# Design Document

## Team: Blind Vision

## Project: STARS Visually Impaired

Date: December 4th, 2015

# 1 Table of Contents

# 2 Revision History

| Date | Author | Revisions Made |
|---|---|---|
| 4/27/2014 | Entire Team from Spring 2014 | 4.5 Overall Project Timeline<br>5.5 Specification Development<br>6.1 Team members<br>6.2 Current Status and Location on Overall Project Timeline<br>6.3 Goals for the Semester<br>6.4 Semester Timeline<br>6.5 Semester Budget<br>6.6.1 Summary of Semester Progress<br>6.6.2 Draft Timeline for the next semester<br>7 Past semester Timeline |
| 12/1/2014 | Entire Team from Fall 2014 | 4.5 Overall Project Timeline<br>5.5 Specification Development<br>6.2 Current Status and Location on Overall Project Timeline<br>6.3 Goals for the Semester<br>6.4 Semester Timeline<br>6.5 Semester Budget<br>6.6.1 Summary of Semester Progress<br>6.6.2 Draft Timeline for the next semester<br>7 Past semester Timeline |
| 4/30/2015 | Entire Team from Spring 2015 | 4.5 Overall Project Timeline<br>5.2 Narration of Delivery Phase of Design<br>5.3 Design Specification<br>5.3 Phase Three<br>6.2 Current Status and Location on Overall Project Timeline<br>6.3 Goals for the Semester<br>6.4 Semester Timeline<br>6.5 Semester Budget<br>6.6.1 Summary of Semester Progress<br>6.6.2 Draft Timeline for the next semester<br>7 Past semester Timeline |

# 3 Design Status Summary

| Phase 6: Service / Maintenance | Status: Incomplete |
|---|---|
| *Gate 6: Project Partner and Advisor approve continued fielding of project. If not, retire or redesign.* | |
| Date of Advisor approval: | |

| Phase 5: Delivery | Status: In Progress |
|---|---|
| *Gate 5: Continue if Project Partner, Advisor and EPICS Admin agree that project is ready for delivery!* | |
| Date of Advisor approval: | |

| Phase 4: Detailed Design | Status: In Progress |
|---|---|
| *Gate 4: Continue if can demonstrate feasibility of solution (is there a working prototype?). Project Partner and advisor approval required.* | |
| Date of Advisor approval: | |

| Phase 3: Conceptual Design | Status: In Progress |
|---|---|
| *Gate 3: Continue if project partner and advisor agree that solution space has been appropriately explored and the best solution has been chosen.* | |
| Date of Advisor approval: | |

| Phase 2: Specification Development | Status: Complete |
|---|---|
| *Gate 2: Continue if project partner and advisor agree that you have identified the "right" need, specification document is completed and no existing commercial products meet design specifications.* | |
| Date of Advisor approval: | |

| Phase 1: Project Identification | Status: Complete |
|---|---|

| | |
|---|---|
| ***Gate 1: Continue if have identified appropriate EPICS project that meets a compelling need for the project partner.*** | |
| Date of Advisor approval: | |

# 4 Project Charter

## 4.1 Description of the Community Partner

The project partner for this project initiative is STARS (Scottsdale Training and Rehabilitation Center). STARS' mission is "*to improve the lives of individuals with developmental and cognitive disabilities"*. The primary beneficiaries of this project are people with visual impairment and the families, friends and co-workers of those with visual impairment, along with facilities that accommodate the visually impaired. The recipients of the project's outcomes/deliverables are also the visually impaired.

## 4.2 Stakeholders

The parties that have the most vital interest in our project and its success are Arizona State University, Intel, and Gore because they have invested in EPICS.

## 4.3 Project Objectives

The reason for undertaking this project is to ensure easy mobility for the visually impaired that otherwise would have incredible difficulty navigating in a typical indoor or outdoor setting. This is in congruence with the mission statement of STARS i.e. to improve the lives of individuals with developmental and cognitive disabilities. We want to help make them more independent and be safe in a natural environment.

## 4.4 Outcomes/Deliverables

The project will result in a device and system of navigation ideal and usable by visually impaired individuals to independently navigate the campus safely that is sustainable and requires minimal need for maintenance. Blind Vision will leave behind a system that can be easily update and effective at helping the visually impaired navigate with minimal or no human assistance.

## 4.5 Overall Project Timeline

Our current goal of this project is to deliver a sustainable and cost-effective solution to community partners by the end of this current semester. We did a test run of our product this summer and while useful data was minimal, we were able to figure out many problems with the design and how they can be addressed. The goal of the next semester would be towards maintenance and further iterative design betterment. We intend to deliver by the end of this semester and our future goal is establish proper maintenance to ensure our community partners can solve problem autonomously.

# 5 Overall Project Design

## 5.1 Phase Six

| **Phase 6: Service / Maintenance** | **Status:** | **Evidence can be found:** |
|---|---|---|
| • Evaluate performance of fielded project | Incomplete | |
| • Determine what resources are necessary to support and maintain the project | Incomplete | |
| ***Gate 6: Project Partner and Advisor approve continued fielding of project. If not, retire or redesign.*** | Decision: | Rationale summary: |
| Advisor approval: | Yes / No | Date: |

## 5.2 Phase Five

| **Phase 5: Delivery** | **Status:** In Progress | **Evidence can be found: Section 5.2** |
|---|---|---|
| Goal is to refine detailed design so as to produce a product that is ready to be delivered! In addition, the goal is to develop user manuals and training materials. | | |
| • Complete deliverable version of project including Bill of Materials | Incomplete | |
| • Complete usability and reliability testing | In Progress | |
| • Complete user manuals/training material | In Progress | |
| • Complete delivery review | Incomplete | |
| • Project Partner, Advisor, and EPICS Admin Approval | Incomplete | |
| ***Gate 5: Continue if Project Partner, Advisor and EPICS Admin agree that project is ready for delivery!*** | Decision: | Rationale summary: |
| Advisor approval: | Yes / No | Date: |

After developing our improved prototypes, we plan on test piloting the waypoint navigation system with solar technology over the winter and collecting crucial data to see what needs improvement in our current system. This includes periodically checking with our clients, both the administration at STARS campus as well as the recipient of our product, Chris, and possibly giving them surveys to see how effective our prototype is. In addition, we hope to begin development of a proper maintenance plan in conjunction with test piloting the waypoint navigation system over the summer. This includes notes on what should be in the manual, whether to have a written maintenance guideline for the client or tutorial videos, or a combination of the two. By the spring semester, we hope to have several implementable ideas for maintenance and by the end of fall semester, to expand Chris's accessibility, all in the hopes that by next spring, we have installed a system for Chris that is fully sustainable and reliable.

