# Wardrobe Inventory Management

**Figure 1 Wardrobe**

02.12.2021
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## Overview

In the modern world the idea of automation has spread far and wide to virtually every aspect of a person's life. The process of Automation has been applied to many different ideas to great effect, Like Henry Ford with the car manufacturing process or the Mcdonalds brothers with fast food. Some people claim it to be an inevitability that machines will soon do every task that the average person finds too trivial. What about the most basic of human activities though? Simple menial tasks that waste a person's time, that could be used more productively. There are many individuals, across the planet, that find organization to be absolutely mandatory. It obviously allows them to be more efficient and save time. Like everything else a person does it is prone to human error or interruptions from outside sources. The idea of Automated organization is very simple in concept but what would be the best way to test this theory.

There are hundreds of people who want to keep neat and orderly. For demonstration purposes, what better way to test this idea than on clothing. Keeping track of clothes becomes more cumbersome the more one thinks about it. A person has lost their favorite shirt even though they are certain it was in their closet but it cannot be found. Ensuring that people remember to wash the clothes they need for a specific situation or realizing that this particular brand of attire has not been worn in months. So why not donate it or dispose of it? This project isn't limited to clothes. Once completed it could be used in the kitchen to organize ingredients or by a student who has too many notebooks/ binders.

The inventory system will consist of three major components that will assist the user in organizing their wardrobe. A radio frequency identification tag (RFID tag), a RFID scanner, and a user-friendly application. The tags will be attached to the hangers which will be carrying unique pieces of clothing that the user wants to keep track of. The RFID tags will serve as the input for the system. For the purpose of testing and demonstration the system will be limited to an input of three to five items. These tags will be detected by the scanner when entering and leaving the inventory.

The scanning device will be wall mounted and have a minimum range of 12 inches. It will consist of three major components. The sensor, a microcontroller and a PCB that connects the two. The sensor's role is to pick up the specific signal from the RFID tag then send it to the microcontroller. The PCB board will ensure that this signal is properly transmitted and received. Once it reaches the microcontroller the data will be transmitted to a database via wifi. When the data has reached its destination, a web application will allow the user to interact with the database and submit information on the unique article of clothing. Upon removal of an item from the inventory the user will scan the RFID tag corresponding to the article of clothing. This will trigger the database to check if the item is present. If it is in the inventory then it will remove it from the database.

The wardrobe inventory system was designed to save the users time and give them peace of mind when dealing with their clothing. By implementing this system, the user will have a clear oversight of what articles of clothing are inside of their inventory. By keeping track of items in their wardrobe the database will be able to display statistical analysis of what items the user wears frequently. This system achieves the goal of automation with regards to the process of organization.

## Goals

1. To help people with organization and time management.
2. Ensure that people don't waste space in their closet or have superfluous pieces of clothing.
3. To challenge our current abilities as student engineers.
4. Utilize the knowledge we have learned over our combined years of undergraduate study.
5. Learn more about radio frequency signals / Signal processing.
6. Learn PCB design and application.
7. Learn how to develop and deploy an enterprise software application.
8. Designing a project that can be utilized by the average person.
9. Learn how to work within a team.
10. Simulate a real-life working environment.
11. Add this experience to our career resumes.
12. Demonstrating that automation can be applied to many different concepts and ideas.
13. Inspire future senior design groups.
14. Completing this project and finishing our undergraduate degrees.

## Requirements / Specifications

- RFID tags
    1. The RFID tags will be mounted onto the clothing hangers.
- Passive RFID Scanner
    1. Passive low frequency scanner range of at least 12 inches
    2. Feeds information to the microcontroller. (Via direct USB port)
    3. Will be mounted to a wall outside the closet.
- PCB board that connects the scanner to the microcontroller
- Microcontroller MSP430
    1. Powered by two AA batteries. (3.3 Volts)
    2. In low power mode (LPM) until the RFID tag is detected and will return to LPM after 60 second.

- Implement a MERN stack (MongoDB, Express, React, NodeJS)
    1. MongoDB - document database
    2. Express(.js) - Node.js web framework
    3. React(.js) - a client-side JavaScript framework
    4. Node(.js) - the premier JavaScript web server
- Implement an API that will handle the interaction between the client and the server
    1. Log in
        a. Register/ Log in
        b. Recovery (Retrieve Username/ Update password)
    2. Primary Features
        a. Create, Read, Update, Delete items from database
        b. Statistical analysis on user interaction
            i. Frequently used clothing chart
            ii. Favorite colors chart
    3. Secondary Features
        a. Support for Outfit Maker
            i. Use pictures to create virtual outfits
        b. Alerts
            i. Receive alerts about recommend clothing to wear due to weather
        c. Quick scan queue operation

## Estimated project budget & financing

Prices listed below are estimates of current online research and quotes from manufacturers. With that being said, prices are bound to fluctuate as we get closer to the dates of purchase. Additional expenses may arise if we decided to add more features regarding hardware. As of now, we are currently not sponsored and all costs will be inherited by the group.

