

# Secure Food Delivery Dropbox

**Electrical & Computer Engineering** 

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Problem



### **Growing Food Delivery Space**

 70% of College students order food delivery from places like (Doordash, Uber Eats, etc..) (CPS Daily News, 2022)

## **Few Safeguards in place**

- Food often gets
  - Stolen by drivers or porch pirates
  - Cold
  - Damaged



### **Our Solution**

### Secure dropbox

- Modified a locker with security and heating elements
- Easy for drivers to access
- User has constant information on status of their order

## How it works

- Box connects through wifi to user on a website
- User sends driver a one time code to drop off food
- User controls heating through app
- User uses 2 factor authentication to retrieve food









# **Power Subsystem**

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- 12V AC to DC Wall Plug
  - 12V up to 5A
- LM2596
  - 12V 4.7V up to 3A
  - Buck Converter Noise
  - Only used as a step down for the AMS
- AMS1117-3.3
  - 4.7V 3.3V up to 800mA
  - 2 of these 1 for ESP 32 1 for everything else







# **Control Subsystem**



### **Control Subsystem Overview**



#### • ESP-32-S3-WROOM-1-N4R2

- Wi-Fi
- 3.3V
- 4 MB Flash
- GPIO
- FTDI UART
  - ESP PROG
  - Pull Up Resistors
  - Debouncing Capacitors







# Authentication Subsystem

### **Authentication Subsystem Overview**



- 3X4 Keypad
  - Matrix scanning communication
  - Temp code for driver
  - Changeable master code for user

### RC522 RFID Scanner

- 3.3V
- Recognizes authorized tag
- SPI Communication





# Box Mechanics Subsystem

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### **Box Mechanics Subsystem Overview**



- Solenoid lock
  - 12V
  - Controlled by BJT (TIP 120)
  - Inductor pulls a spring
- 0-5kg Load cell
  - 3.3V
  - 5kg strain gauge
  - HX711 analog to digital amplifier













### **Heating Subsystem Overview**





- DS18B20 Temperature Sensor
  - 3.3V
  - One Wire Communication
- Polyimide Heater
  - 12V
  - Controlled by BJT (TIP 120)





# User Interface Subsystem

### **User Interface Subsystem Overview**



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# Design Process.



### **Block Diagram**

Key:

Power

Protocol



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### **Original PCB and Schematic**





**Final PCB** 





### **Final Schematic**



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### **Power System Verification**



•	Buck convertor outputs 4.7V
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- Linear regulator outputs 3.3V
- AC to DC converter outputs 12V

Requirements		Verification	
1.	The DC to DC buck converter must take a 12V input and output a 4.7V output	1. Measure the voltage across the output of the DC to DC buck converter using a multimeter and verify that it is 4.7 Volts.	
2.	The AMS 1117-3.3 linear regulator must take a 4.7V input and output a 3.3V output when being powered by the barrel jack connector	2. Measure the voltage across the AMS 1117-3.3 Vout pin and GND pin using a multimeter and verify that it is 3.3 Volts.	

#### **Output of AC to DC converter**



#### **Output of the Buck Converter**



#### **Output of the Linear regulator**



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### **Control System Verification**

- All inputs are recognized by ESP
  - Keypad presses
  - RFID tag
  - Correct sequences unlock
  - Heater toggle
- ESP can be programmed

Card UID: DE AD BE EF Correct RFID - Waiting for 2FA

Card UID: BA AD F0 0D Incorrect RFID - UID Not Accepted

Card UID: DE AD FA CE Incorrect RFID - UID Not Accepted

Key	Pressed:	1
Key	Pressed:	2
Key	Pressed:	3
Key	Pressed:	4
Key	Pressed:	5
Key	Pressed:	6
Key	Pressed:	7
Key	Pressed:	8
Key	Pressed:	9
Key	Pressed:	*
Key	Pressed:	0
Key	Pressed:	#
Inva	alid code	
Key	Pressed:	3
Key	Pressed:	4
Key	Pressed:	5
Key	Pressed:	6
Key	Pressed:	#
Temr	code Unlo	ocked

Temperature:	21.3 C	
Temperature:	21.5 C	
Temperature:	21.7 C	
Temperature:	21.9 C	
Temperature:	25.5 C	
Temperature:	27.2 C	
Temperature:	29.0 C	
Temperature:	32.1 C	



### **Heater Safety**

Verification

1a Turn the heater on

using the enable heater

be 32 degrees Celsius or

1c. Once it is 32 degrees

button is off and verify by

viewing the heater directly

1d. Try to turn the heater

on when the temperature is over 31 degrees Celsius

and verify that it does not turn on until it is below 31

Celsius or more, check

that the heater enable

button on the website

1b Wait for the

more.

temperature sensor reading on the website to

Requirements

1

The heater will

turn off within

30 seconds after

the temperature



Heater will not turn on again until below 31°C



degrees Celsius

### Load Cell Verification

• Load Cell Should Detect Weight of 40 Grams or More Within 20 Seconds









### Conclusion

## Challenges

- Inconsistent inputs
- Shipping and Construction time constraints
- Programming the ESP

### **Takeaways**

- Iterative problem solving
- PCB design and construction
- Embedded Programming

## **Next Steps**

- Neater Presentation
- Add insulation
- Digital display for authentication





# Questions