# Senior Design: Project Alfred
# The Building Master


Group 6:

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## Alfred's Beginnings:

In the beginning, while working as a project manager at Disney World Company I began most of my days with showing contractors where the equipment and rooms that would be used during construction on new projections or refurbishing facilities. After doing this many weeks I found one thing in common with all of the projects: most of us had no idea where anything was. We would spend hours trying different doors guessing which key would work for what door. I would have to contact the Maintenance manager of every ride a day ahead of schedule to locate things for me, just so we wouldn't spend time finding an electrical. As a result, I as every engineer in the history of mankind said, "there has to be a better way to do this!" The answer came to me while watching Batman one night when I saw a particular butler showing everyone where each room was to speak to master Bruce Wayen. I said, "That's it! Why not put a butler in every building?" Of course, putting a man in a building creates no electrical challenges plus hiring a butler seemed to old school but I said what if I could but an electronic butler in every building. Thus, thus the building master was born.

We want to create a better system for buildings in order to store, organize, and location of information of buildings and the rooms that lie within them. This system, Alfred, would know the ins and outs of the building as if it were the companies own personalized butler. The system would start with creating a small device at every door with a touch screen that would manage and store the entire room's data, whether it is the, electrical room's contents, to the janitors supply closet inventory, meeting room schedule, or even a patients records for a hospital. That would all tie into one system or main box at the front desk that will know the location of every room in the building as well as its directions and small sample access to what is inside the room. Our goal: to help the people navigate, manage, and be informed about their buildings to increase efficiency, information, and organization in the work place.

To the future: we believe this as a base system and the sky is the limit, and just like the IPhone is the starting point to many more application. We believe that this system can be improved, added to, or customized for any personalized use. With this in mind, we can start to develop a possible base design of the first smart building.

## Specifications

To start off with, the project will be split into two separate boxes. One will act as the box that will be placed in front of all the doors that monitor, manage, and store information about that room. The other box will be designed the main monitor box that will store the information of all the room locations and tap into the other boxes throughout the building.. These two boxes will be our prototype to represent the entire building system for Alfred project. Each one of the boxes will include the following items in order for them to work properly with our design:

### Hardware

- **AC to DC converter:** To start with we will be creating an AC to DC converter from scratch or order a premade one to be implemented into the box. We believe the box will be placed on the wall near the door or somewhere inside the room. It will then need to tap into the buildings power which will be standard USA AC 120 volt outlet. All of the components

inside will be DC so we need to convert the building power to our own use. We can estimate it will need the same amount of power as a ipad or phone and will use a 5 watt power adapter 100 – 240 ac Voltage (50-60 HZ) convert to 5 volt 1 amp DC

- **Power Devices:** We will be going with a battery device similar to those in smart phones and tablets. The design will ensure the device still running if the power goes out. A power saving program written in the processor to go into sleep mode when not in use. We guess a battery will be a good product, because of its small quantity which will work well will low power applications such as these.
- **Mounting equipment and box for both main and door box:** Mounting equipment will be big enough to house all the equipment but small enough to not be inconvenient to add near the door. We want to add a screen for use so if the person is unable to tap into it with wireless access they can update it on location. Due to safety we prefer to place them near the door not on the door or the swing location to keep people from hitting those who go in and out of the door. We want an easy mounting system that can be installed on any door. Standard materials can be used since this will be for inside of buildings we are not worried about to many weather hazards. However the materials should be shock proof to avoid any accidents.
- **Networking:** So we can tap into without using the boxes and to help locate the box with another device that has Wi-Fi, be a IPhone or tablet. Also helpful so you can update the door files and mainframe via the door device. Okay so for the small boxes we agreed that they need to be able to send and receive data. Best way to do this will likely be a wireless adapter. We went with some pretty expensive usb adapters. They use the newest 802.11ac standards so they are as fast as they get. We can easily downgrade to less expensive ones. We don't know if the basic software will just run or we will need to find freeware or program them ourselves. Ideally I'd see us hooking everything up to a computer setting up the network and then just running. Since we talked about being able to bounce the signal off other boxes we could use software to turn it into a wireless repeater when it doesn't have data to transmit. We can easily patrician it for the different subsystems. For the main Box we are going to want to set it up as a Router. That way it will be the main network hub. We should be able to do that with a wireless network adapter and the proper Distros software.Linux has a bunch of freeware when it comes to this so we may want to go that route. Here's a list of them: http://en.wikipedia.org/wiki/List_of_router_and_firewall_distributions We going to go with LibreWRT since its designed for systems with limited recourses.
- **Storage Catalog (hard drive):** Each one to store, download, and update information at any time, for this reason we recommend an actually hard drive to store large amounts of data to maximize uses thought out the building. For the main box. We went with a pretty expensive 32 GB SSD so we will have wiggle room and a 16 GB SSD for the small box. The storage software will be written using RISC OS or the android OS platform, Python or C++. This will allow us to create a search function to look for all of the things cataloged in the building as well as update the information, quantity, or details on the items or things that are in the room. Also we would like it to store the date and keep track of time for the program. So it

