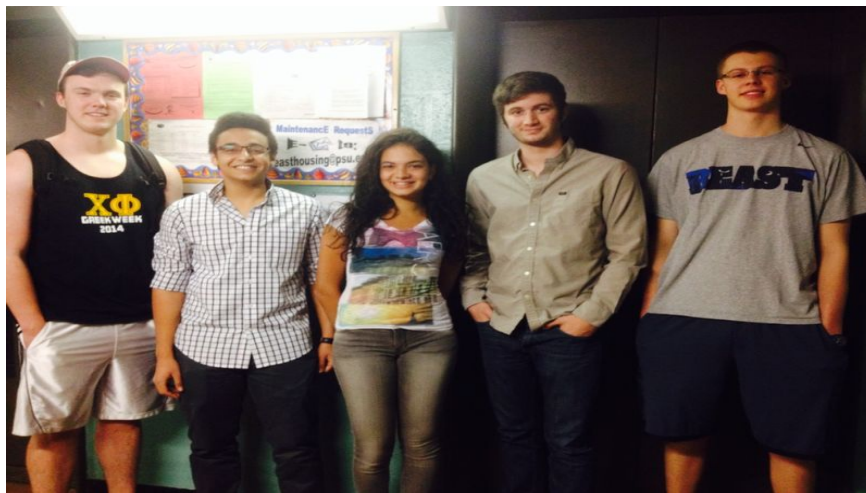


Smart Pantry



Engineering Design 100
Section 015
Team 2



(From left to right)

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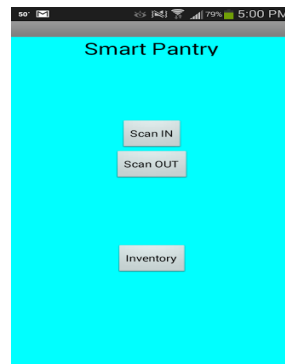


FIG. 1. Example of a Smart Pantry phone App.

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Abstract

AT&T tasked Penn State engineering students with coming up with a solution to an everyday problem utilizing the Internet of Things. Team 2 recognized a problem that occurs in the average person's kitchen, and they solved the issue of unorganized pantries with an intuitive app.

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Introduction

The engineering design class was assigned to design a product which would ameliorate the lives of people by connecting them more with the advanced technology that surrounds us. The team recognized that it becomes a hassle to sit and write down which grocery items are missing before going shopping. Moreover, it becomes much more of a mess when the person realizes he/she forgot to buy an item just because they forgot to write it down on their list of items. It is the age of communication; age of technology. Almost every adult who is economically stable has a device of communication; a phone. Smart phones are taking over the world as they make peoples lives easier. Keeping this fact in mind, the team decided to not only make the process of grocery shopping easier, but also use the technology of phone applications to get rid of this everyday problem.

Design Task

- **Problem Statement:** Pantries tend to be really disorganized causing food to be lost or expired without you realizing immediately. This causes you to lose money and is overall a major inconvenience since the consumer has to search through their pantry to find out if they have all the ingredients for a recipe.
- **Mission Statement:** Our goal was to design an effective product to help keep an inventory of all the items in your pantry so that when a consumer purchases groceries they immediately have an inventory of all of those items and when they are consumed, that information is also logged as well for easy access. When going shopping or determining if you have an ingredient required for a recipe, our product will make it quick and simple to find out the information the consumer needs so they know what items they need to purchase without spending time rifling through their pantry.
- **Design specifications:** Our product is an application for you Android smartphone or iPhone that allows you to enter in the groceries you buy and store them in the cloud for access on all of you devices connected with an easy to make account. There are two means of entering each item into our application. The first, and more convenient method is to use the scanning capability of your smartphone's camera to individually scan in each item when you unpack your groceries and when a good is used up. If you want to add groceries that do not have barcodes, such produce purchased at a local farm stand, you have the option to manually enter the information for any item and the application will recognize it and place the item in your inventory stored in cloud storage.

Design process/approach

Concept Generation –Brainstorming- Design Concepts

The team wanted to come up with a design that would satisfy all of the necessary criteria that the team believed would be most important to the consumer. The five design concepts were compared and contrasted in order to come up with a final design that would have the highest overall rating.

The three designs that were compared/contrasted with the final design of the barcode were as follows;

RFID Tags:



RFID technology is the wireless non-contact use of radio-frequency electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. RFID allows goods to be tracked as they are registered when they arrive at a new place and they are scanned out when they leave. The main problem with the RFID tag was its ease of implementation because it would be very expensive to get each and every manufacturer to implement a RFID tag in every good. This is not what the team is aiming for.