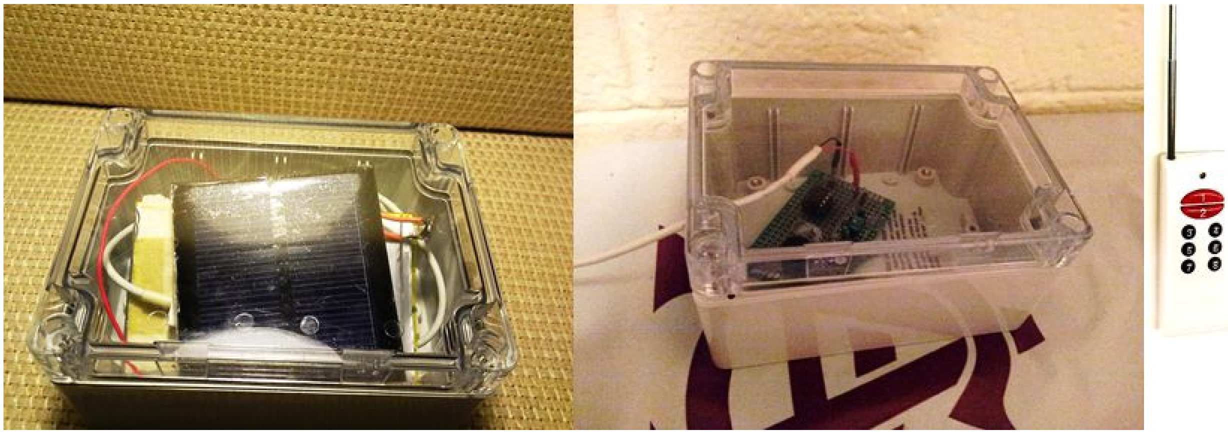


Figure 5.2.1: Current Prototype Aesthetics: Speaker module powered by a solar panel, speaker module powered by a usb adapter, 8 channel wireless transmitter (Left to Right)

## 5.3 Phase Four

| **Phase 4: Detailed Design** | **Status:** | **Evidence can be found:** |
|---|---|---|
| Goal is to design working prototype which meets functional specifications. | | |
| ● Bottom-Up Development of component designs | Incomplete | |
| ● Develop Design Specification for components | Complete | Reference the specification for each design |
| ● Design/analysis/evaluation of project, sub-modules and/or components (freeze interfaces) | Complete | Received feedback from design review; noted below. |
| ● Design for Failure Mode Analysis (DFMEA) | In progress | |
| ● Prototyping of project, sub-modules and/or components | Complete | Reference pictures below under the section |
| ● Field test prototype/usability testing | In progress | |
| ***Gate 4: Continue if can demonstrate feasibility of solution (is there a working prototype?). Project Partner and advisor approval required.*** | Decision: | Rationale summary: |
| Advisor approval: | Yes / No | Date: |

# Design Specification
## Waypoint Navigation System

An important part of this autonomous navigation system is the waypoint navigation system. While touring the STARS campus, we found that our visually impaired client had trouble navigating indoors. More specifically, they had trouble navigating to doors of a building in a room. There are a number of feasible solutions that were explored, but ultimately, we devised an efficient and reliable solution known as a waypoint navigation system.

This system is similar in function to a car locking system. In the waypoint navigation system, a user enters his or her destination in a building by the means of a numerical pad, which correlates to a corresponding waypoint in a room. This pad is effectively a keyfob transmitter that transmits a specific signal based upon the specific button pressed.

This emitted signal from the transmitter is then converted to a radio signal which is captured by all receiver speakers within the range. This receiver module, which is based on a an ATTINY85 microcontroller, processes the signal. If the signal matches the given speaker's ID signal, the speaker buzzed with a random series of binary audio pings. The profile of these audio pings are constant but they are unique for every speaker just like a hashing algorithm.

Various methods of signal transmission were researched, but the most feasible and reliable method to interface the central access point with the waypoints is with a wireless. This autonomous navigation can be potentially installed in households to aid any visually impaired users in autonomous navigation across the house, giving them an unbridled sense of independence. Individual aspects of each part of the autonomous navigation system are outlined below.

**Signaling**

The transmitter module on a 433 MHz 8 button toggle remote is responsible for sending radio signals based upon button activated events to the receiving module so it activates the respective speaker. The transmitter sends a 26 bit signal for the receiver to 'realize' an incoming signal. The data rate has been established to be less than 1 bit per second.

**Data Processing**

The receiver microcontroller processor (currently an AtTiny85 8 pin chip), is responsible for processing and interpreting the received signal and establishing the signal by repetitive checking systems. It will continuously check for a specific sequence of 0's and 1's until it recognizes the correct sequence based on the length of data output. Once it recognizes the right sequence it sends a voltage burst to the speaker to make a noise for three cycles. The code for data processing is as follows:

```
const uint8_t data = 3;
const uint8_t speaker = 10;
const boolean key[8] = {1,1,1,1,!1,!1,!1,!1};
void setup(){
  pinMode(data,0);
  pinMode(speaker,1);
}

const uint8_t seed = (key[0]*key[0]*key[0]*key[0]+key[2]*key[2]*key[2]+key[4]*key[4]+key[6])*32;
boolean d[60];
int j = 0;

void loop(){
  uint16_t i = pulseIn(data,HIGH);
  boolean a;
  if (i > 800) a = true;
  else a = false;
  d[j] = a;
  if (j >= 59){
    for (int n = 0; n < 36; n++){
      if (d[n+1] && d[n+3] && d[n+5] && d[n+7] && d[n+9] && d[n+11] && d[n+13] && d[n+15]){
        if (!d[n] && !d[n+2] && !d[n+4] && !d[n+6] && !d[n+8] && !d[n+10] && !d[n+12] && !d[n+14]){
          if ((d[n+16]==key[0]) && (d[n+17]==key[1]) && (d[n+18]==key[2]) && (d[n+19]==key[3]) && (d[n+20]\
          ==key[4]) && (d[n+21]==key[5]) && (d[n+22]==key[6]) && (d[n+23]==key[7])){
            activateSpeaker();
            break;
          }
        }
      }
    }
    j=0;
  }
  j++;
}

void activateSpeaker(){//Incase different sound is needed for different speaker
  randomSeed(seed);
  digitalWrite(speaker,1);
  delay(10);
  for(int cn = 0; cn < 10; cn++){
      digitalWrite(speaker,random(0,2));
      delay(25);
  }
  digitalWrite(speaker,0);
}
```

**Signal Range**

Signal range is a function of various factors. Under line of sight activation, the speakers were activated up to a distance of 50 meters. Also it was noticed that an increased antenna length improved the range of transmission. The optimal data rate according to the FS1000a datasheet is 9600 bits per second. However, one the contrary, the arithmetic operations for data signal checking significantly reduced this data transmission rate.

