

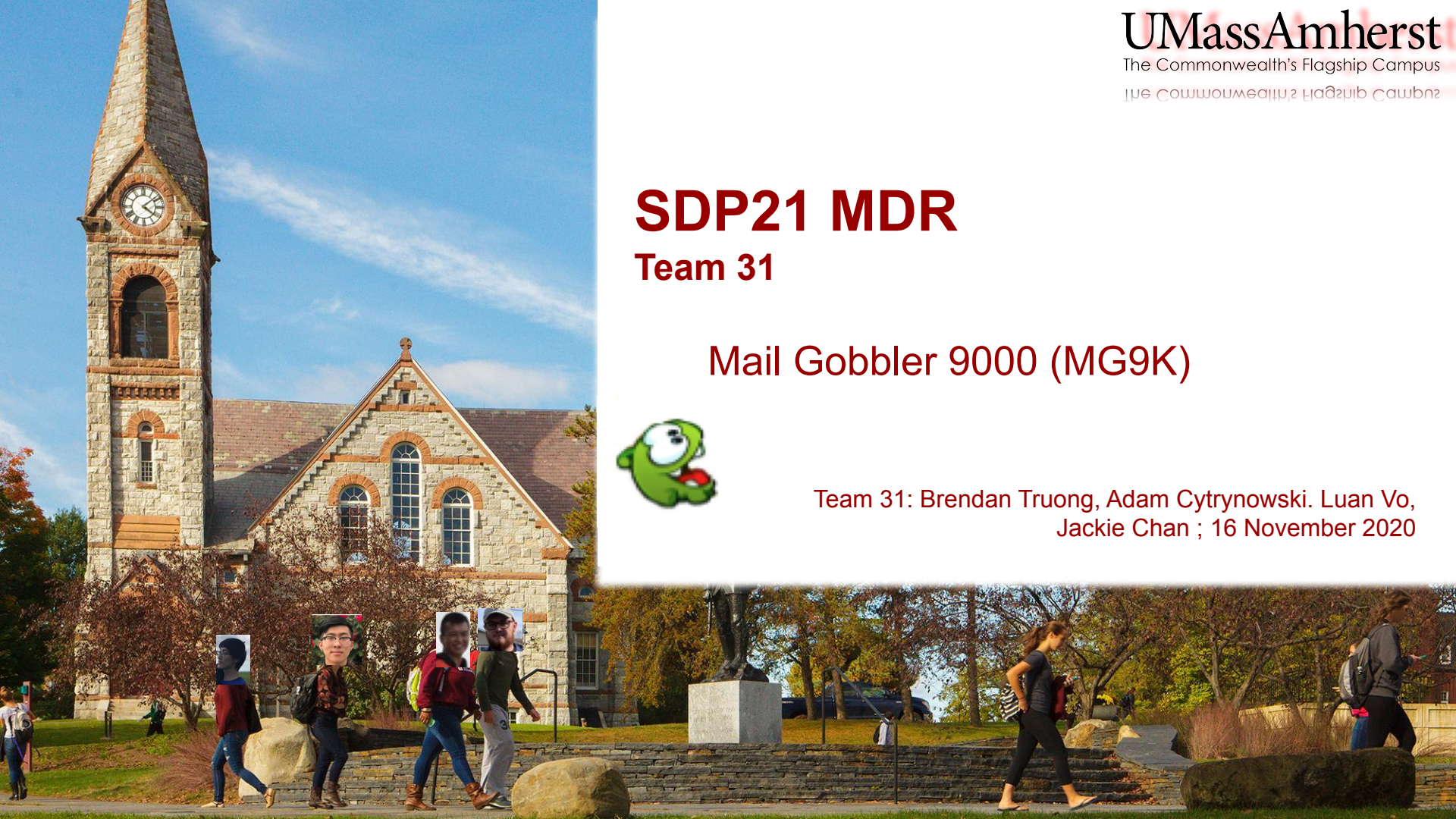
SDP21 MDR

Team 31

Mail Gobbler 9000 (MG9K)



Team 31: Brendan Truong, Adam Cytrynowski, Luan Vo,
Jackie Chan ; 16 November 2020



Brendan Truong

Team Leader and Backend Developer

Jackie Chan

Budget Management and Front-end Developer

Luan Vo

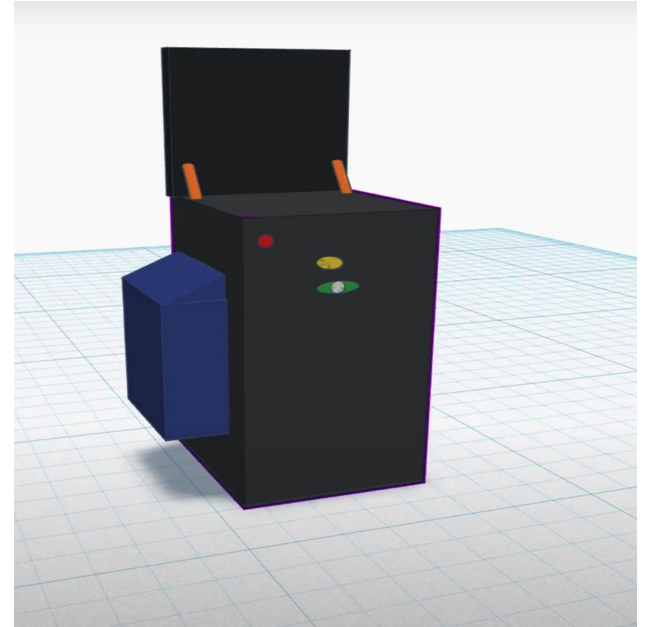
Hardware and Circuit Designer

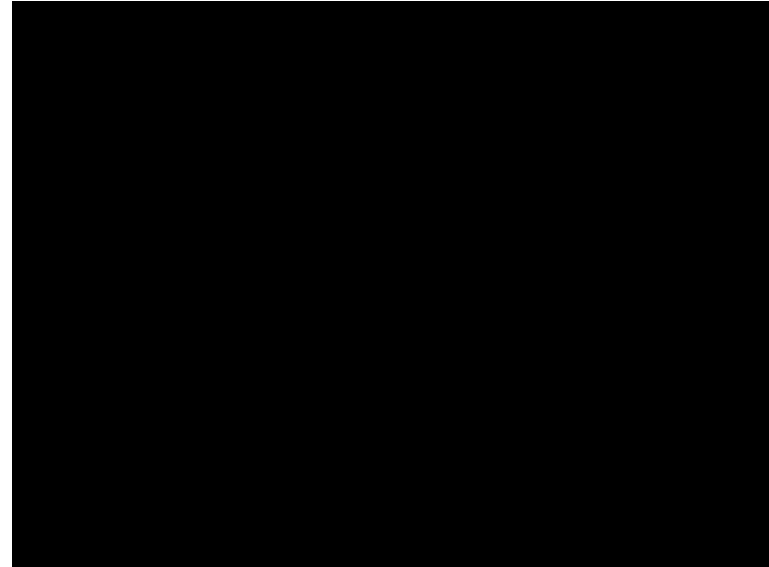
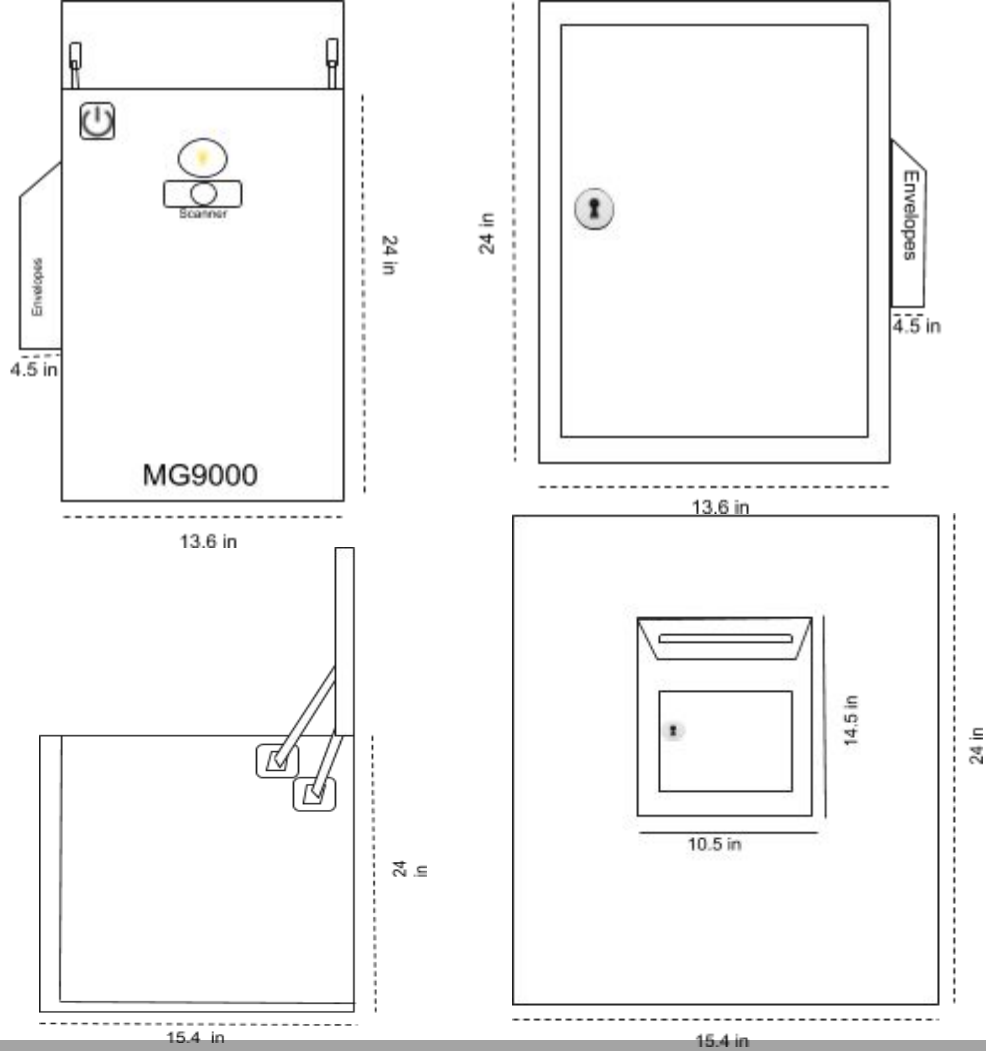
Adam Cytrynowski