FIG. 2. RFID Tags

NFC Tags:



NFC is known as the near field communication technology and it is a lot like the RFID tag; however, it is more of a personal type of wireless. They are not specialized and they cannot be used from a distance, as their maximum range is about 4 inches. NFC chips are incorporated into the phone's circuitry and that how one can scan the tag on a restaurant menu and get the entire menu on the phone. The problem with this technology was mainly its degree of automation and ease of implementation. Like the RFID tag, the NFC tags would require a lot of effort and money to implement, as they would have to be placed on each and every good.

FIG. 3. NFC Tags



Manual Search:

Manual search is when you write down the things you purchase manually into the app, you would also have to remove the items manually every time it is finished. This is the most basic way to keep track of your groceries and it is not much of an advanced technology. The team did not choose this design option because of its low degree of automation and also it is not easy to use, as it would require the customer to do everything manually.

FIG. 4. Manual search

Description of the best design selected:



Barcode:

The team decided to go on with the idea of the barcode mainly because of its ease of implementation, ease of manufacturing, ease of use and its degree of automation. Barcodes are already present on consumer goods; therefore it would only require a cellphone that can scan in order to add it to a virtual inventory. As

scanning does not

FIG. 5. Barcode

require much effort, the three designs are all ranked highly, as opposed to the manual search, which is much less efficient. Overall, the design was ranked first with an average score of 8.25.

DESIGN MATRIX

Selection Criteria		CONCEPTS		
	BARCODE	RFID TAGS	NFC TAGS	MANUAL SEARCH
Ease of Use	+	+	+	-
Ease of Implementation	+	-	0	+
Degree of Automation	+	+	0	-
Ease of Manufacturing	+	0	+	+
Sum of +'s	4	2	2	2
Sum of 0's	0	1	2	0
Sum of -'s	0	1	0	2
NET SCORE	4	1	2	0
RANK	1	3	2	4
CONTINUE	YES	NO	NO	NO

Table 1. Design Matrix

Graded from 1-10					
	Bar Code	RFID Tags	NFC Tags	Manual Search	
Ease of use		7	9	6	3
Ease of implimentation		10	2	5	10
Ease of manufacturing		10	5	7	10
Degree of automation		6	10	5	1
Sum		33	26	23	24
^Winner					

Table 2. Concept Selection

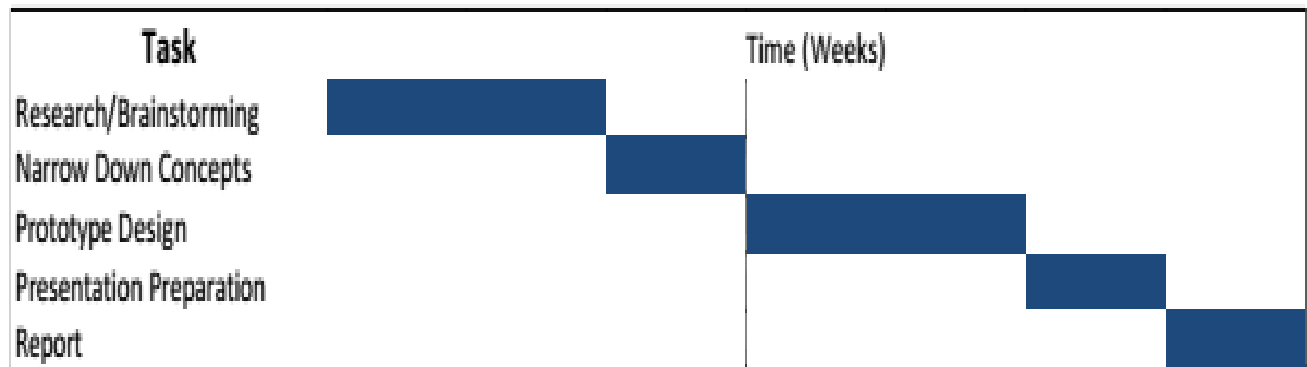


FIG. 5. Gantt Chart

Prototype/Model



Design Features: The final application would appear similar to this prototype. It would have a home screen with buttons to allow the user to quickly scan products in or out of his inventory, and a button to see said inventory. The driving principle behind the design of this layout is ease of use and readability. It is very easy to see what the functions of the application are, and how to access them.