**Setup**

Various methods of signal transmission were researched, but the most feasible and reliable method is wireless communication via a transmitter and receiver. A small hand held remote will be held by Chris which can send out signals with specific profiles that are registered by their corresponding AtTiny85 microcontroller. These AtTiny85s are connected to a receiver and a speaker. So once a signal is registered it will create a nominal frequency audio burst with a unique binary pseudorandom profile. which can be a noise easily heard by Chris but not a distraction to the students.

**Power**

The transmitter is powered by a 12V 23A battery that is replaceable after it loses its charge. The receivers were planned to be powered by the 110VAC sockets covered to 5VDC by a usb adapter. However the sparseness of the sockets resulted in us creating a new power source i.e. the sun. Solar panels will power 6 out of 8 speakers on the recommendation of the STARS. Hence the two remainder speakers will be powered by the sockets.

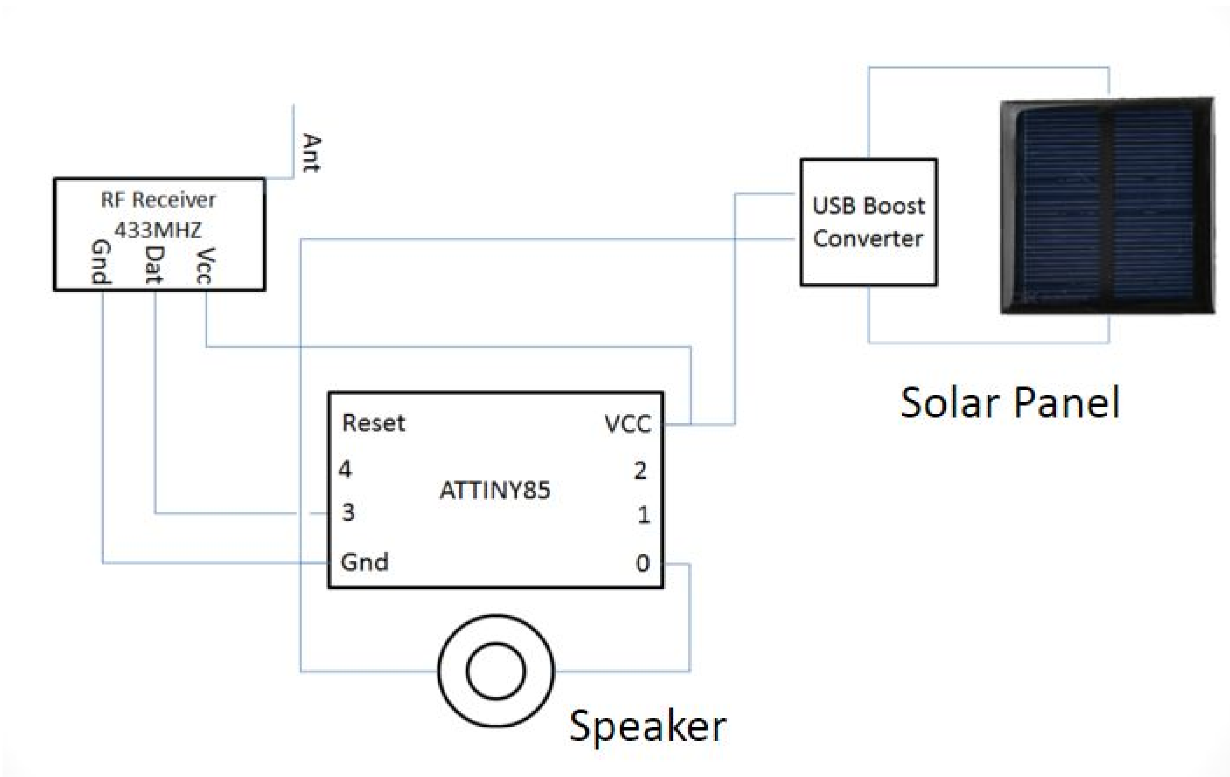



Figure 5.3.1: Circuit diagram of the solar powered speakers

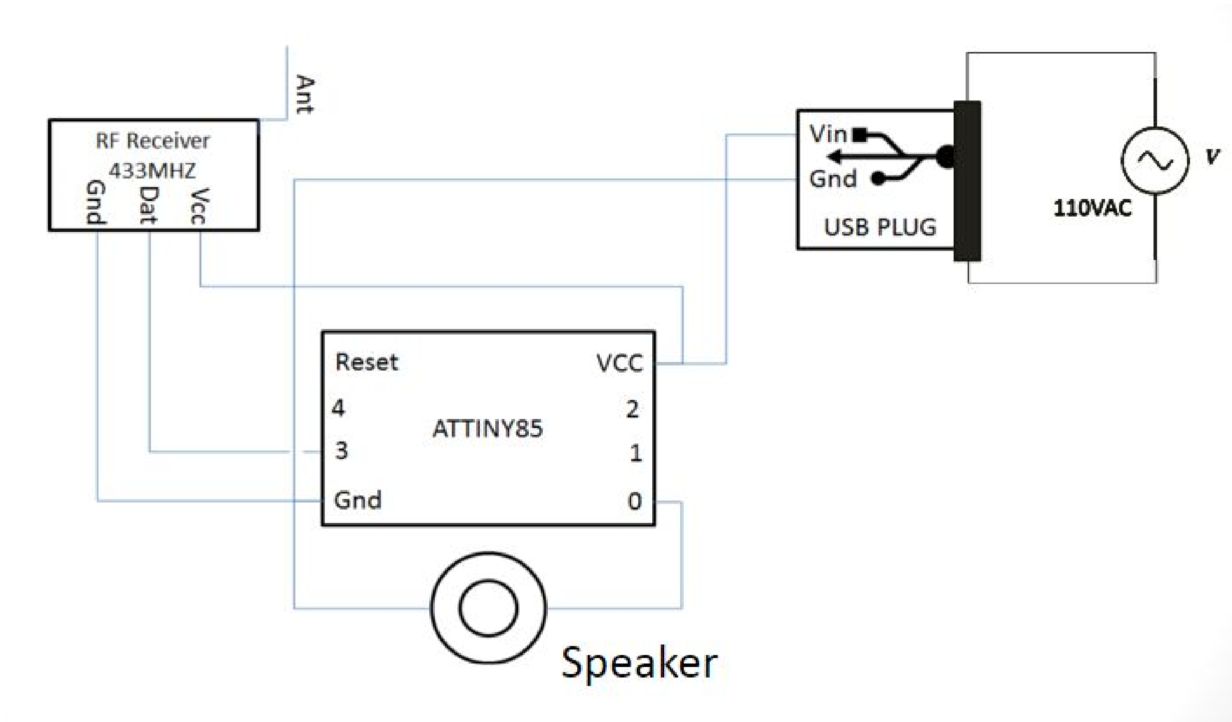



Figure 5.3.2: Circuit diagram powered by a usb adapter on a socket.