Communication Specialist and Box/Website Designer

Mail Gobbler 9000 (MG9K)

- Smart drop-box for postal security
 - Barcode Authorization
 - Quality of Life
 - Delivery notifications
 - Multiple unlocking mechanisms
 - Historic logs
 - Power-efficient & low cost

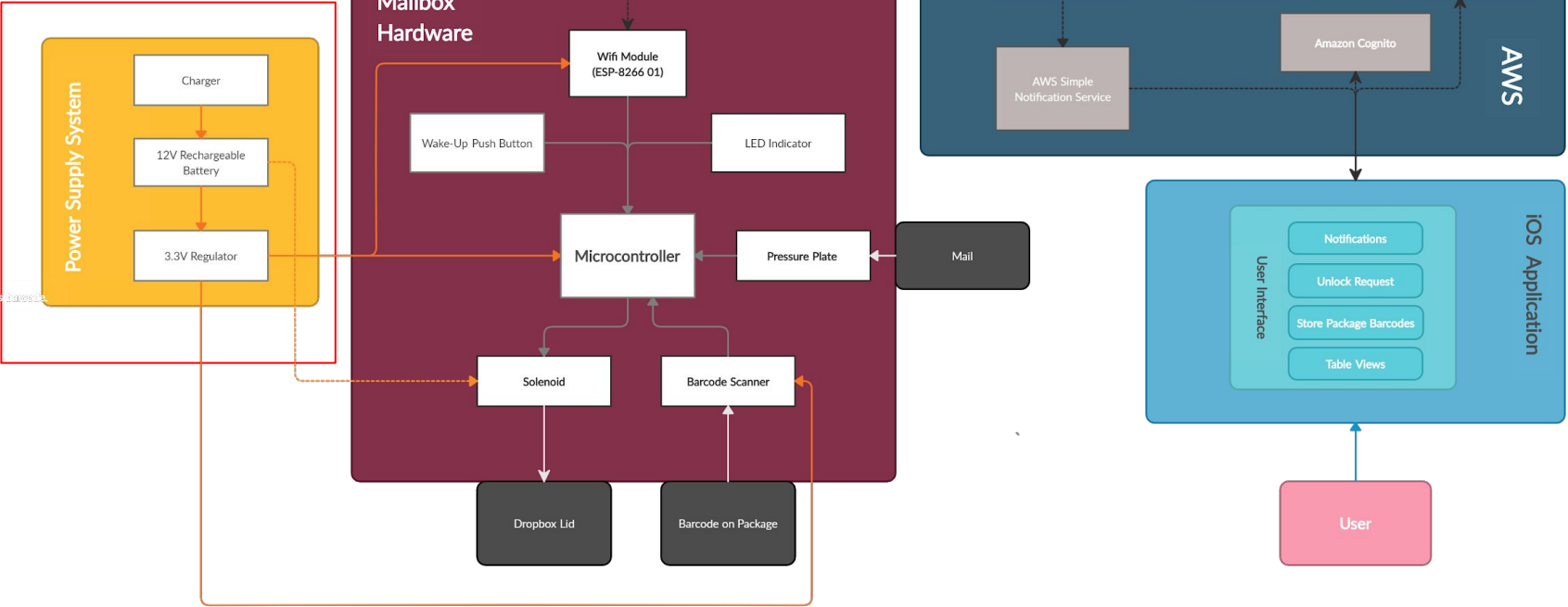




Product Statement and Specifications

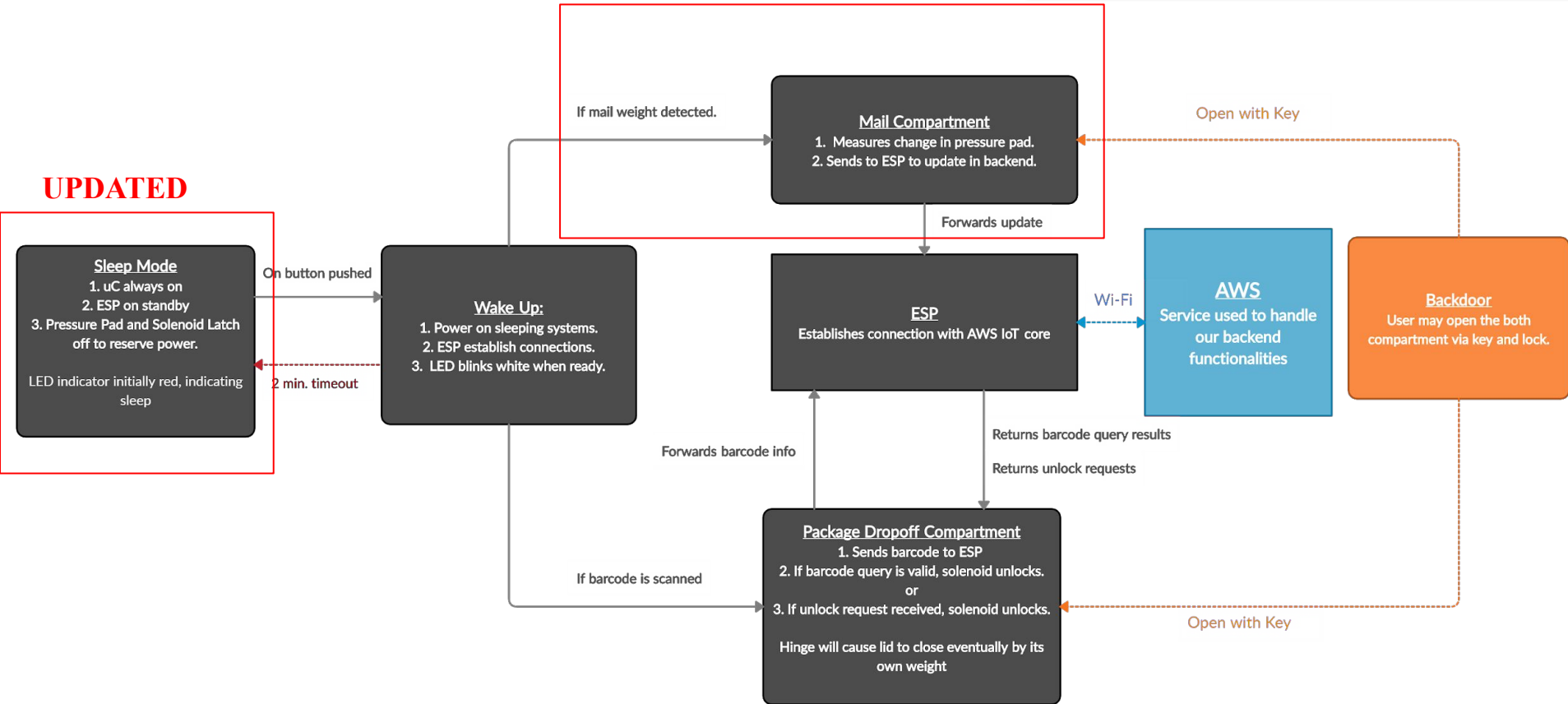
System Block Diagram

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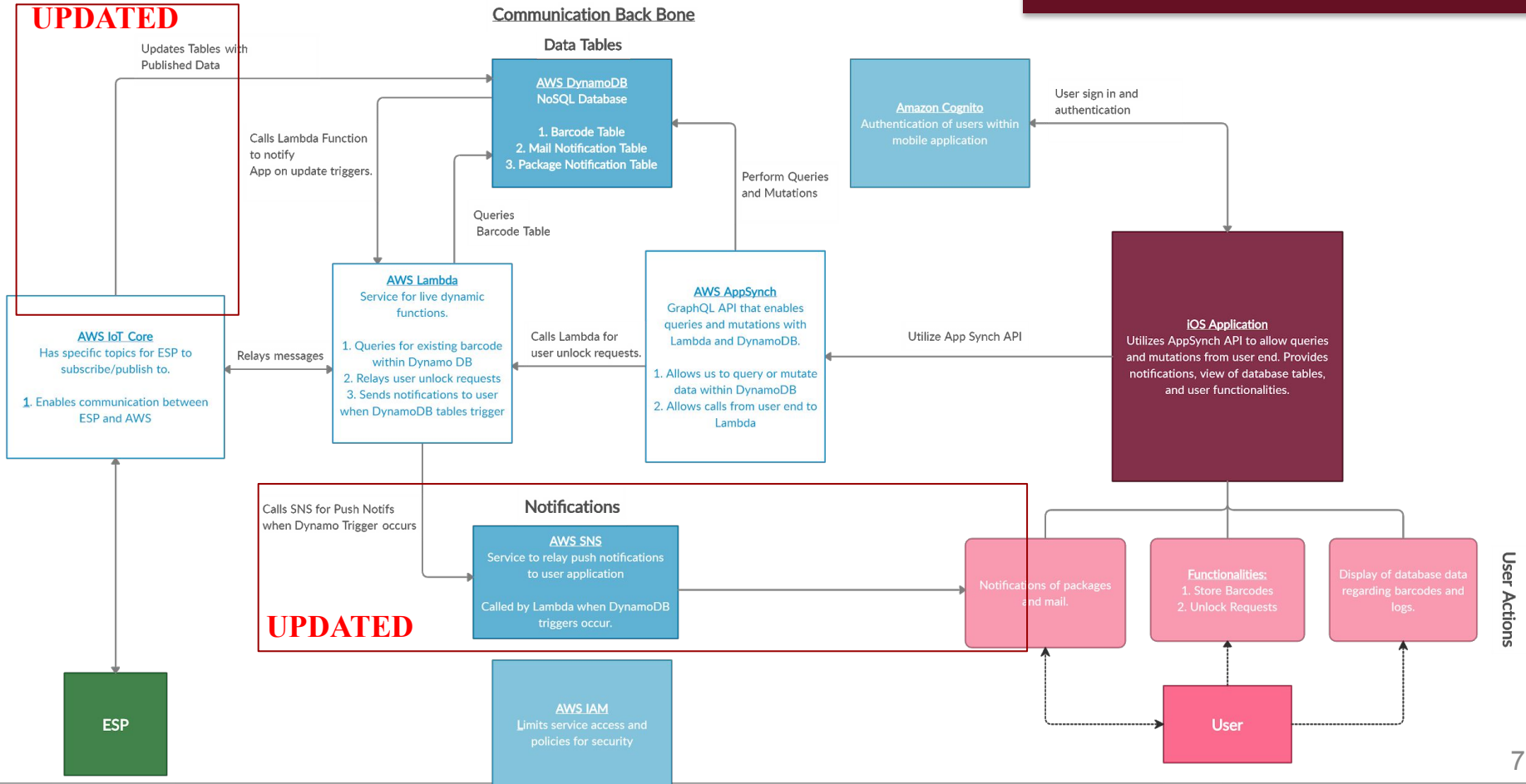


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Software Functionality Block Diagram



User Actions

1. Set up subsystem's various hardware functionalities.
2. Program ESP for data reception and communication.
3. Develop AWS Backend for cloud computation and data storage.
4. Code Mobile Application for user interaction