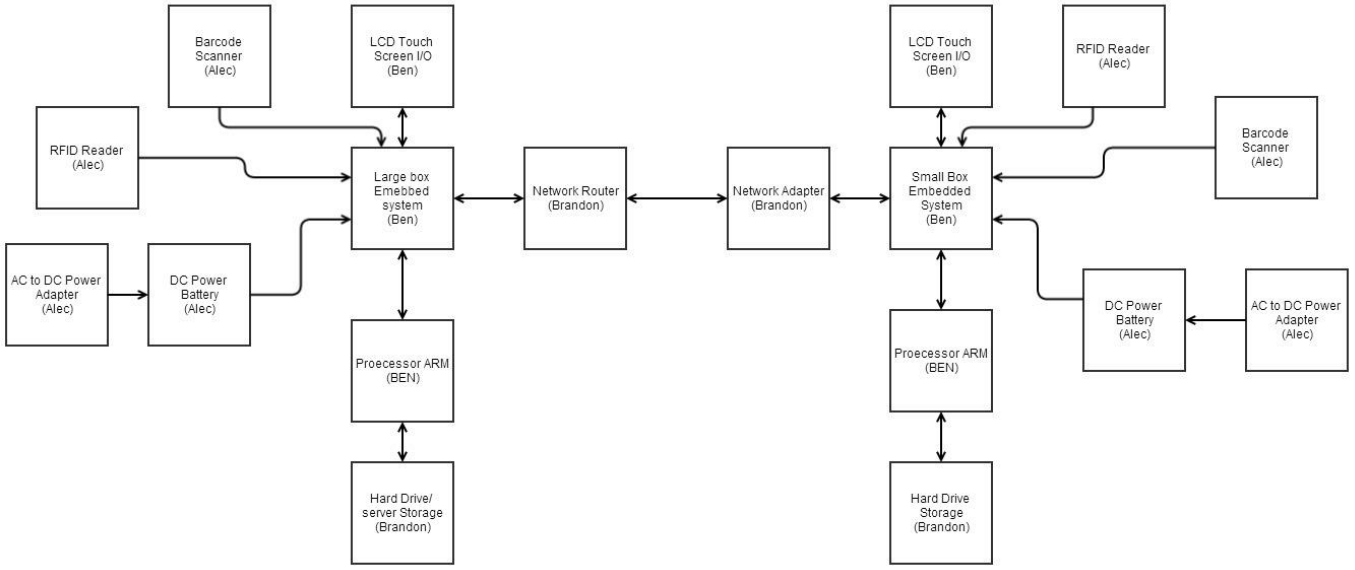
will store the dates and times things have been cataloged in the room. Furthermore, the main box will keep track of all records so you can access all information on the time.

