Mail Gobbler 9000

Team 31

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Problem Statement

Ongoing Pandemic (1+ years)

- Package Security
- Closing of retail stores
 - Transition to online shopping

Mail Gobbler 9000 Specifications

- Authentication of received packages via barcodes
 - Using a barcode scanner
- Mobile App
- Lock/unlocking mechanisms via solenoid lock
 - Unlock request from App
 - Correctly Identified Barcode Scan
- Low-Power System
 - Swappable recharge batteries
 - Backdoor safeguard



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System Overview

- 1. The mailbox can be opened in 2 ways:
 - successful barcode scanned from delivery personnel.
 - User issued an unlock request via application
- 2. On a successful unlock, box will stay on for 2 minutes before turning off.
- 3. Mailbox communicate with AWS database wirelessly.
- 4. User app allows user to set up mailbox wifi manually.
- 5. Remains locked if the presented barcode does not exist.



Functionalities overview



CDR Deliverables

General Deliverables:

- 1. Fully working and presentable prototype.
- 2. Full functionality, even if still using break out boards and single board computers (Arduino etc.).
- 3. At Least a blank PCB.

Finished Progress:

- 1. Working integrated system using breakout board [Luan & Adam]
- 2. PCB Design [Luan]
- 3. Team Website [Brendan]
- 4. AWS Communication (Hardware Software) [Brendan]
- 5. Mobile App [Jackie]



Hardware & Software

Hardware Modules

- □ Wi-Fi Module (ESP-8266 Node MCU)
- Microcontroller (ATMEGA328P-PU)
- □ Barcode Reader (PS/2)
- Solenoid
- Rechargeable Battery (12-Volt 7AH)
- Miscellaneous: LED, Capacitors, Diodes, Resistors, and Inductors

PCB Modules

- □ Altium PCB Designer Tool
- Atmel Studio

Backend Modules

Amazon Web Services (AWS)

- IoT Core
- Lambda
- AppSynch
- DynamoDB
- Cognito
- □ SNS

Frontend Modules

- □ xCode (Swift)
- Google Drawing
- Github

Website Modules

- □ HTML/CSS
- Github Pages









Software Functionality Block Diagram



Current Prototype





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Hardware Functionality Block Diagram





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Integrated System Demo

1. Demo App

- 1.1. Show Initial Log-in
- 1.2. Show barcode log (one item)
- 1.3. Add barcode, show new log
- 1.4. Delete just added barcode

2. Demo Backend

- 2.1. Visual of DynamoDB (NoSQL)
- 2.2. Visual of Notification

3. Demo Hardware

- 3.1. Scanner Unlock Demo
- 3.2. Mobile App Unlock Demo



Demo App

https://github.com/MailGobbler9000/iOS





AWS Demo

- Visual of Database
- Quick Recap of End to End Connection
- Uploaded Barcode Example
- Visual of Notification

Q	Find items		
	barcode ⊽	value	
	075720000	Delivered	
	MARTEST	Delivered	
	MDR	Delivered	
	NEWTEST	Not Delivered	
	FEBTEST	Delivered	

AWS Notifications <no-reply@sns.amazonaws.com> to me 👻</no-reply@sns.amazonaws.com>	6:47 PM (0 minutes ago)	☆	*	:				
Barcode: 2348902309 has changed status to Delivered.								
If you wish to stop receiving notifications from this topic, please click or visit the link below to unsubscribe: https://sns.us-east-1.amazonaws.com/unsubscribe.html?SubscriptionArn=arn:aws:sns:us-east-1:531782831217:MG9K_email:c94e973a-e974-4b11-aea8- a7b3029e288a&Endpoint=btruong413@gmail.com								
Please do not reply directly to this email. If you have any questions or comments regarding this email, please contact us at https://aws.amazon.com/support								
Reply Forward								



MG9K Physical Demo *Backup Video in case of Live Demo Failure

Schematic Overview

- **Primary Components**
- U1 denotes the 3.3V DC/DC buck converter.
- U2 is ATmega328P microcontroller
- U3 is ESP-WROOM 02 wifi transceiver.

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 Node MCU only for prototyping.



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Schematic Overview

- Secondary Components:
- Solenoid connects to 12V battery and also parallel with a diode.
- BJT as a switch to turn solenoid on/off depending on conditions.
- Scanner to scan incoming barcode from delivery.
- Tactile Switch as power button.