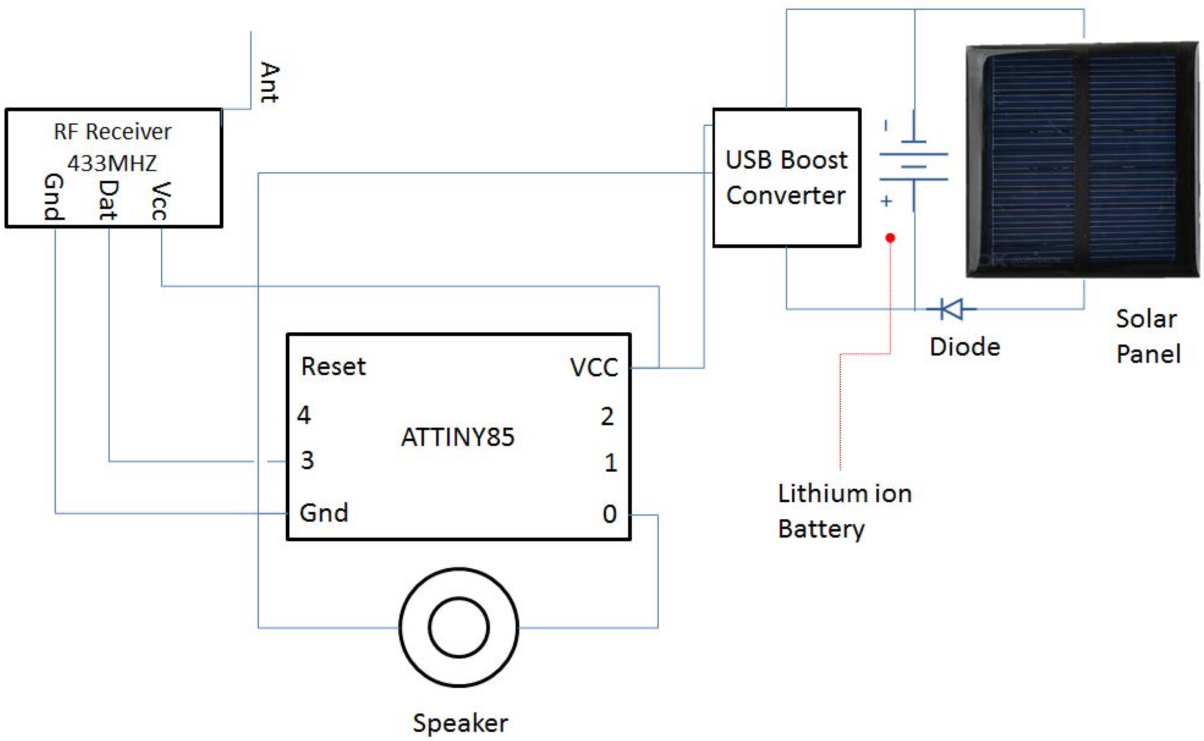



Figure 5.3.3: This is a modified solar panel circuit as it adds a lithium ion battery which backups solar power for nights and cloudy days.

The product is a simple and elegant device. The wireless transmitters have eight buttons, each of which can remotely activate one of eight speakers. The range should theoretically be at least 50 meters and hence they would be ideal for an indoor setting like a house–or more importantly, an outdoor setting (if there are outlets present outside a building or structure). According to a visually impaired subject, the most disorienting part of navigation is outdoor navigation because there are very few reference sounds. It is particularly difficult to pinpoint their location since the reference sounds blend in with the ambient noise. All in all, this product would be perfect for visually impaired individuals who intend to be able to navigate independently without getting disoriented and to reach their destinations more efficiently and effectively.

The casing  is waterproof Project Box that is enclosed by a transparent lid which doesn't prevent light from entering inside. It was chosen out 3 designs, one which was our existing design at the beginning of the semester.

| Ranking | 10 | 2 | 6 | 8 | 9 | 15 | |
|---|---|---|---|---|---|---|---|
| | Waterproof | Lighweight | Cost | Volume | Durability | Interface Complexities | Total |
| Prototype Plexiglas | 5 | 9 | 8 | 8 | 5 | 10 | 375 |
| Project Box | 10 | 9 | 8 | 5 | 8 | 10 | 428 |
| Waterproof Ipod Case | 10 | 5 | 5 | 10 | 9 | 1 | 316 |

Figure 5.4.3: This is the decision matrix regarding specific casing of choice.

There were many milestones attained over the past two semesters. One of the milestones were the implementation of solar panel as the power source for the speakers due to the sparseness of plug outputs and usage of project boxes as producing a weatherproof and waterproof box from scratch is a rather difficult task.

**FMEA**

FAILURE MODE AND EFFECTS ANALYSIS

| | | | | | |
|---|---|---|---|---|---|
| Item: | Waypoint Navigation System | Responsibility: | Blind Vision | FMEA number: | |
| Model: | | Prepared by: | Adil Ansari | Page : | 1 of 1 |
| Core Team: | Blind Vision | | | FMEA Date (Orig): | 11/15/2015 Rev: 2 |

| Process Function | Potential Failure Mode | Potential Effect(s) of Failure | Sev | | Potential Cause(s)/ Mechanism(s) of Failure | Occur | Current Process Controls | Detec | RPN | Recommended Action(s) | Responsibility and Target Completion Date | Action Results: Actions Taken | Sev | Occ | Det | RPN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Transmitter Key fob | Battery Drained | Signal does not reach the receiver (Subject will not know where he is) | 4 | | Physical/time related damage. Short circuit | 5 | Searching for new equipment | 1 | 20 | Find a high quality transmitter with a slower bitrate | Entire Team/End of Semester | Giving the user multiple replacement batteries | 4 | 5 | 1 | 20 |
| Receiver Box | Signal is lost | Does not receive the message (Subject becomes confused in regards to his location) | 8 | | Lack of time synchronization | 9 | Calibrate after every new transmitter purchased | 5 | 360 | Change data reception scheme to account for variable data rate | Entire Team/beginning of Semester | Changed data reception scheme to account for variable data rate | 8 | 2 | 5 | 80 |
| Wires | Break | All connection would be lost | 6 | | Physical/time related damage. Short circuit | 2 | Searching for new equipment | 3 | 36 | Inform the employees to look for signs of potential damage to the wires. | Entire Team/End of Semester | Made casing weatherproof | 6 | 1 | 3 | 18 |
| Batteries | Lose power | System turns off (Subject can no longer use the product) | 4 | | Not charged properly / Faulty connection | 6 | Replacement | 2 | 48 | Decrease Solar Panel Voltage by the decreasing insolation | Entire Team/End of Semester | None | 4 | 6 | 2 | 48 |
| Case | Does not properly contain the contents | Contents are removed and unsafe | 5 | | User drops the products / the product is placed in an unsafe area | 7 | Creating a compact case and eliminating potential opening areas. | 2 | 70 | Making it Weatherproof | Entire Team/End of Semester | Switched from Plexiglas to Weatherproof boxes | 5 | 5 | 1 | 25 |
| Buttons | Cannot press the buttons (they get stuck) | Receiver does not get a signal | 3 | | Lack of use / something spills on the buttons to make them stick | 2 | Create a cleaning mechanism to sell with the product (a wipe) | 1 | 6 | Switch to a different equipment | Entire Team/End of Semester | Switched to different key fob | 3 | 1 | 1 | 3 |
| Buttons | Buttons correspond to the wrong speaker | The user gets confused about their location | 3 | | Mechanical Failure | 1 | Hashing Scheme on the receiving end | 3 | 9 | Smaller bitrates will result in lower error | Entire Team/End of Semester | Switched to different key fob with smaller bitrate | 3 | 3 | 1 | 9 |
| Speakers | Sound blows out | User cannot hear the wanted sound | 6 | | Heat | 3 | Replacement | 1 | 18 | Research more robust speakers | Entire Team/End of Semester | None | 6 | 3 | 1 | 18 |
| Solar Panel | Stop Functioning | User cannot hear the wanted sound | 8 | | LED consuming too much power | 10 | Replacement | 1 | 80 | Standalone Solar Panel interfaced with USB bus | Entire Team/End of Semester | Switched to Standalone Solar Panel | 8 | 1 | 1 | 8 |

