SDP21 PDR

Team 31

Mail Gobbler 9000 (MG9000)

Team 31: Brendan Truong, Adam Cytrynowski. Luan Vo, Jackie Chan ; 23 September 2020

Team 31 Team Members

Brendan Truong
CSE Major

Team Coordinator
Backend (AWS) Developer

Fun Fact:
Food blogs on the side.

Jackie Chan
CSE Major

Budget Management Lead
Front End Mobile App Developer

Fun Fact:
We all wear glasses

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Team 31 Team Members

Luan Vo
EE Major

Altium Lead
Hardware Developer 1

Fun Fact: used to work as an Assistant Director in MV production.
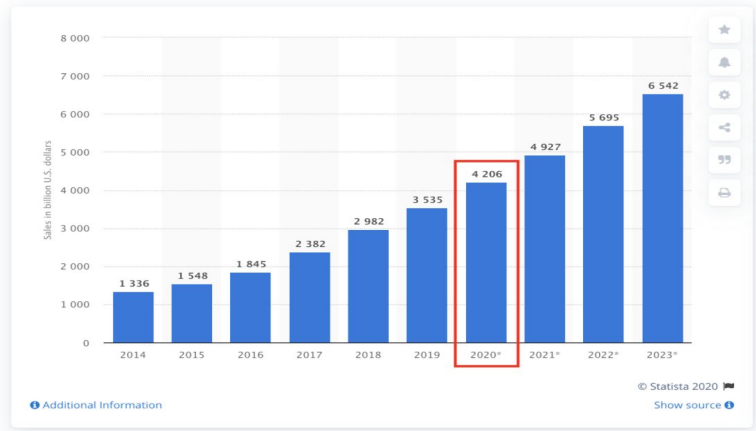
Adam Cytrynowski
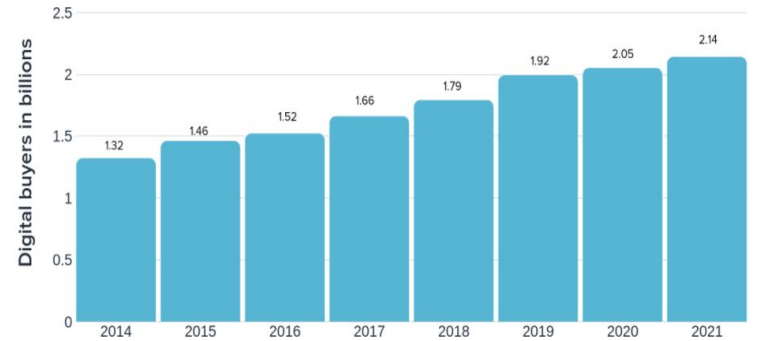*CSE*

Hardware Developer 2

Fun Fact: I have a background in Electronics

E-Commerce Statistics

Retail e-commerce sales worldwide from 2014 to 2023 (in billion U.S. dollars)
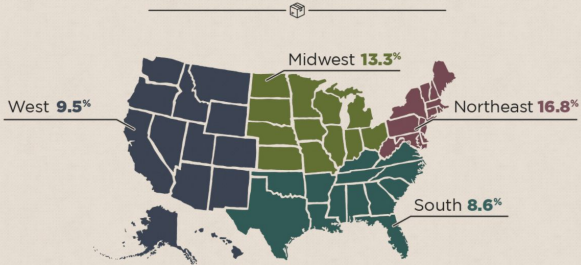

Digital buyers worldwide from 2014 to 2021 (in billions)

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Problem Statement

Theft from buildings as percentage of all larceny theft

Midwest **13.3**%

West **9.5**%

Northeast **16.8**%

South **8.6**%

Frequency of package delivery by times per month

1-2 Packages — **37**%

3-5 Packages — **41**%

6-10 Packages — **17**%

11-15 Packages — **3**%

15+ Packages — **2**%
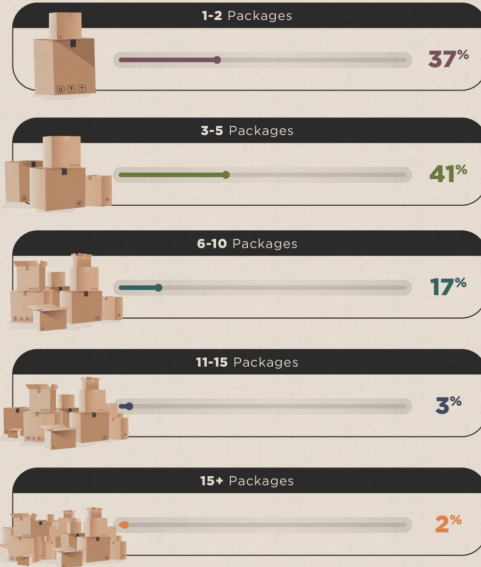
Percentage who have or are planning on taking steps to prevent package theft*