Success in each subsystem allowed complete end to end communication, from ESP through the backend to the Mobile Application.

Brendan's Subsystem (Backend AWS)

Detailed Responsibilities

1. In charge of communication between the team and faculty, monitoring the team's progress, and keeping the team on track and productive.
 2. In charge of developing system's backend with AWS, and ensuring full end to end connection.
-

Subsystem entails the AWS backend functionality for the project, which encompasses services for data storage, manipulation and cloud computing. Main services are as follows:

1. **AWS IoT Core**

Set up "Thing" in AWS with proper policies and rules for specific topics.

2. **AWS Lambda**

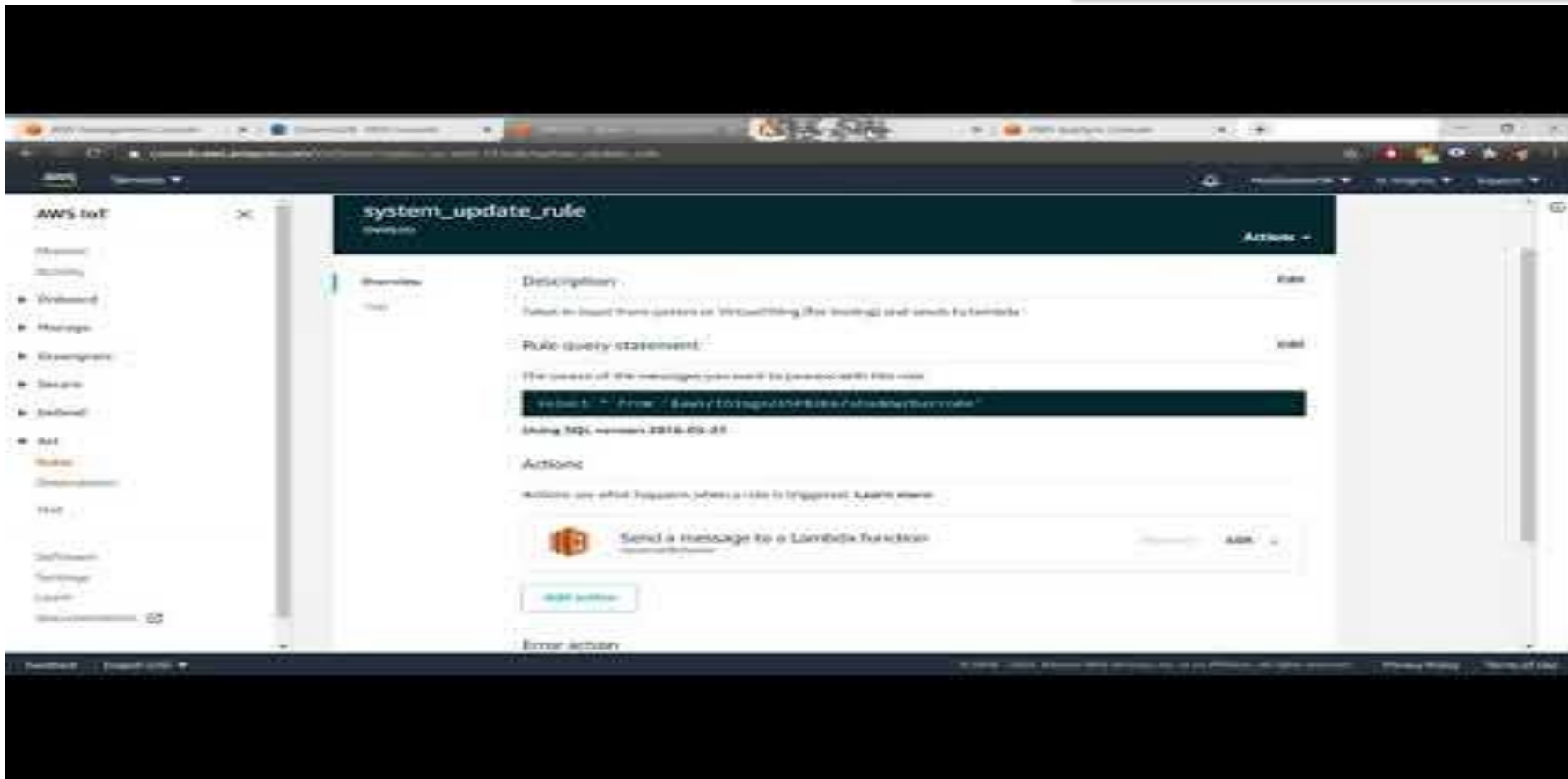
Coded dynamic javaScript functions to communicate with IoT Core and manipulate tables.