Figure 5.3.4: This is the DFMEA as of Fall of 2015

After much consideration with the team and with the community partner, a baseline RPN value has been set at 80 for an unacceptable failure. We got this value by deciding a severity level of 6, an occurrence rate of 5, and a detectability factor of 3 were all unreasonable.

With this being said, receiver box not working and solar panel going dysfunctional are all the biggest issues on our DFMEA that need addressing.

## 5.4 Phase Three

| **Phase 3: Conceptual Design** | **Status:** | **Evidence can be found:** |
|---|---|---|
| Goal is to expand the design space to include as many solutions as possible. Evaluate different approaches and selecting "best" one to move forward. Exploring "how". | | |
| • Complete functional decomposition | Complete | Reference the Functional Decomposition of the two projects below |
| • Brainstorm several possible solutions | Complete | Reference Decision Matrix below |
| • Prior Artifacts Research | Complete | Reference fourth paragraph |
| • Create prototypes of multiple concepts, get feedback from users, refine specifications | Complete | Reference Decision Matrix below |
| • Evaluate feasibility of potential solutions (proof-of-concept prototypes) | Complete | Reference second and third paragraphs below |
| • Choose "best" solution | Complete | Reference Decision Matrix below |
| ***Gate 3: Continue if project partner and advisor agree that solution space has been appropriately explored and the best solution has been chosen.*** | Decision: | Rationale summary: |
| Advisor approval: | Yes / No | Date: |

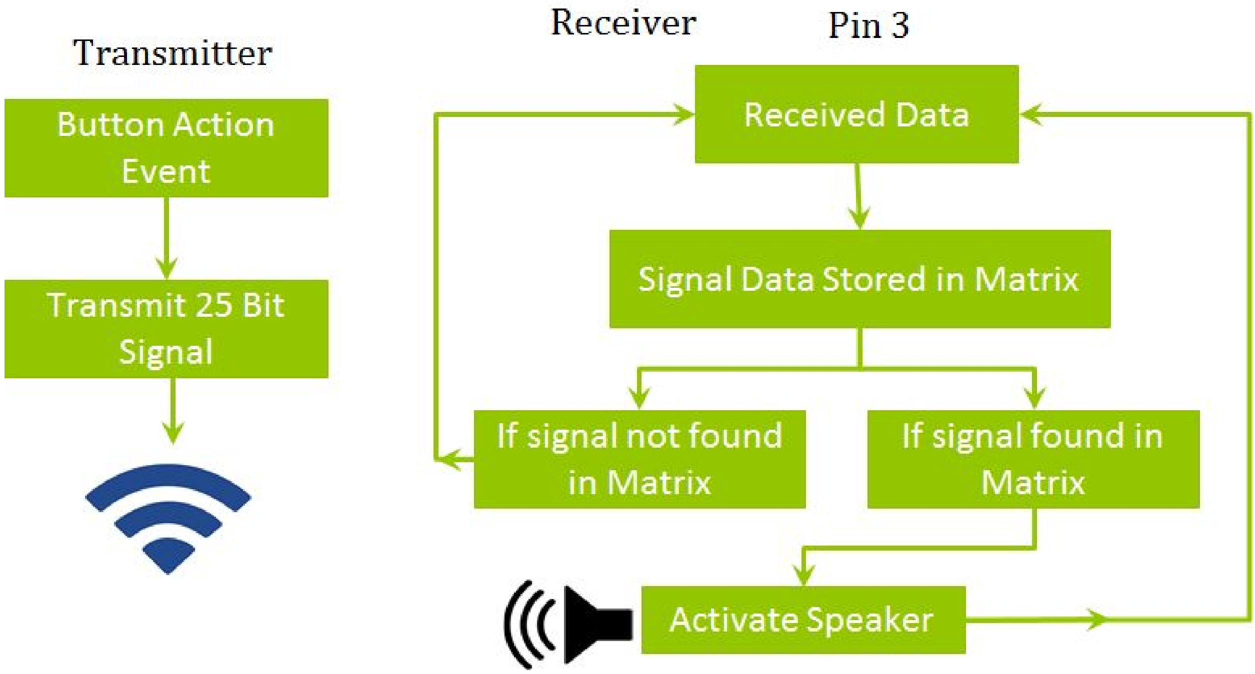



Figure 5.4.1: This is a functional decomposition chart of the navigation system.

The device in question should be able to activate a specific speaker based on a specific command on a keyboard. Given that the user knows the layout of the map, he or she can navigate based on the audio outputs of the speaker.

| Criteria | Weight | Wireless System | Central Access Point | Central Access Points for each building |
|---|---|---|---|---|
| Complexity | 15 | 9 | 6 | 7 |
| Reliability | 50 | 9 | 7 | 8 |
| Cost | 10 | 10 | 5 | 7 |
| Ease of installment | 15 | 9 | 5 | 7 |
| Non-Distracting | 10 | 8 | 6 | 7 |
| | Total Weight | 900 | 625 | 750 |

Figure 5.4.2: This is a Decision matrix used to evaluate which type of speaker system is the best fit for the problem.

After visiting our community partner over the winter break between the fall 2014 semester and spring 2015 semester, they offered the idea of making the waypoint navigation system wireless. After successive improvements we arrived at our current design.

When working with individuals that are impaired, reliability turns out to be the heaviest in terms of weight as we are creating this device to bring back their sense of independence. Also, it is a high risk if anything were to happen to the visually impaired while using this device as an aid. Along with this, it is important that our design is extremely subtle so as to integrate the visually impaired individuals into society in an inconspicuous manner.