Project Initial Budget: $100/person total = $400

**Table 1 Parts and pricing**

| Virtual Wardrobe Assistant | | | | | | |
|---|---|---|---|---|---|---|
| Number | Part Number | Description | Vendor | Price Per Unit | Amount | Total Estimated Price |
| 1 | MSP - 430 | MSP-EXP430G2 LaunchPad | Texas Instruments | $23.40 | 1 | $23.40 |
| 2 | | Raspberry Pi 3 Complete Starter Kit | CanaKit | 74.99 | 1 | 74.99 |
| 3 | | PCB Board for Scanner | Saturn PCB Design, Inc. | Unknown | 1 | Unknown |
| 4 | | Plastic Clothing Notched | Sharpty | $13.99 | 1 | $13.99 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Hangers (20) | | | | |
| 5 | | Power Supply | Unknown | Unknown | 1 | Unknown |
| 6 | | Clothing | Self | N/A | 5 | 0 |
| 7 | | DNS and Server Hosting | Go Daddy | $49.99 | 1 | $49.99 |
| | Total | | | | | $162.37 |

Note: If we host on Roku number 7 is irrelevant.

# Milestones

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This is me
_Assigned to Juan Herrera_

**Table 2 Milestones**

| Milestones | | | | | |
|---|---|---|---|---|---|
| | Task | Start | End | Status | Responsible |
| | Senior Design I | | | | |
| 1 | **Ideas** | 1/12/2021 | TBA | In Progress | Group 17 |
| 2 | **Project Selection & Role Assignment** | 1/12/2021 | TBA | In Progress | Group 17 |
| | **Project Report** | | | | |
| 3 | Initial Document - Divide & Conquer | 1/21/2021 | 1/29/2021 | Completed | Group 17 |
| | Updated the to a new version after the feedback that we received from Dr. Wei | | | | |
| 4 | Initial Document - Divide & Conquer V2 | 2/2/2021 | 2/12/2021 | In Progress | Group 17 |
| | More Information will be given as we approach the date | | | | |
| 4 | 60 Page First Draft | 2/12/2021 | 3/15/2021 | Not Started | Group 17 |
| | More Information will be given as we approach the date | | | | |
| 5 | 100 Page report submission | 3/15/2021 | 3/29/2021 | Not Started | Group 17 |
| | More Information will be given as we approach the date | | | | |
| 6 | Final report | 3/29/2021 | 4/12/2021 | Not Started | Group 17 |
| | **Research, Documentation, & Design** | | | | |
| | RFID tags | 2/1/2021 | TBA | Researching | Max & Efren |
| | How they work, and which ones we are going to get | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 8 | Power Distribution | 2/2/2021 | TBA | Researching | Max & Efren |
| 9 | Schematics | 2/3/2021 | TBA | Researching | Max & Efren |
| 10 | Raspberry Pie Data Distribution | 2/4/2021 | TBA | Researching | Juan & O'neal |
| 11 | MERN Stack and Mongoose Documentation | 2/4/2021 | TBA | In Progress | Juan & O'neal |
| 12 | Node JS Package Installation | 2/4/2021 | TBA | In Progress | Juan & O'neal |
| 13 | Phase 1 of WebApp | 2/8/2021 | TBA | In Progress | Juan & O'neal |
| | Initializing the server, Implementing Routes and Creating the Database | | | | |
| 14 | **Order & Test Parts** | TBA | TBA | TBA | Group 17 |
| | Senior Design II | | | | |
| 15 | Build Prototype | TBA | TBA | | Group 17 |
| 16 | Testing & Redesign | TBA | TBA | | Group 17 |
| 17 | Finalize Prototype | TBA | TBA | | Group 17 |
| 18 | Peer Presentation | TBA | TBA | | Group 17 |
| 19 | Final Report | TBA | TBA | | Group 17 |
| 20 | Final Presentation | TBA | TBA | | Group 17 |