3. **AWS DynamoDB**

Created three essential tables to hold data. Includes barcodes, package logs, and mailing logs.

4. **AWS AppSync**

Designed and programmed a GraphQL API for queries and mutations.



Jackie's Subsystem (Front End Application)

Detailed responsibilities:

1. Front-end developing of an application that allows the user to upload barcode, send unlock request, **receive historic logs**.
2. Ensuring team's expenses do not exceed allocated budget and serving as liaison between the team and purchasing coordinators.

App Creation:

1. **xCode**

IDE created by Apple for the development of iOS Apps.

2. **Google Drawing**

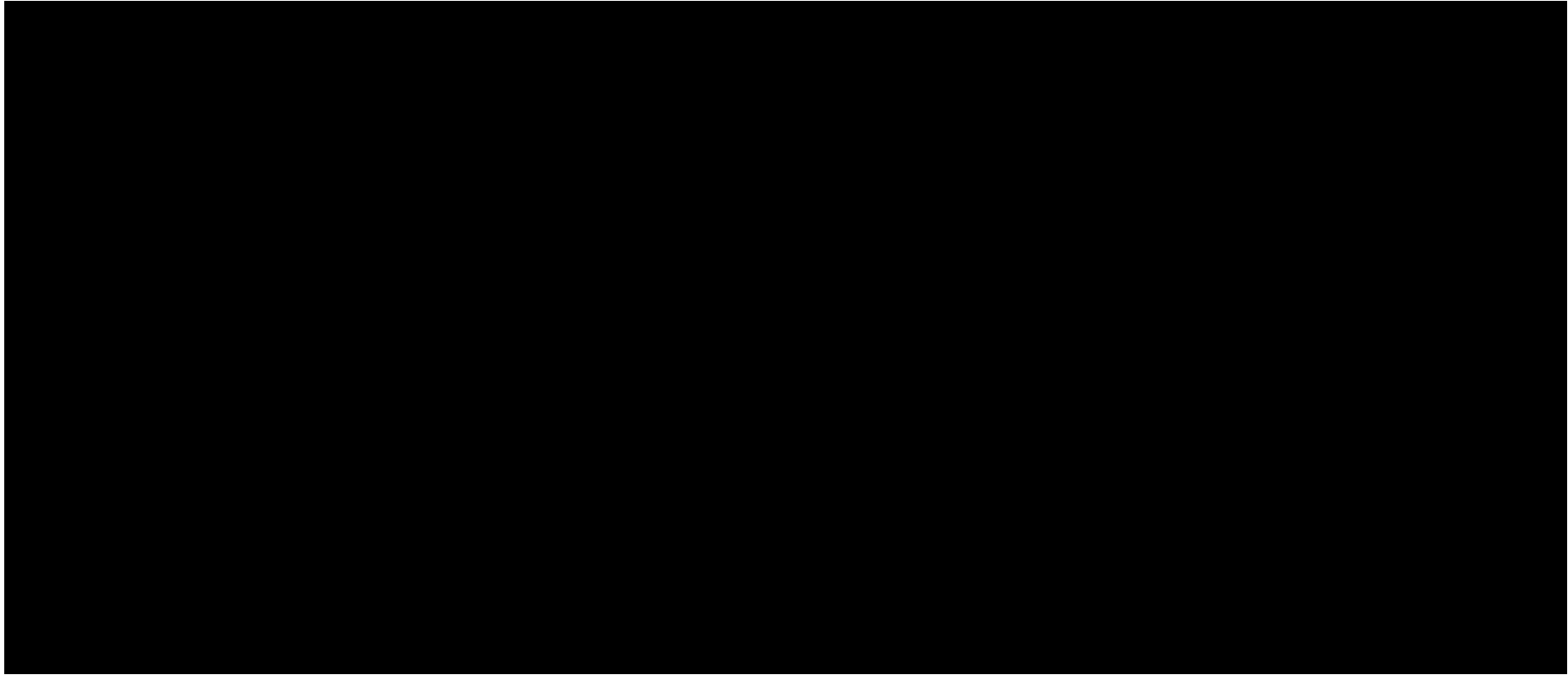
Allows for the use of shapes to create charts and diagrams.

3. **Github**

Hosting service that offers source code management.



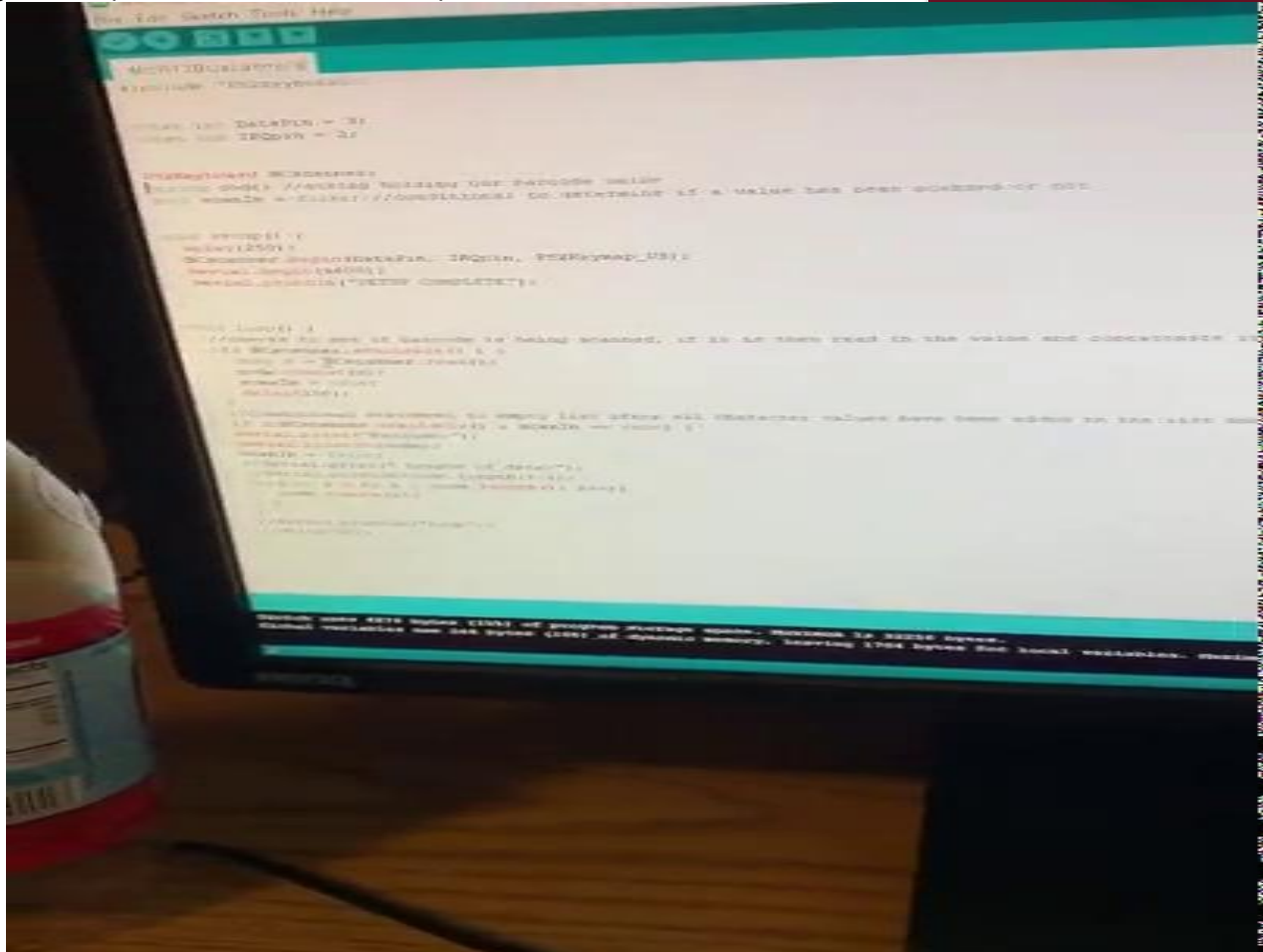
Jackie's Portion (Front End App)