As far as preexisting products for blind people go, the cane that helps them feel the ground is the only product they use to navigate around a specific area. Other devices for aiding the blind in navigation are currently being worked on and are in either a conceptual phase or a detailed design phase. Nothing is currently finished and usable. These potential products include an iPhone App that uses the camera phone to map out an unfamiliar area and let the user know precisely where anything is located. One other product that is in the detailed design stage is a gps-like insole for shoes that would vibrate according to when and which way to turn in order to arrive at a destination. These insoles target more runners than visually impaired people, but it would still benefit the blind.

## 5.5 Phase Two

| **Phase 2: Specification Development** | **Status:** | **Evidence can be found:** |
|---|---|---|
| Goal is to understand "what" is needed by understanding the context, stakeholders, requirements of the project, and why current solutions don't meet need, and to develop measurable criteria in which design concepts can be evaluated. | | |
| • Understand and describe context (current situation and environment) | Complete | First paragraph below |
| • Create stakeholder profiles | Complete | Reference the STARS website below |
| • Create mock-ups and simple prototypes: quick, low-cost, multiple cycles incorporating feedback | Complete | See section 5.3 above and STARS profile below for their feedback. |
| • Develop a task analysis and define how users will interact with project (user scenarios) | Complete | See table below |
| • Identify other solutions to similar needs and identify benchmark products (prior art) | Complete | Reference the second paragraph below |
| • Define customer requirements in more detail; get project partner approval | Complete | Reference email below. |
| • Develop specifications document | Complete | Reference section 5.3 |
| • Establish evaluation criteria | Complete | Reference pie chart below |
| ***Gate 2: Continue if project partner and advisor agree that you have identified the "right" need, specification document is completed and no existing commercial products meet design specifications. [This includes their agreeing that you have captured and documented the critical requirements and specifications for this project]*** | Decision: | Rationale summary: |
| Advisor approval: | Yes / No | Date: |

The specification development based upon the criteria as well as feasibility of the technology with potential constraints. By subsequent visitation we discerned that subtlety is of the utmost priority so as make the user look completely normal. This would imply an aesthetically subtle layout of relatively low volume and consequently low mass allowing easy mobility. Another aspect to make mobility realistic would have to be a wireless communication system. Different debuggers communicating would need no error what-so-ever. A bug free source code would have to be necessary in order to establish reliability. The device can communicate with the user via anything but visual means. The design needs to be integrated with the mainframe fire-alarm safety systems to ensure reliability in emergency situations. The design needs to have low cost-per-person and reliable functionality vs. cost. Lastly, sustainability of extremely important so as to keep the device functional with minimal needs and skills for maintenance and no man-power for operation.

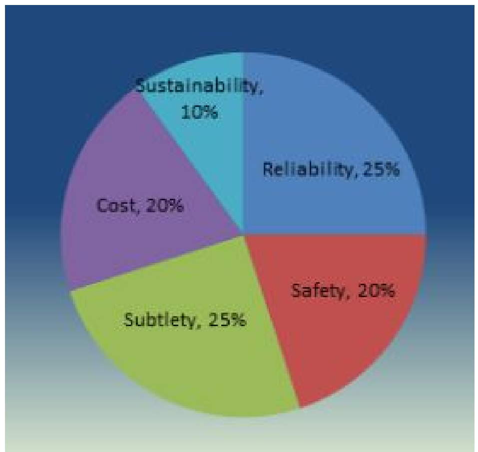



Figure 5.5.2: A Pie chart to visually represent the amount of weight we assigned to each of the criteria we decided on.

## Stake Holder Profile:

STARS website: http://www.starsaz.org/

| | | |
|---|---|---|
| Gina Griffiths | GGriffiths@starsaz.org | Community Partner |
| Melissa Mistal | MMistal@starsaz.org | Employee |
| Claudia Chavez | CChavez@starsaz.org | Employee |
| Rick Hopwood | RHopwood@starsaz.org | Employee |

## 5.6 Phase One

| **Phase 1: Project Identification** | **Status:** | **Evidence can be found:** |
|---|---|---|
| Goal is to identify a specific, compelling need to be addressed | | |
| • Conduct needs assessment (if need not already defined) | Complete | First paragraph below |
| • Identify stakeholders (customer, users, person maintaining project, etc.) | Complete | Second paragraph below |
| • Understand the Social Context | Complete | Third paragraph below |
| • Define basic stakeholder requirements (objectives or goals of projects and constraints) | Complete | |
| • Determine time constraints of the project | Complete | Fourth paragraph below |
| ***Gate 1: Continue if have identified appropriate EPICS project that meets a compelling need for the project partner [This includes a Project Charter]*** | Decision: | Rationale summary: |
| Advisor approval: | Yes / No | Date: |

The STARS center's main goal is to help the disabled and impaired be more self-sufficient. Analogous to one of their goals is to find a safe way to help their visually impaired members navigate on their campus safely and independently.

We have identified our stakeholders as all of the companies who have sponsored EPICS , ASU as well as the STARS community. We realize that because there are sponsors that have invested their time and money in this project, we must develop an effective solution. For the development of our design we realize that we have a budget that we have to consider.

As far as the implementation of our project goes, we have decided that the device needs to have a simple user interface and can be easily maintained. We plan to create a device that is able to understand a speech-to-text input and is able to generate an audio output. A major concern we have is the safety of the visually impaired students that use our design. We are aware that the participant could be seriously hurt if there was any miscommunication, or problems with our design.

Our goal is to create a portable compact device that can support all of the programs we wish to develop as well as be trustworthy for the participants. As of right now there are no time constraints put on by our community partner. We hope to create a design that can help the students at the STARS facility navigate independently. Not only will the visually impaired benefit but he employees of STATS will too. The visually impaired will not need as much assistance going from place to place, therefore the employees of the STARS committee will be able to tend to other students in need and be able to trust the that the students can navigate by themselves safely.

# 6 Semester Documentation (current semester)

## 6.1 Team Member

| *Name* | *Role* | *Email* | *Phone #* |
|---|---|---|---|
| **Adil Ansari** | **Team Leader** | **adil.ansari@asu.edu** | **408 768 5896** |
| **Christian Seto** | **Communications Officer** | **bob.smith@asu.edu** | **602 702 2097** |
| **Elexus Rangel** | **Finance Chair** | **evrangel@asu.edu** | **623 363 3198** |