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• LED for indicating if system is ready or not.



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PCB Integration

Designed using
 Altium Designer

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PCB Integration

Placements of primary parts:

- U1: Voltage Regulator
- U2: ATmega328P Microcontroller
- U3: ESP Wifi Transceiver
- Top right: Power supply





PCB Integration

Placements:

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- Blue boxes represent pads use for external wirings:
 - Allows external wiring to the PCB board.
 - First reason being: flexible and less time consuming for prototyping and soldering purposes.
 - A lot of components also rely on external wirings.
- Yellow boxes represent voltage test points
 - Test points allow us to probe and measure voltage after soldering.



PCB Integration

- PCB trace:
 - Certain distance apart to avoid crosstalks
 - Appropriate width for current and temperature.
- GND and 12V polygons pour to stabilize GND and 12V nets.
 - No need to separate Digital and Analog Ground.
 - Polygon pours are more stable than traces.
- Layout and Layers:

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- 2 layers PCB low speed, simple circuit.
- Requires some external connections to breadboard (for example solenoid, scanner).



Transition from CDR to FPR

PCB Fix

- 1. Wifi Transceiver antenna needs to be exposed (boxed in red)
 - ESP Wroom's antenna need to be exposed and unhindered by any copper traces or polygons.
 - Because these copper materials can interfere with the wifi signal.

PCB Improvements

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- 1. Solder Components onto PCB.
- 2. Voltage Source Noise Reduction via Decoupling Capacitors.
- 3. Choosing the better passive models (R, L, C) for PCB schematic. Making soldering easier.
- 4. Transition of Microcontroller and Wi-Fi Module



FPR Responsibilities

Individual Responsibilities

- 1. [Luan] Testing and Soldering PCB
- 2. [Adam] Build Physical Box and Incorporate Components
- 3. [Jackie] Verify and Improving PCB
- 4. [Brendan/Jackie] Take lead of SDP Report

Group Responsibilities

- 1. Migrate Arduino Code to C/C++
- 2. Write SDP Report



Gantt Chart

					CDR	Draft SDP Report		FPR	Demo Day	Final SDP Report
-	Task Name	Start Date	End Date	Team Member	April 2nd	April 9th	April 16th	April 23rd	April 30th	May 4th
Hardware					a design of the second second					
	Verifying and Improving PCB	April 2nd	April 9th	Jackie						
	Testing and Soldering PCB	April 2nd	April 9th	Luan						
	Migrate Arduino code over to breadboard	February 26th	March 5th	Everyone						
Dropbox Design										
	Build and Finalize Physical Box	April 2nd	April 9th	Adam						
	Incorporating PCB into physical box	April 9th	April 2nd	Adam	10 					
SDP Report		-	-							
	Initial SDP Report	April 2nd	April 9th	Everyone						
	SDP Report Revision/Finalization	April 9th	May 7th	Everyone						
Initials Key:										
B.T.	Brendan Truong									
L.V.	Luan Vo									
J.C.	Jackie Chan									
A.C.	Adam Cytrynowski									



Project Expenditures

Budget	Current Total Cost	Remaining Budget			
\$500.00	\$285.47	\$214.53			
Circuitry Costs	Link	Status	Unit Price	Quantity	Total Cost w/Shipping
Rechargeable Lithium Battery	https://www.homedepot.com/p/	Own	\$17.50	2	\$40.99
Battery Charger	https://www.amazon.com/Peleu	Own	\$10.99	1	\$10.99
ESP- Wroom - 02	https://www.digikey.com/en/pro	Own	\$2.70	6	\$29.80
USB Host BOB	https://www.digikey.com/produc	Own	\$4.50	1	\$4.50
Scanner	https://www.adafruit.com/produ	Own	\$69.95	2	\$151.30
2-Layer PCB	jlcpcb.com	Own	\$0.40	5	\$19.80
Box Construction Costs	Link	Status	Unit Price	Quantity	Cost w/Shipping
12 oz. #P140-7 No More Dram	https://www.homedepot.com/p/	Own	\$5.98	1	\$11.97
Construction Box Materials	From Shira	Own			
Gorilla Dual Temp Mini Hot Glue Gu	https://www.amazon.com/Gorilla-840	Own	\$12.49	1	\$12.49
Masking Tape	https://www.amazon.com/Scotch-Offi	Own	\$3.63	1	\$3.63



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Closing Remarks

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Questions?