Analysis

- The Internet of Things (IoT) is the network of physical objects accessed through the Internet, as defined by technology analysts and visionaries. These objects contain embedded technology to interact with internal states or the external environment.
- This product basically enables the user to be aware of what he/she has in his pantry through his virtual pantry. It makes it easier to see what he has through a list on his app instead of going through the actual pantry and looking for stuff. Furthermore, it makes his pantry more organized so the user could easily search through the list and see what he/she is missing. The user could also refer to the app before buying new ingredients to avoid buying something twice. Moreover, the app also gives you recipe recommendations. It also tells you what dishes you could make with the available ingredients, and what ingredients you are missing in order to make a specific dish you like. To sum up, this app could help you be more efficient in your day-to-day allocation of resources, ex: cooking.
- Concept of Operations: The app will hold every single item that you have in your pantry and make a list with it. The app will also give recipe recommendations with the available ingredients in your pantry and tell you what you are missing in order to make a certain dish.
- The app is not going to take a lot of bandwidth usage as it only sends signals to the server every time an item is added to your virtual pantry. Every user will have his own account, with a password; this makes him the only one who's able to view his virtual pantry. Furthermore, when the app scans the item, it encrypts the information and sends it to the online server, which is connected to your personal account.
- Economic viability: The only expenditure here is creating the app, which is not really a problem. Thus, it would easily make revenue if well advertised.

Summary and Conclusions

In order to summarize the project, one must go back to the beginning. The AT&T Corporation specifically tasked us with utilizing the Internet of Things to solve an everyday problem by developing a product to be used in the home, or perhaps even a vehicle. After being tasked with this problem, Team 2 concentrated their efforts on a more specific issue, the kitchen. The team discovered there was an opportunity for innovation that existed within the most overlooked of spaces, the pantry. With the help of Professor Xinli Wu, the team used all the resources offered within the confines of the Engineering Design 100 classroom to solve the problem of disorganized pantries. After a meticulous design process, Team 2 decided to utilize the universal technology present in almost every good purchased, the barcode. Other options ranging from the advanced RFID technology, to the most basic of all, manual entry, were also on the table, and through the beauty of the design process and use of matrices, Team 2 took the best of both worlds to create Smart Pantry. Briefly, the application Smart Pantry allows users to organize their groceries by scanning in the good's barcode, therefore placing it into a digital inventory. With this dynamic inventory the application, which can be accessed through any device with a unique account, is able to generate a grocery list based on items that have been scanned out of the inventory. Also, the application has the capability to take what exists in the inventory currently and develop a list of recipes that the user could throw together with the ingredients they already have. Smart Pantry takes advantage of an everyday technology to solve an everyday problem in a unique and simple way.

SMART PANTRY

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PROBLEM

- Pantries are disorganized
- Food is lost or forgotten
- Consumers lose money when goods expire



SOLUTION

- Electronic virtual inventory of items in pantry
- Inventory is kept up to date with a smartphone app
- Goods are identified by UPC barcodes– scanned in by cellphone camera



SMART PANTRY APPLICATION

- Taking advantage:
 - Smartphone barcode recognition capability
 - Universal presence of barcodes in grocery industry



HOW SMART PANTRY WORKS



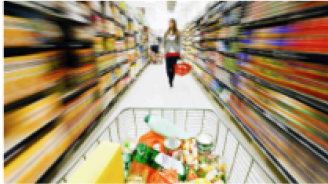
- Scan new groceries in the app, place in pantry or refrigerator
- When a good is consumed, scan items out on the app
- Smart pantry stores this information in a dynamic inventory

CAPABILITIES

- Pantry inventory management
- Grocery list generation
- Recipe recommendations



Brochure:





Just one Click!

It just got easier.

The application Smart Pantry allows users to organize their groceries by scanning in the good's barcode, therefore placing it into a digital inventory. With this dynamic inventory the application, which can be accessed through any device with a unique account, is able to generate a grocery list based on items that have been scanned out of the inventory.


Smart Pantry takes advantage of an everyday technology to solve an everyday problem in a unique and simple way.



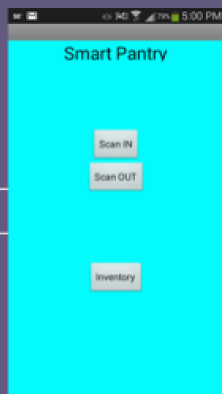
SMART PANTRY

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TEAM 2- EDSGN 100-Xinli Wu's Section 15



This product basically enables the user to be aware of what he/she has in his pantry through his virtual pantry. It makes it easier to see what he has through a list on his app instead of going through the actual pantry and looking for stuff. Furthermore, it makes his pantry more organized so the user could easily search through the list and see what he/she is missing.



- Holds every item that you have in your pantry.
- Makes a list of the items.
- Gives recipe recommendations.
- Tells you what items are missing for a certain dish.

More awareness, Less frustration.

When going shopping or determining if you have an ingredient required for a recipe, our product will make it quick and simple to find out the information the consumer needs so they know what items they need to purchase without spending time rifling through their pantry.

- The only problem would be that every item would have to be scanned in/out of the app; however, this is not considered much of an issue as it will help get rid of the shopping-list part; the list will be just one click away, always!