## 6.2 Current Status and Location on Overall Project Timeline

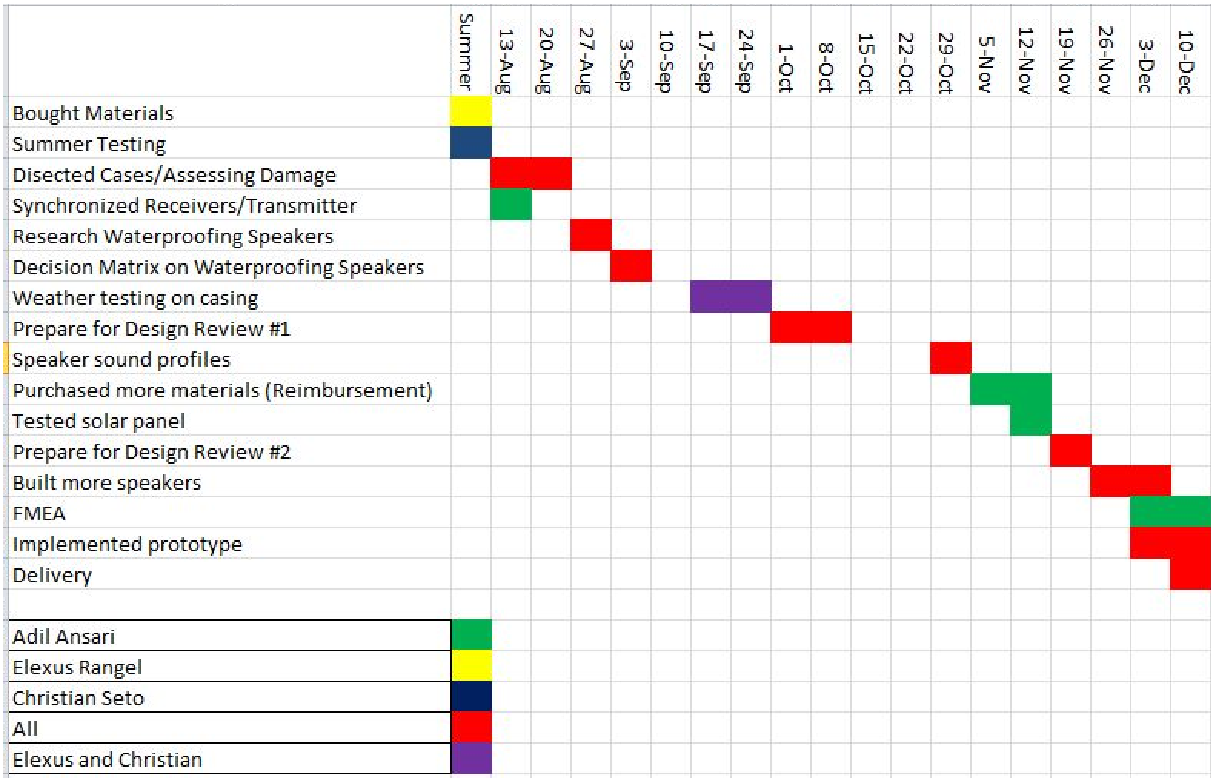
Where we are in the design process is analogous to the plan referenced in the project timeline. We have received our speakers back from our summer testing and we spent this semester improving upon the design. Chris was not able to use the prototype because the keyfob went missing so we decided to add a keychain to the device to make it more portable.

We have currently finished setting up 2 enclosures for the speaker system so that it can be used over the summer. By having Chris use this prototype this summer, we will be gaining a valuable amount of feedback and manners in which we would need to improve the device. More research will need to be done regarding power sources and ensuring that the final delivery will implement a reliable source of power. The current options are solar powered, power from an outlet or using a rechargeable battery. At the moment, our current implementation allows the user to use 4 different buttons from one key fob, which provides the user with access to 4 unique key locations. Even though we faced a few minor setbacks this semester, we were able to bring ourselves right back up to speed in time for delivery of the prototype this summer. However, the documentation for the project still needs to be collated.

## 6.3 Goals for the Semester

For this semester the main goal was to create a functional prototype of the navigation system which utilizes auditory cues. Additionally, another goal was to implement a solar powered solution. Other goals included to meet with the community partner, STARS, meet the visually impaired members, express to them our idea clearly, and, finally, produce a prototype to present to them. This is projected to be done by the end of the fall 2015 semester. We intend to deliver a functional prototype for our customers in the winter of 2015 to test out the feasibility of the technology especially with the solar power array and to debug any potential issues. As for the second part of the implementation of the device involves a failure mode analysis of the device to foresee any potential dangerous failures.

## 6.4 Semester Timeline



## 6.5 Semester Budget

| Description | Funding | Quantity | Unit Price | Expense |
|---|---|---|---|---|
| Requesting amount | $ 400.00 | | | |
| Solar Panel | | 6 | $ 4.29 | $ 25.74 |
| Weatherproof Boxes | | 10 | $ 15.72 | $ 157.20 |
| batteries (x5 set) 12V 23A | | 1 | $ 2.99 | $ 2.99 |
| Extension cords | | 10 | $ 5.00 | $ 50.00 |
| USB adapters (x10 set) | | 1 | $ 10.32 | $ 10.32 |
| PCB x2 set | | 3 | $ 4.30 | $ 12.90 |
| DC DC converter | | 6 | $ 3.56 | $ 21.36 |
| USB Cables | | 4 | $ 2.99 | $ 11.96 |
| | | | | |
| Overhead (8.5%) | | | | $ 24.86 |
| Totals | $ 400.00 | | | $ 317.33 |

## 6.6 Transition Report

### 6.6.1 Summary of Semester Progress / Comparison of Actual Semester Timeline to Proposed Semester Timeline

The actual semester timeline is slightly different from the actual timeline of events that occurred. The model of the campus was created a little towards the middle of the semester compared to the beginning. This was done because we finalized the design for the project form the several prototypes we had initially designed. We were able to arrive at this with the help of a decision matrix. The speaker system was developed thoroughly throughout the semester and by doing so we were able to deliver a working prototype of the speaker system to our community partners. We also decided to meet with our community partners over spring break to finalize ensure the speaker noises that would be used would not bother or irritate the other students that are present on the campus. The power source for the device is also still in the works and currently we are using a temporary rechargeable battery pack. However, we haven’t had the opportunity to put together the testing documentation for the device but it has been tested an adequate amount. The documentation remains to be completed and that has been carried over to be completed this following semester.