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Trace Width Calculator

- 2 calculations were made each with different current load.
- The bulk of our traces are between 20mil to 25mil.
 - Since this is a simple, low speed PCB
 - And ... a lot of empty spaces.
- Traces carrying 1A are unlikely. Unless they are directly connected to the power source.
 - Polygon pour is used for the PWR plane instead of traces to stabilize these nets.

Inputs:	_ Inputs:									
Current	1		Ai	mps	Current	nt 0.5		A	Amps	
Thickness	1			z/ft^2 🗸	Thickness	1			z/ft^2 🗸	
Optional Input	ts:			Optional Inputs:						
Temperature R	ise	10		Deg C 🗸	Temperature Rise		10		Deg C	~
Ambient Temperature		25		Deg C 🗸	Ambient Temperature		25		Deg C	~
Trace Length		1] [inch 🗸	Trace Length		1		inch 🗸]
Results for Int	ternal L	5:		Results for Internal Layers:						
Required Trace Width		30.	8	mil 🗸	Required Trace Width		11.3	8	mil ·	~
Results for Ext	ternal L	s in Air:		Results for External Layers in Air:						
Required Trace	Width	11.8	3	mil 🗸	Required Trac	e Width	4.5	5	mil •	~
a)	1A	cur	rent		b)	0.5A	CU	rrent		



Presentation & Demo 5% • Presentation must include Problem Statement & System Specifications • Includes the list of CDR deliverables (as submitted in ECE 415) • Begins on time, has been practiced & rehearsed

Teamliness and professionalism

Rubric

(4.0) The presentation and demo were excellent.

(3.0) The presentation and demo were good.

(2.0) The presentation and demo were fair.

(1.0) The presentation and demo were unsatisfactory.

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Integrated System

45%

Demonstration of the integrated system

Meets the milestones set by the CDR deliverables

• Discusses which system specifications are currently satisfied by the current prototype and which are yet to be met

Rubric

(4.0) A demonstration of a fully functioning, integrated system (team is on schedule to FPR).

(3.0) A demonstration of a mostly functioning, integrated system (team is slightly behind schedule to FPR).

(2.0) A demonstration of a partly functioning, integrated system (team is significantly behind schedule to FPR).

(1.0) The demonstration was unsatisfactory (the evaluators have major concerns about the team's progress towards FPR).

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Documentation of the Current Prototype

15%

Describes the current prototype

Includes diagrams & lists for hardware & software

· Includes any other relevant documentation

Rubric

(4.0) Documentation of the current prototype is excellent (clear and complete).

(3.0) Documentation of the current prototype is good (mostly complete, but some details are missing or unclear).

(2.0) Documentation of the current prototype is fair (missing or unclear on significant portions).

(1.0) Documentation of the current prototype is unsatisfactory.

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Custom PCB

15%

Populated or blank PCB in hand

Schematic and board layout are shown and explained

Rubric

(4.0) The custom PCB (fabricated) is in the possession of the team.

(3.0) The custom PCB was ordered, but has not yet arrived.

(2.0) The custom PCB has not yet been ordered.

(1.0) The custom PCB design progress is not satisfactory.



FPR Plan

15%

• Describes the planned FPR version of the system. Highlight changes between current and FPR versions

Plan for testing the project for compliance to system specifications

Plan for hardening the prototype

Plan for FPR demonstration

Rubric

(4.0) Plan for FPR is excellent (clear and complete).

(3.0) Plan for FPR is good (mostly complete, but some details are missing or unclear).

(2.0) Plan for FPR is fair (missing or unclear on significant portions).

(1.0) Plan for FPR is unsatisfactory.



Project Management Plan

5%

Gantt chart from CDR to FPR

Expenditures (current & projected)

State team member responsibilities from CDR to FPR

Rubric

(4.0) Project management plan is excellent (clear and complete).

(3.0) Project management plan is good (mostly complete, but some details are missing or unclear).

(2.0) Project management plan is fair (missing or unclear on significant portions).

(1.0) Project management plan is unsatisfactory.