- **Processor**: We will be using a Dual core ARM processor that will be running between 1200-1400 MHz. An ARM Mali-400 or similar graphics processor will be used to allow for a rich color display for the user input . We expect to use 1024 MB Ram to handle data input, storage and networking between devices more smoothly. Similar to the ones used in Smart phone's we believe the technology to be used to allow for low power consumption with all the features we need to program. To program the processor we can use. For the operating system, we could use the RISC OS or the android OS platform, Python or C++ will be used to code the control devices
- **Touch Screen:** We will use a capacitive touch screen display that is 6-9" large. 720x1280. This gives us the best response time with a low cost with the best display. A good example would be CFAF480272G-043T-CTS Display screen W/ built in Solomon SSD1963 controller
  - 4.3" diag screen
  - 8-bit parallel interface

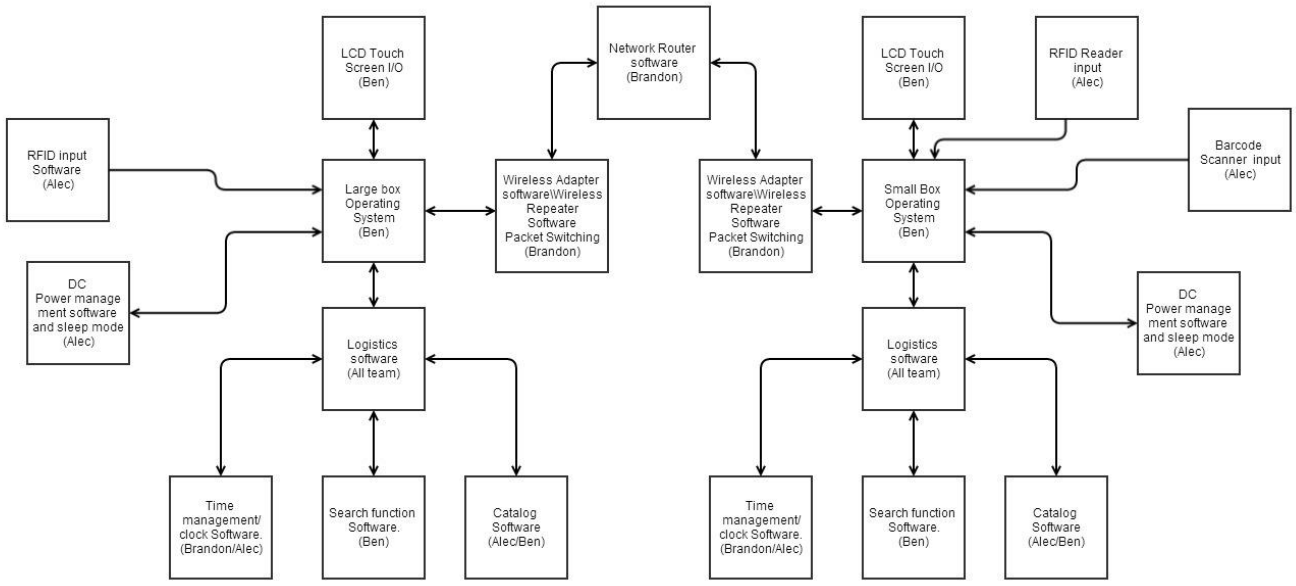
  Python Coding Language
- **RFID, Barcode Scanner, and QR code scanner:** To make life easier on the working man we believe technology has gone three routes in order to catalog items. We will be applying all of them to the boxes to allow for programming. With barcode and qr codes the user can scan in items that will be stored in the room for easy updating of the catalog. And the RFID reader can be used to issue out cards. These cards can work with an electric lock system or a maintenance password to allow them to update the boxes.
  RFID reader: RFID MIFARE S50 CARD READER - PS/2 INTERFACE
  Barcode reader: unitech MS910-CUBB00-SG Barcode Scanner – Bluetooth Interface