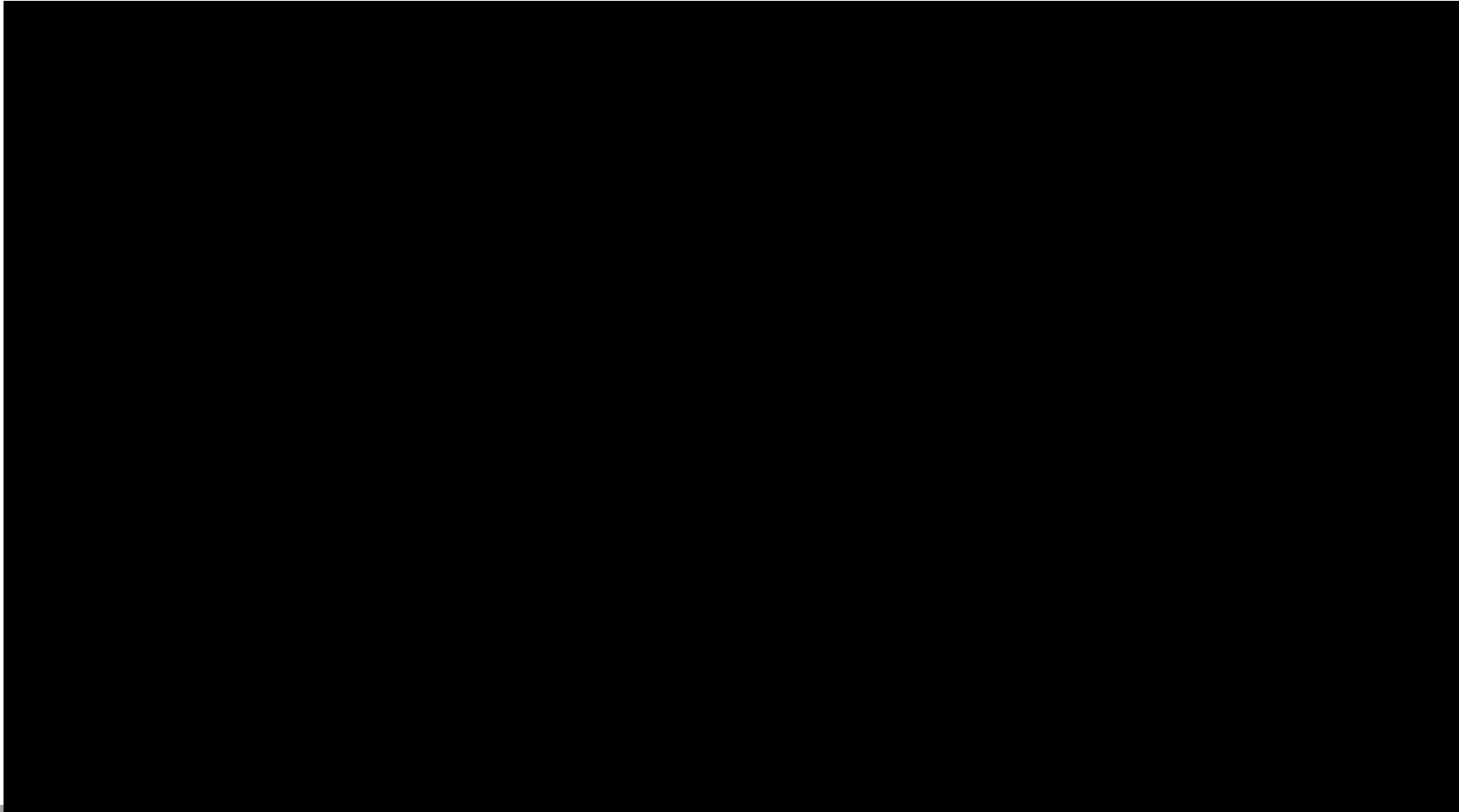


Detailed responsibilities: In charge of ensuring the smooth communication between ESP and AWS IoT. Brainstorming mailbox's mechanic for the actual production phase, and oversees the functionality of the mailbox, and scanner's physical interactions with its surroundings. Assists in website development

Demo Showcases:

1. MCR12 Barcode Scanner - Scanner Functionality
2. ESP to Backend Interaction - MQTT communication with AWS

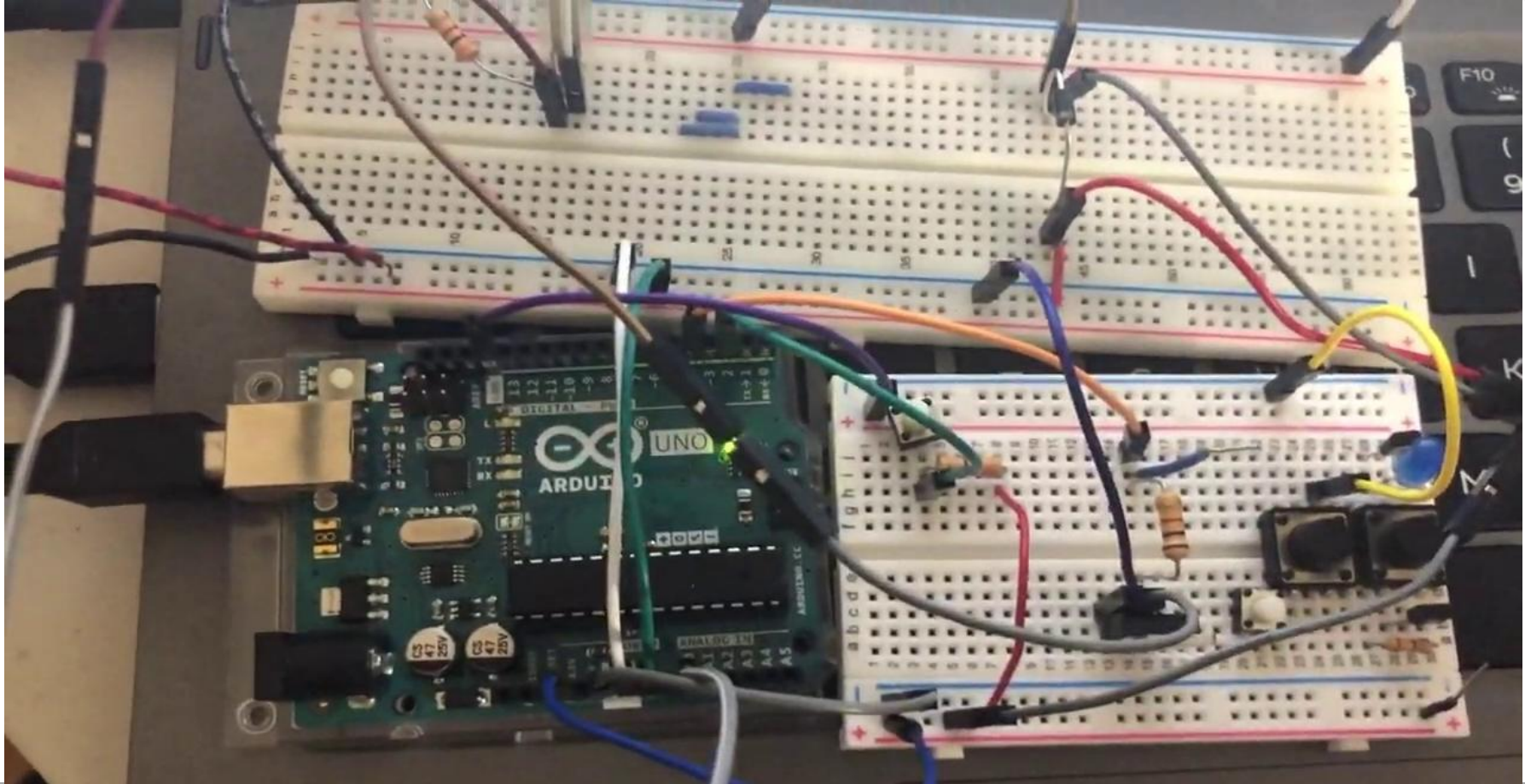


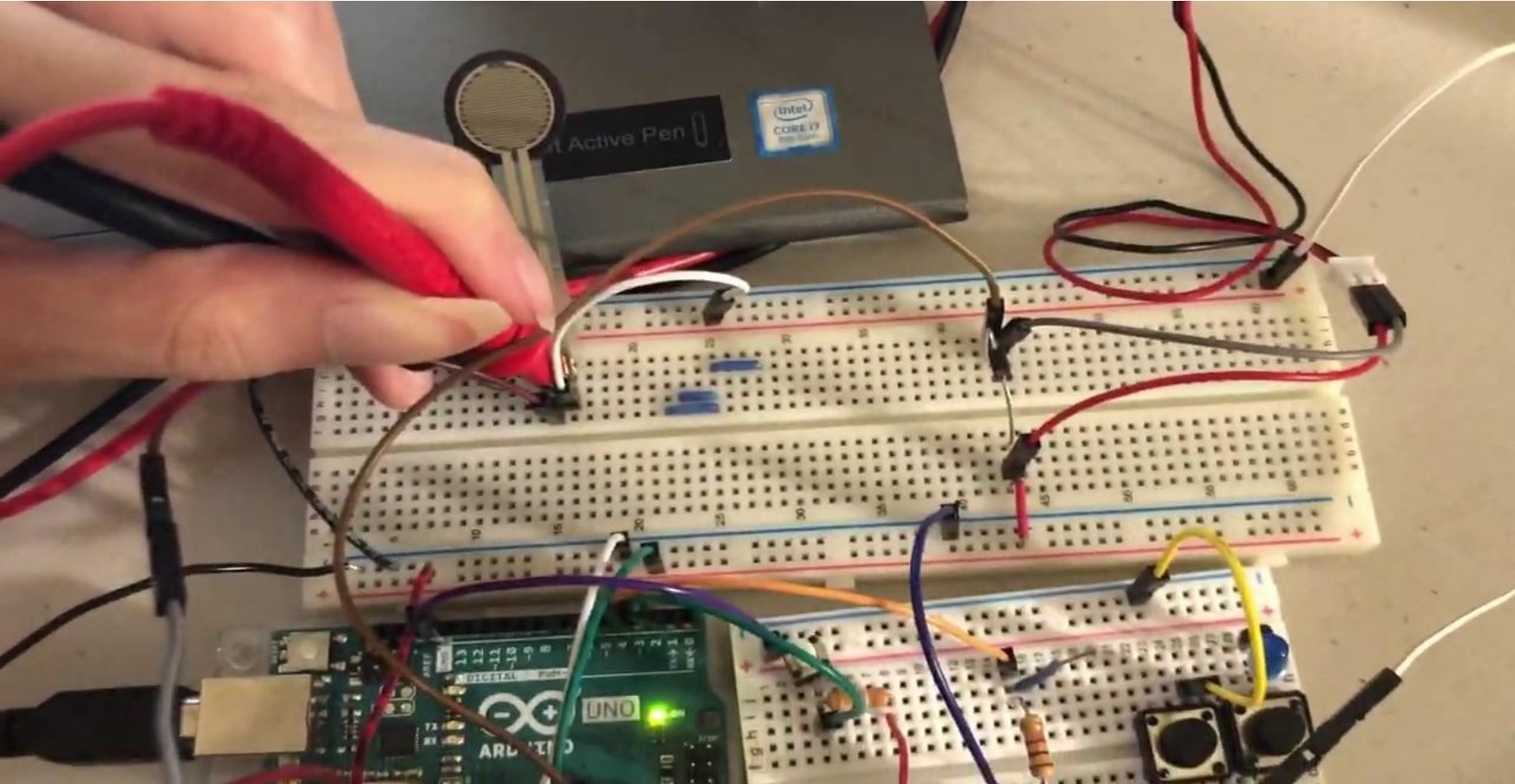


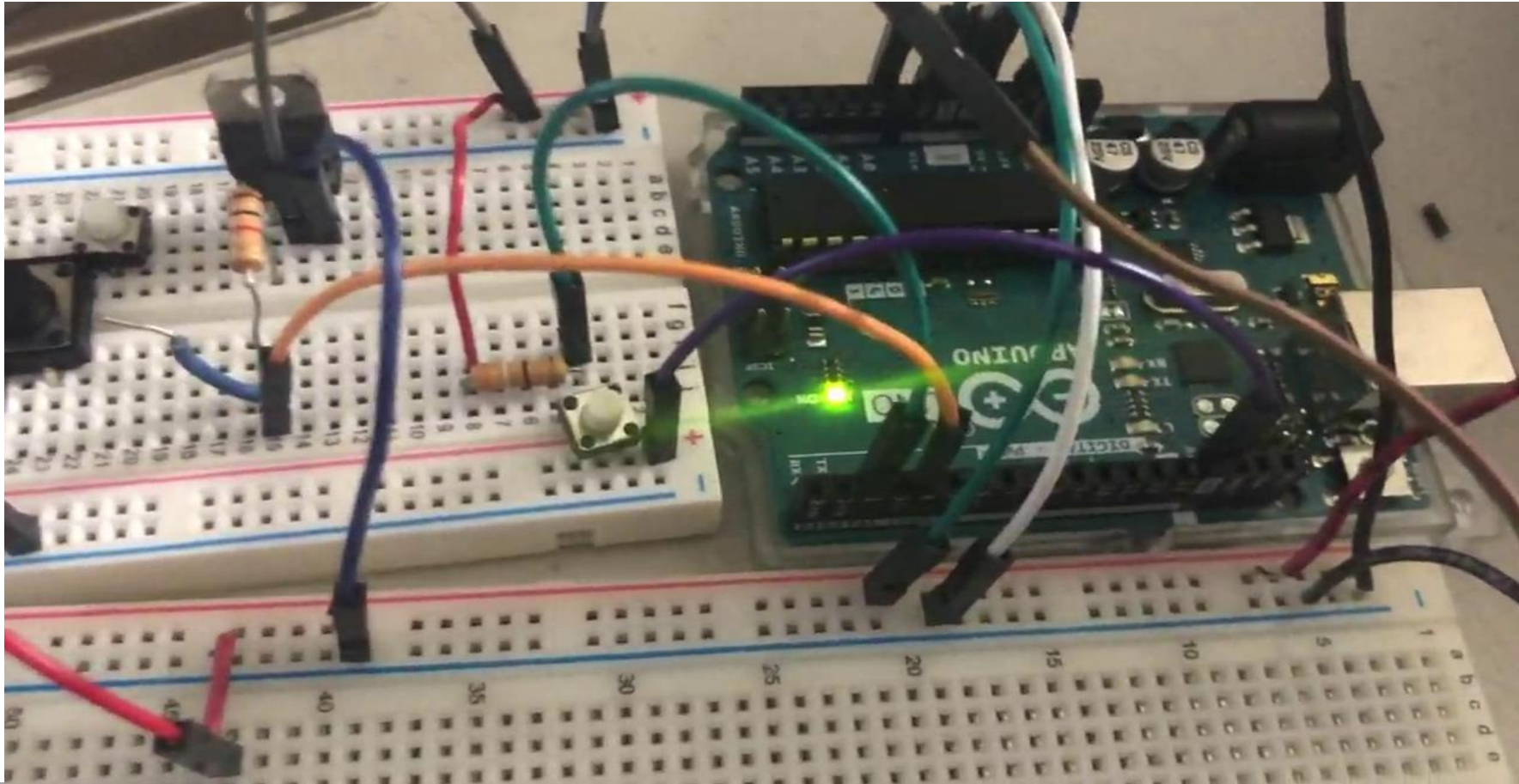
Detailed responsibilities: Design circuit foundation and proposes hardware components that will be used to meet the required specifications listed by the team.

My subsystems consist of the followings:

1. Power button (push button) - Waking the system up from initial stage, during wake up mode, output HIGH voltage on all required pins.
2. **Force Sensing Resistor (mail compartment trigger)** - Detects incoming mail via a change in resistance of the pressure pad.
3. Switching Solenoid (package compartment locking mechanism) - lock the box during initial stage (off mode) and unlock the box once the box wakes up (on mode).
4. Dc/Dc converter - converting 12VDC into 3.3VDC







Power Source					
	Voltage (v)	Current (AmpH)	Power (Wh)		
Rechargeable Lithium Battery	12	7.2	86.4		
Average Operational Power (continuously)				Average Idle State	
Min Total Power (W)		7.73		Min Total Power (W)	0.01617
Max Total Power (W)		16.38		Max Total Power (W)	0.0627
Average Total Power (W)		12.054117		Average Total Power (W)	0.039436
Average Hours (Hours\$)		7.167675575		Average Hours (Hours\$)	2190.947128
Days (Days\$)		0		Days (Days)	91
			Principle: Hour = Battery Power (Wh) / Target Power Consumption (W)		
			If Box operate for X amount		Times Box opened 1 month
			Input Box operate hour (Hour)	0.1	3
			Power consumed by Box in operation (Wh)	1.2054117	Assuming each person
			Remaining hours (Hour)	2160.380076	on average, receive 3
			Power consumed by idle state (Wh)	85.1945883	packages per month
			Remaining Power Check (Wh)	0	
			Total Usable Hours	2160.480076	
			Days	90.02000317	

Since we define a wake up cycle will take 2 minutes, however, Solenoid will only be unlocked once (however, for simplicity sake, lets assume solenoid is powered for the whole duration)
 For additional assumption, each package delivery will take 10 minutes

Operation cycle (minutes\$)	2
Operation cycle (hrs\$)	0.033333333333

Lets define the number of times that box opened = the number of times package goes in or out (or more simply, the number of usage)

Full spreadsheet:

https://docs.google.com/spreadsheets/d/1X-PXSN7Y21ZjLVsWIBEaUqzN06b_FOBv/edit#gid=2117688693

Hardware/Software List

Current

Hardware Modules:

1. ESP8266
2. MCR12 Barcode Scanner
3. 12 - V Solenoid
4. ATmega328P
5. Pressure Plate

Front-End Modules

1. xCode
2. Google Drawing
3. Github

Backend Modules

1. AWS (Amazon Web Services)
 - a. IoT Core
 - b. Lambda
 - c. AppSynch
 - d. DynamoDB
 - e. EC2
 - f. Cognito

Future

Website Modules:

1. HTML and CSS
2. Github Pages

Hardware Modules:

1. Atmel Studio
2. PCB
3. Buck Converter
4. Wii Fit Board Sensor / Ultrasonic Sensor



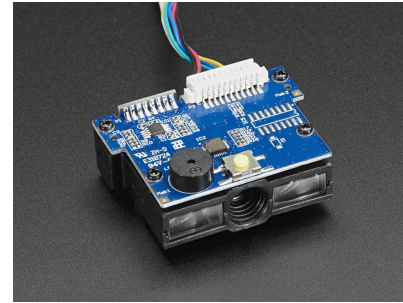
PCB



Atmega328P



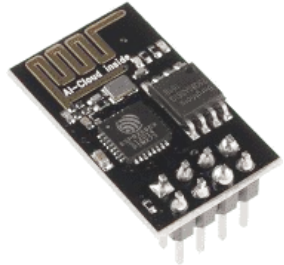
Vocomo Lid Support Hinge



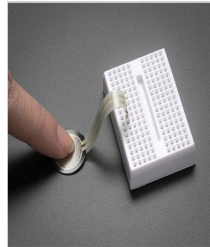
MCR12 Barcode Reader/Scanner Module



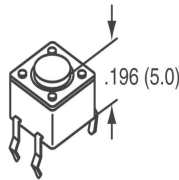
Solenoid Pull 1512



ESP8266 Wifi Module



Pressure Sensor Development Tool



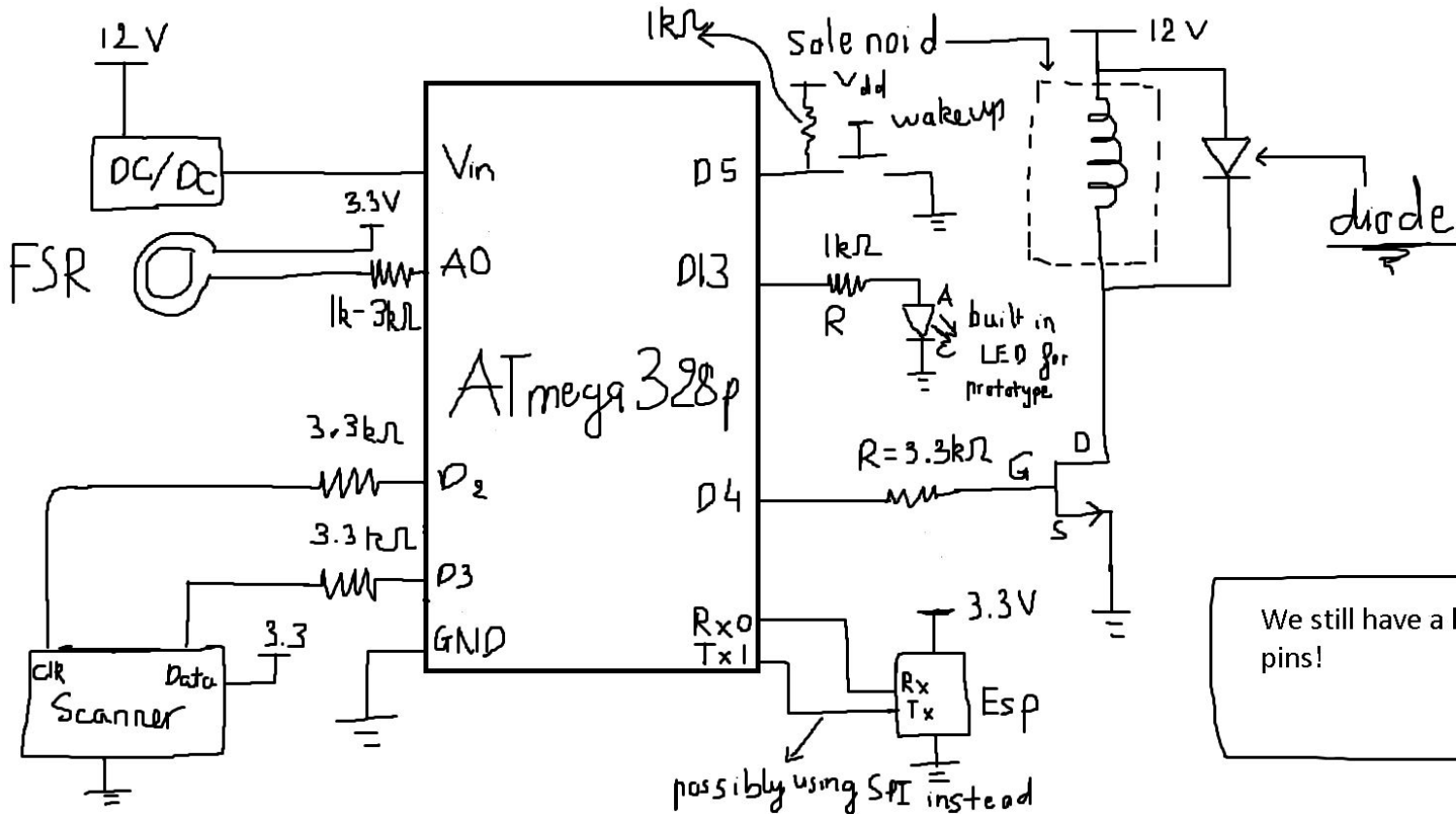
Tactile "Wake up" Switch



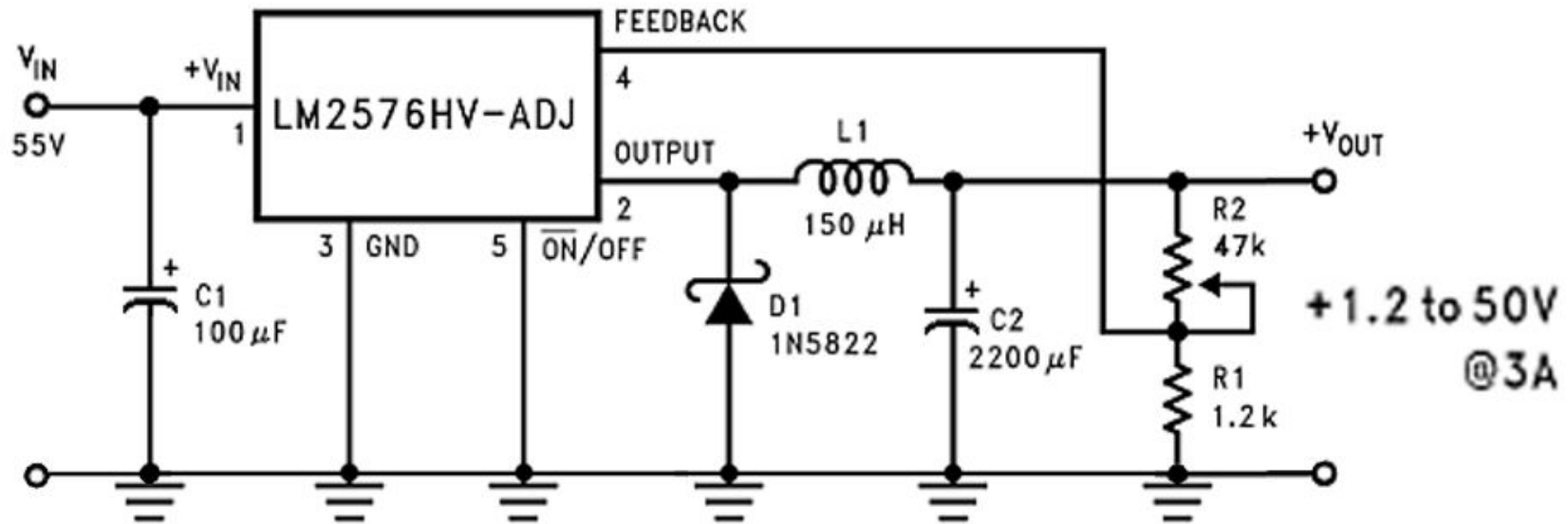
3.3V Buck Converter



12V 7.2Ah battery



We still have a lot of spare pins!



Project Expenditures

Budget	Current Project Total Cost	Remaining Budget	Projected Future Total Cost	Remaining Budget
\$500.00	\$127.56	\$372.44	\$102.02	\$270.42
Current Project Expenditures				
Necessary Parts	Links	Status	Costs	
Arduino Uno Rev3 SMD	https://store.arduino.cc/usa/arduino-un	Owned		
Rechargeable Lithium Battery	https://www.homedepot.com/p/MIGH	Bought	\$36.17	
Barcode Read Scanner Module	https://www.adafruit.com/product/120	Bought	\$75.90	
USB Host BOB-12700	https://www.digikey.com/product-detai	Bought	\$4.50	
Battery Charger	https://www.amazon.com/PeleusTech	Bought	\$10.99	
Pressure Plate	https://www.mouser.com/ProductDetail	M5		
ESP8266	https://www.ebay.com/itm/ESP8266-E	M5		
Solenoid		M5		
LED Lights		M5		
3.3V Regulator	www.sparkfun.com/products/526	M5		
Tacticle Switch (Wake Up Botton)		M5		
MOSFETS	nMos / pMos	M5		
Resistor	1k Ohm Resistor	M5		
Diode 1N5819	1N4001 Diode	M5		
Transistor	TIP120 NPN BJT Darlington Transistor	M5		
Regulator	LM2575T 3.3V 1A Buck Regulator	M5		
Diode	Diode 1N5819	M5		
Capccitors	Capacitor 330uF and 100uF	M5		
Inductors	Inductor 330uH	M5		
			\$127.56	Total Cost
Estimated Future Expenditures				
Necessary Parts	Links	Bought/Not	Costs	
Hinges	https://www.amazon.com/Tulead-Non-	Need to Buy	\$9.99	
Friction Lid Support	https://www.amazon.com/VOCOMO-	Need to Buy	\$37.99	
Corner Braces	https://www.homedepot.com/p/Everbil	Need to Buy	\$9.98	
Drop box Material	https://www.lowes.com/pd/Royal-Building-F	Need to Buy	\$33.85	1734 Sq. Inches
Mailing Slot Material	https://www.lowes.com/pd/Royal-Building-F	Need to Buy	\$10.21	529.5 Sq. Inches
Tools and Power Tools		Owned/M5		
			\$102.02	Total Cost

Gantt Chart

				CDR											FPR	Demo Day			
Task Name				Start Date	End Date	Team Member	February 5th	February 12th	February 19th	February 26th	March 5th	March 12th	March 19th	March 26th	April 2nd	April 9th	April 16th	April 23rd	April 30th
Hardware																			
	Integrate ESP & Arduino	February 5th	February 16th	A.C.															
	Learning Altium	February 5th	April 23rd	Everyone															
	Migrate Arduino over to PCB	February 5th	February 19th	L.V.															
	Wiring Arduino to breadboard	February 12th	February 26th	L.V.															
	Migrate Arduino code over to breadboard	February 26th	March 5th	L.V / A.C															
	Create Design	March 5th	March 12th	L.V / A.C															
	Integrate Working Circuitry to Box	March 19th	April 2nd	L.V / A.C															
Dropbox Design																			
	Finalize Blueprint	February 5th	February 12th	J.C. & B.T.															
	Gather Materials	February 12th	February 19th	J.C. & B.T.															
	Construct Box	February 19th	March 12th	Everyone															
	Construct Box with All Physical Interactions	April 9th	April 23rd	Everyone															
Website																			
	Make Website Skeleton	February 5th	February 26th	B.T. & A. C.															
	Touch Up and Enhance Website	March 5th	April 9th	B.T. & A. C.															
	Finalize Website	April 9th	April 23rd	B.T. & A. C.															

Initials Key:	
B.T.	Brendan Truong
L.V.	Luan Vo
J.C.	Jackie Chan
A.C.	Adam Cyfrynowski

**Thank You!
and
Questions?**

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The Commonwealth's Flagship Campus