Initial Project Document

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BlackBox

A porch package protection system

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Group 3

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Project Narrative

Objective: Reduce package theft by creating a secure location for postal carriers to place packages on a customer's front porch.

Project Description: Ever since the U.S. Postal system was established in 1775, mail deliveries continue to be made to this day. With advancements in technology, it is easier to purchase a package from online stores such as Amazon and have it delivered to the customer in a short period of time (about two to four days). However, there are occasions where he/she orders an item that is too big to fit into a typical mailbox or requires customer verification; thus, it is delivered to the customer's front door (given that the mailman has the correct address). If any of the homeowners are not present to answer the mailman, consequently, the package is left at the front door. This is problematic since it leaves the item vulnerable to theft which causes issues for both the customer and the retailer.

Mail is unpredictable and can be delivered at any time. In some cases, mail can be delayed by unexpected environmental factors and it is unreasonable to attempt to make yourself available for such an erratic delivery time. One potential solution includes Front Door cameras; however, front door cameras and phone systems only provide information, not protection. If a theft occurs, even if it is caught on camera, there is little the police usually do because they are working on more important crimes.

To provide a solution to this, the "Black Box" project idea is formed to hopefully provide countermeasures to theft. The "Black Box" is a porch package protection system that will allow postal carriers to place deliveries inside of it whenever the customer is not presently there. Once the package is placed, it will keep the package secured using magnetic locks to prevent itself from being opened. It will then notify the user that the package has been delivered and is safely secured awaiting for it to be opened once the user is available.

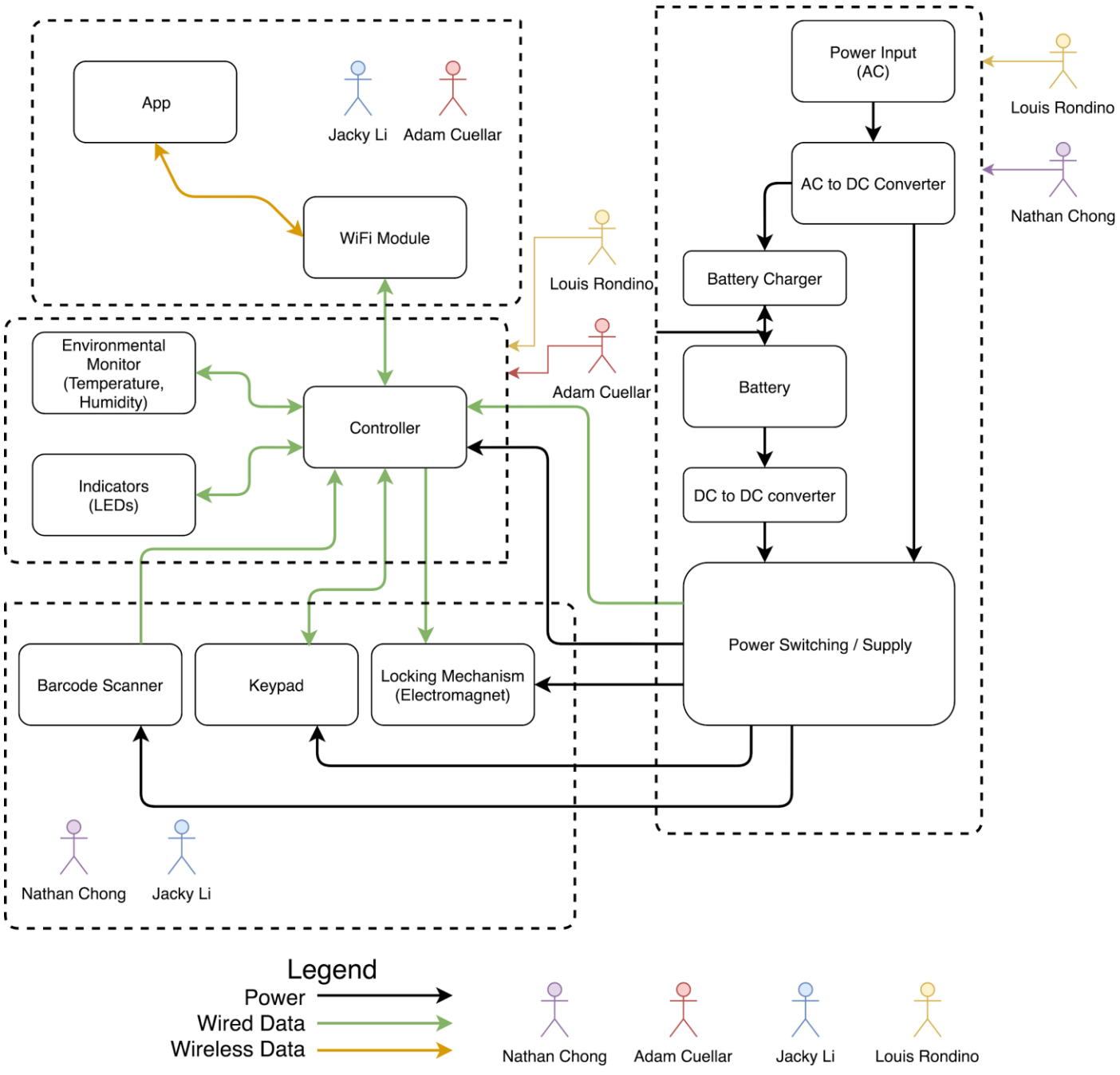
The motivations for this project are to demonstrate the knowledge and technical skills we gained from attending the CpE/EE curriculum at the University of Central Florida. Additionally, there are past experiences we have had from ordering an item online and having it delivered to us when we are not available to receive it. Leaving a package out in the open with the possibility of it being taken away is a disadvantage to all customers and producers; thus, the idea of keeping that package secured is what inspired us to come up with this project idea.

The project design can be described as a three dimensional metal container that is big enough to hold a few packages depending on the size. A barcode scanner with numbers based on the package barcode will be used to unlock the protection system. Electromagnetic locks will be used to keep the container locked and secured and is more ideal when compared to designing mechanical locks. Given that there may be heavy packages, the container should be able to carry a bulky weight. In addition to protection against theft, it should be able to withstand weather conditions such as thunderstorms, hurricanes, etc. The box will be tightly sealed, preventing any rain from entering it that could not only damage packages, but the electronic components in it as well. Since the box will be placed in front of porches, it must be drilled into the ground securely to prevent the box itself from being stolen.

Requirements / Specifications

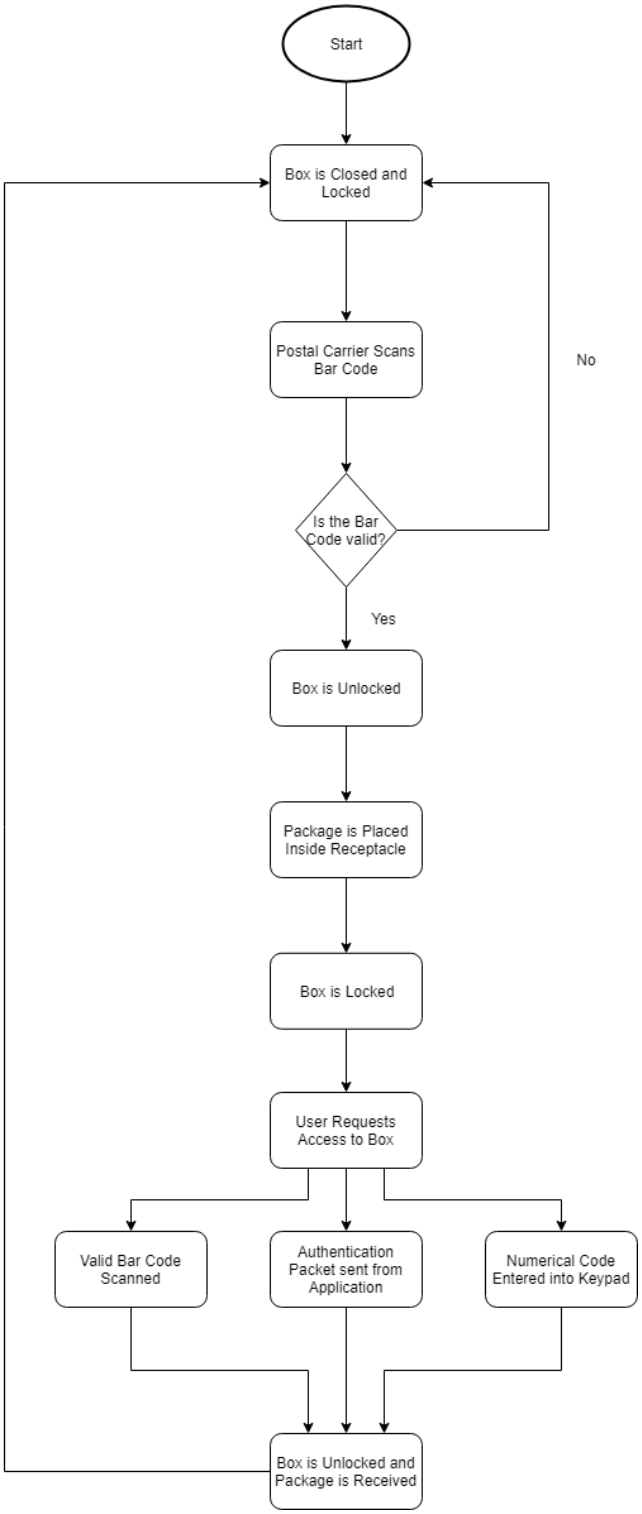
Classification	Description	Value/Units
C1	Device with Wireless Protocol - Unlock the box from a device using a wireless protocol.	
C2	Microcontroller - Used to implement locking/unlocking mechanism	
C3	Stored Energy - Box should operate continually for 1000 locking/unlocking cycles	Lock Cycles
C4	Cost - Affordable	Dollars
C5	Temperature Resistant - withstands extreme temperatures	Celsius
C6	Water Resistant - withstands light rain	Inches
C7	Electromagnet	Volts
C8	WiFi module range	Feet
C9	Thermal sensor	Degrees
C10	Barcode Scanner	
C11	Durable package receptacle	Length x Width x Height
C12	Plugs into House power	
C13	Back-up battery when there is an outage	Runtime

Hardware Diagram



All blocks are currently being researched.

Software Logic Flowchart



The diagram above displays a broad-spectrum of how our project is intended for use. To explain how the “Black Box” will work, it initially starts in the closed and locked stage. When the package delivery arrives, the postal carrier scans the barcode to verify that the requested package is delivered then places it inside if it is unlocked. The box proceeds to keep the item locked and informs the user that the package is received. The user has two ways of unlocking it, via barcode or a numerical code entered into the keypad.

Required Parts	**Pricing (Market + $5.00)**
Metal Box	**$100.00**
Keypad	**$30.00**
Electronic Magnetic Lock	**$30.00**
Thermal Sensor	**$8.00**
Barcode Scanner	**$30.00**
Wifi Module	**$15.00**
Battery	**$50.00**
Siren	**$20.00**
Power supply control/ AC to DC convertor	**$20.00**
Backup battery	**$50.00**
MCU	**$50.00**
Paint	**$10.00**
Waterproofing / packaging	**$50.00**
Apple Dev software	**$100.00**
PCB design, Final design	**$150.00**
LED lights for viewing at night	**$25.00**
Total	**$638.00**

Initial Project Milestones

Number	Mile stone	Completion date	Status	Responsible
Senior Design 1				
1	Project selection	Feb 1st	Completed	Whole Group
2	Divide & Conquer	Feb 1st 2019	Completed	Whole Group
3	Research requirements and preliminary components		In Progress	Whole Group
4	Submit 60 page draft	March 29th 2019	In Progress	Whole Group
5	Begin writing draft paper and early breadboard testing	March 29th 2019	In Progress	Whole Group
6	MicroController	End of semester	Research	Whole Group
7	PCB Layout	End of semester	Research	Jacky & Nathan
8	Begin research app development/ build	End of semester	Research	Adam & Louis
9	Recording & Data abstraction	End of semester	Research	Whole Group
10	Submit 100 page paper, continue breadboarding	April 12th 2019	Research	Whole Group

11	Revise components if needed, work on draft	End of semester	Research	Whole Group
12	Breadboard entire project, submit 120 page paper	April 22nd 2019	Research	Whole Group
Senior Design 2				
1	Test PCB design	TBA		Jacky & Nathan
2	Testing & Redesign	TBA		Whole Group
3	Combine Work with people in the group	TBA		Whole Group
4	Finalize prototype	TBA		Whole Group
5	Peer presentation	TBA		Whole Group
6	Final report	TBA		Whole Group
6	Final Presentation	TBA		Whole Group

Decision Matrix

Project	Cost	Sponsorship	Familiarity	Educational Goals	Motivation
Porch Package Protection System	$600+	No	9	7	10
Smart Lock	$500+	No	9	7	8
Smart RV	Sponsored	Yes	3	5	5