## System diagrams

### Hard Ware diagrams




### Software Block Diagram




## Financing and Funding

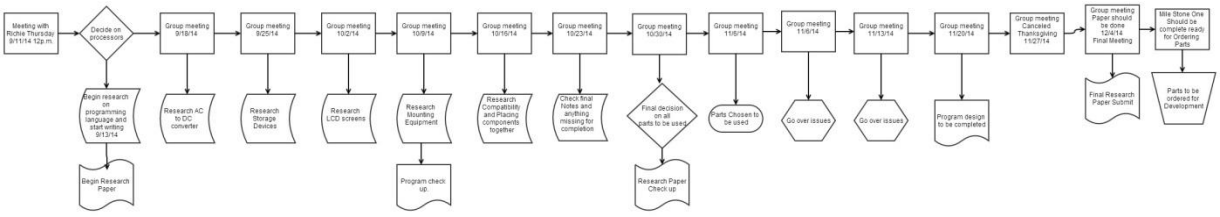
To finance our project we will be applying to Boeing for funding. We meet the basic requirement for Boeing which requires the project to cost less than one thousand and to submit a document telling all the different things things that our parts will cost. Below shows a graph of our part list break up. In

the list we looked up a few good canidates for what we will be needing in our project and the prices of those. The quantities are in US dollars Rough over estimate being a total of 1046 Dollars.

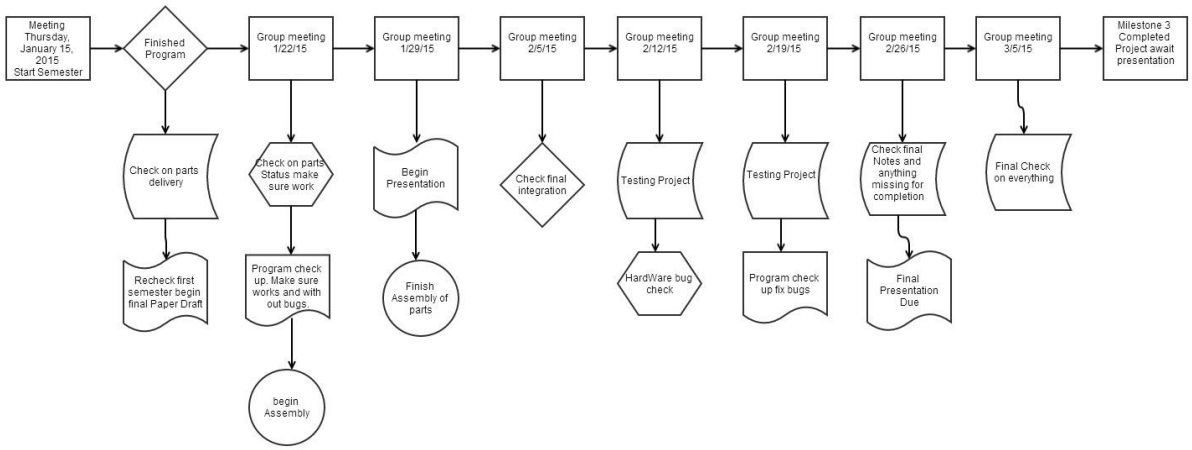
| System | Part | Small box | Main box |
|---|---|---|---|
| AC to DC converter | Apple 5W USB Power Adapter | 20 | 20 |
| box for both main and door box | To be determined based on part sizes. | 50 | 100 |
| wifi adapter | NETGEAR A6200 WiFi USB Adapter | 70 | 90 |
| processor | ARM Cortex-A9 | 70 | 70 |
| Storage main box (hard drive) | 2.5" SSD SATA2 16GB Flash Hard Solid State Disk 2.5 Inch<br><br>SSD AData Premier Pro SP900 32GB 2.5" SATA III 6GB/S MLC $92 | 49.99 | 92 |
| Embedded controller | MSP 430 | 10 | 10 |
| touch LCD screen | CFAF480272G-043T-CTS Display screen W/ built in Solomon SSD1963 controller | 65 | 65 |
| RFID Reader | RFID MIFARE S50 CARD READER - PS/2 INTERFACE | 39.95 | 39.95 |
| Battery Power system | Battery for iPad Mini | 25 | 25 |
| Barcode Scanner | unitech MS910-CUBB00-SG Barcode Scanner – Bluetooth Interface | 135 | N/A |
| Total | | 534 | 512 |

## Project Schedule

**Semester 1 schedule**:



**Semester 2 schedule**:




**Key for Schedules**: