31/2017	09/08/2017
Dividing tasks	Completed	09/06/2017	09/06/2017
Divide and conquer	Completed	08/31/2017	09/21/2017
Table of contents	Completed	09/21/2017	09/27/2017
Update divide and conquer	Completed	09/27/2017	10/06/2017
Power supply	Researching	9/20/2017	11/01/2017
PCB design	Researching	9/20/2017	11/01/2017
60 page paper	In progress	09/21/2017	11/03/2017
100 paper paper	In progress	09/21/2017	11/17/2017
120 page final paper	In progress	09/21/2017	12/04/2017
Order Parts and Materials	Researching	09/21/2017	12/04/2017

Table 3 Timeline for task that need to be completed in Senior Design 2

Description	status	Start date	End date
Build prototype	Not started	TBD	TBD
Program prototype	Not started	TBD	TBD
Test prototype	Not started	TBD	TBD
Finalize prototype	Not started	TBD	TBD
Peer presentation	Not started	TBD	TBD
Final paper	Not started	TBD	TBD
Final presentation	Not started	TBD	TBD



## Decision Matrix