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## Block Diagram

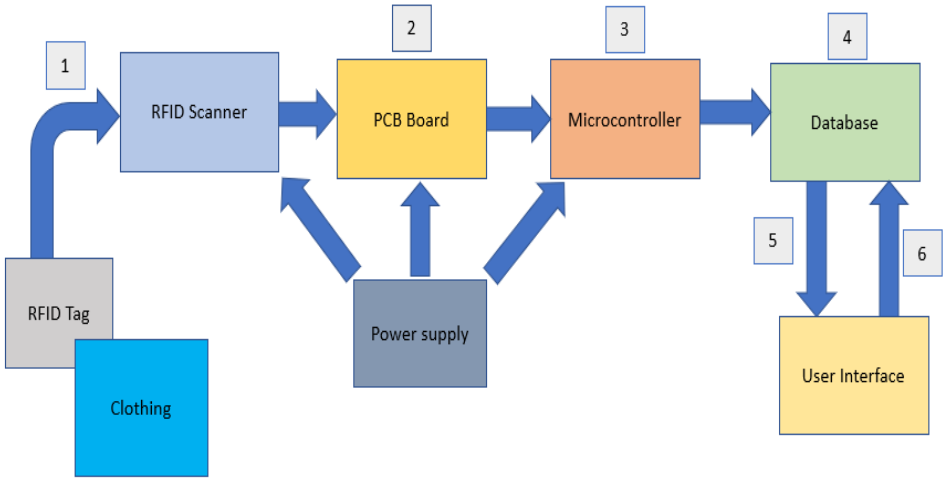


**Figure 2 Block diagram**

**Table 3 Block diagram description**

| | | |
|---|---|---|
| 1 | Maximilian Carroll | Signal from RFID tag |
| 2 | Maximilian Carroll | Takes RFID signal sends to PCB board |
| 3 | Efren Cintron | Microcontroller process the RFID signal |
| 4 | Juan Herrera | Database receives the signal from the microcontroller |
| 5 | O'Neal Thomas | Data is sent to user Interface |
| 6 | Juan Herrera | User modifies information and sends to database |

### Diagram Description

1. RFID tag, Serves as input to the system
2. PCB board still needs to be added
3. RFID Scanner processes the tag and sends the information to the Microcontroller.
4. Through Wifi the microcontroller will send the information to the database as a JSON file.
5. Wardrobe inventory  is sent to the User from the database upon request, statistical information and analysis will be processed after the data is received by the user.
6. Users will input new articles of clothing as needed into the database for inventory.

### Status of each block as of 2/2/2021

1. Currently each member of the group is working on researching their assigned area.
2. The power source will likely just consist of two AA batteries that will power all the necessary equipment.( This is subject to change because the required energy specifications will not be fully known until all the parts have been properly assembled)
3. We are still deciding exactly what sensor and RFID tags that will be utilized.
4. The microcontroller's have been acquired. Have not decided yet if it will be a Raspberry Pi or a MSP430G2.
5. We have made a decision on implementing a MERN stack to develop the database and the user interface.

### Status of each block as of 2/9/2021

1. Currently each member of the group is working on researching their assigned area.

2. We are still deciding exactly what sensor and RFID tags that will be utilized.
3. We are still deciding to either host on daddy for C-Panel, or Roku.

Commented [4]: @efrencintron7@gmail.com This is all you look at example Sum_G02_Initial_Project_Document_Divide_and_Conquer_.pdf _Assigned to Efren Cintron_

## The Engineering-Marketing Trade Off Matrix

**Table 4 Trade of matrix**

| | Accuracy | Range | Cost | Usability | Size of components | Volume |
|---|---|---|---|---|---|---|
| Accuracy | | ↓ | ↑ | ↑ | ↑ | ↓ |
| Range | ↓ | | ↑ | ↑ | ↑ | ↓ |
| Cost | ↑ | ↑ | | ↑ | ↑ | ↑ |
| Usability | ↑ | ↓ | ↑ | | ↑ | ↑ |
| Size components | ↑ | ↑ | ↑ | ↑ | | ↑ |
| Volume | ↓ | ↓ | ↑ | ↓ | ↑ | |
| Trade off priority | ↑↑ | ↓↑ | ↓↓ | ↑↑ | ↓↓ | ↓↓ |

### Impacts and correlation

↑ Positive impact on each other
↓ Negative impact on each other

### Priorities

↑↑ Primary priority
↓↑ Secondary priority
↓↓ Low priority

- **Accuracy**: The ability of the scanner to detect the right article of clothing coming in or out.

- **Range:** The effective range at which the scanner can effectively read the RFID tag on the desired article of clothing.
- **Cost:** The total cost of everything and how it affects the quality of the components used.
- **Usability:** How easy is it for the user to implement and understand.
- **Size of components:** The size of the scanner and RFID tags that the project consists of.
- **Volume:** The amount of clothes being scanned. How long the user has to wait before scanning a new piece of clothing or how many they can do simultaneously.

## Conclusion

For eons humans have been engineering new ways to make life “easier” and save time. Inventions such as the computer and the motorized vehicle save us time when performing the corresponding tasks. Virtualizing the wardrobe is no different. Utilizing RFID technology can physically be used to keep track of closet inventory. Being a group of young college students we all shared the same view on this topic.  Keeping an organized wardrobe will save a person hours in the long run. This would create more opportunities like working on hobbies and spending time with family. The overall technology of RFID provides us with a safe and cost-effective method of keeping track of the inventory. Our product displays the versatility of radio frequency technology and how it can be applied throughout the common household. In summary, being able to devote more time into other tasks instead of hand managing a closet inventory is completed through our wardrobe inventory management system.

## References


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