### 6.6.2 Draft Timeline for (next semester) and Relationship to Overall Project Timeline

# 7 Past Semester Archive

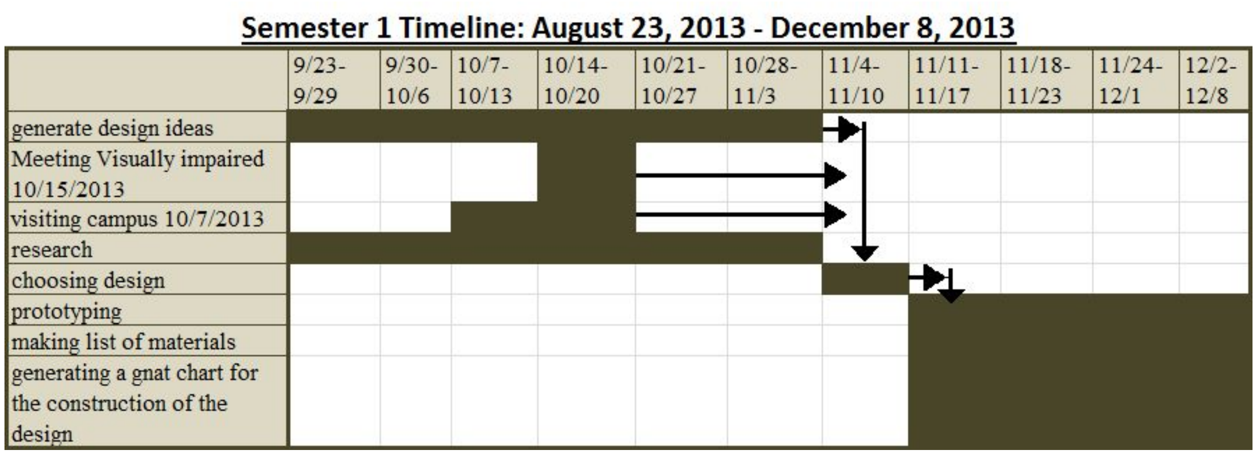
## 7.1 Fall 2014

### 7.1.1 Past Team Members

**Fall 2013**

| *Name* | *Role* | *Email* | *Phone Number* |
|---|---|---|---|
| Adil Ansari | Deputy Team Leader | amcano4@asu.edu | (408) 768 - 5896 |
| Amber Cano | Communications Officer | aansari2@asu.edu | (602) 380 - 4817 |
| Cassandra Steeno | Team Leader | csteeno@asu.edu | (480) 612 – 3070 |

### 7.1.2 Past Timeline




## 7.2 Spring 2014

### 7.2.1 Past Team Members

| *Name* | *Role* | *Email* | *Phone #* |
|---|---|---|---|
| **Cassandra Steeno** | **Team Leader** | **csteeno@asu.edu** | **480 612 3070** |
| **Adil Ansari** | **Deputy Team Leader** | **adil.a44@gmail.com** | **408 768 5896** |
| **Sam Gramer** | **Communications Officer** | **sgramer@asu.edu** | **602 882 6574** |

| | | | |
|---|---|---|---|
| **Elexus Rangel** | **Treasurer** | **elexus.r@hotmail.com** | **623 363 3198** |
| **Hany Arafa** | **Sustainability Officer** | **hany.arafa@asu.edu** | **480 707 7834** |
| **Ashwath Segu** | **Sustainability Officer** | **asegu@asu.edu** | **408 933 8799** |

### 7.2.2 Past Timeline

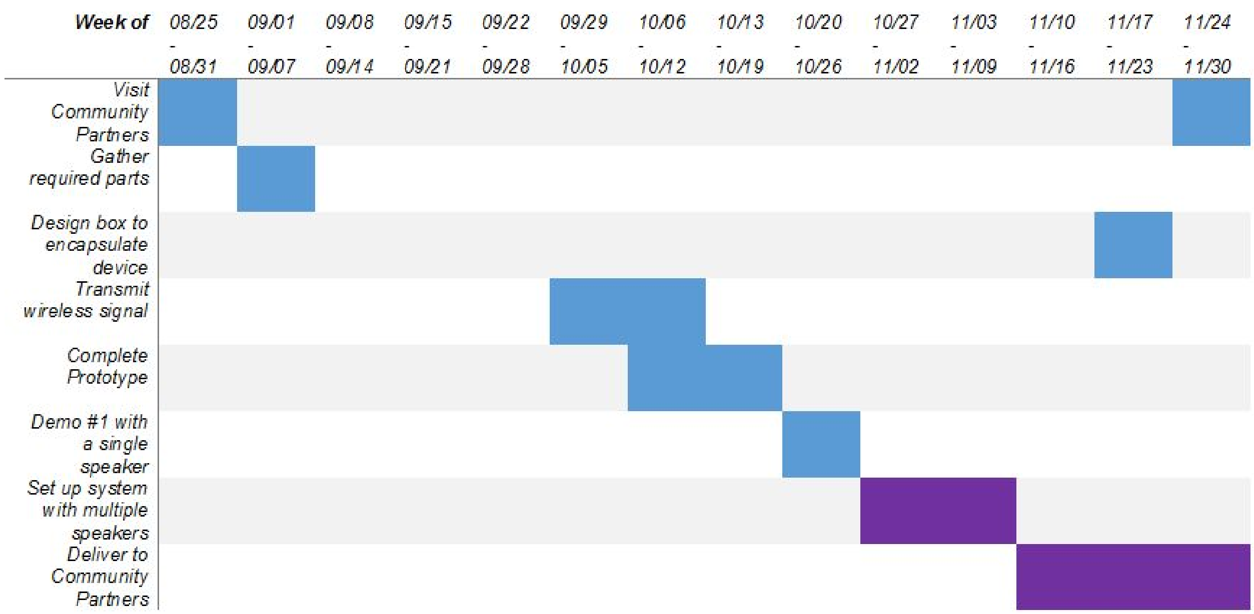
## 7.3 Fall 2014

### 7.3.1 Past Team Members

| ***Name*** | ***Role*** | ***Email*** | ***Phone #*** |
|---|---|---|---|
| **Cassandra Steeno** | **Team Leader** | **csteeno@asu.edu** | **480 612 3070** |
| **Adil Ansari** | **Deputy Team Leader** | **adil.a44@gmail.com** | **408 768 5896** |

| | | | |
|---|---|---|---|
| **Sam Gramer** | **Communications Officer** | **sgramer@asu.edu** | **602 882 6574** |
| **Elexus Rangel** | **Treasurer** | **elexus.r@hotmail.com** | **623 363 3198** |
| **Hany Arafa** | **Sustainability Officer** | **hany.arafa@asu.edu** | **480 707 7834** |
| **Ashwath Segu** | **Sustainability Officer** | **asegu@asu.edu** | **408 933 8799** |

### 7.3.2 Past Timeline




## 7.4 Spring 2015

### 7.4.1 Past Team Members

| ***Name*** | ***Role*** | ***Email*** | ***Phone #*** |
|---|---|---|---|
| **Cassandra Steeno** | **Team Leader** | **csteeno@asu.edu** | **480 612 3070** |
| **Adil Ansari** | **Deputy Team Leader** | **adil.a44@gmail.com** | **408 768 5896** |

| | | | |
|---|---|---|---|
| **Christian Seto** | **Communications Officer** | **bob.smith@asu.edu** | **602 702 2097** |
| **Elexus Rangel** | **Treasurer** | **elexus.r@hotmail.com** | **623 363 3198** |
| **Hany Arafa** | **Sustainability Officer** | **hany.arafa@asu.edu** | **480 707 7834** |
| **Ashwath Segu** | **Sustainability Officer** | **asegu@asu.edu** | **408 933 8799** |

### 7.4.2 Past Timeline