Install doorbell camera — **29**%

Install outdoor camera — **23**%

Have packages sent to another address — **17**%

Get a security system — **12**%
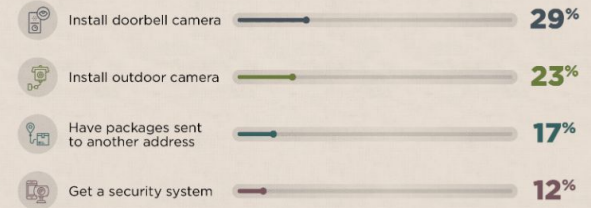
* Note: Respondents could select more than one response, so totals won't add up to 100%

security.org

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Mockup Model

FRONT

BACK

MG9000
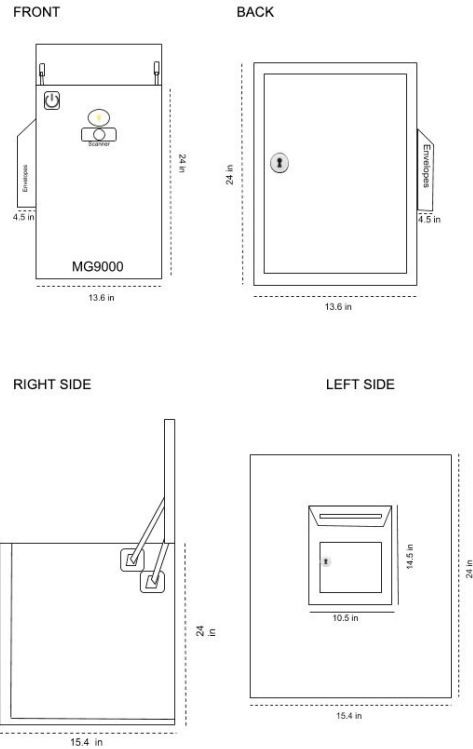
ANGLED PERSPECTIVE

RIGHT SIDE

LEFT SIDE
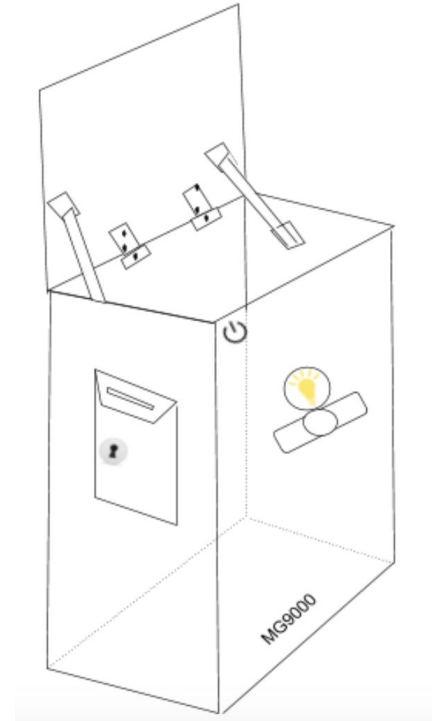
System Diagram

Hardware Component Considerations

ARDUINO UNO REV 3 SMD

Vocomo Lid
Support Hinge

Barcode Reader/Scanner
Module - CCD Camera -
PS/2 Interface

Solenoid Pull 1512

ESP8266 Wifi Module
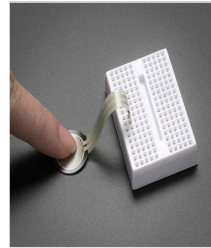
Pressure Sensor
Development Tool
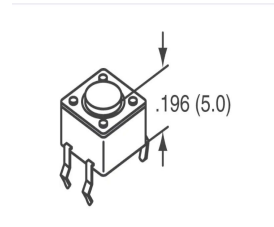
Tactile
"Wake up"
Switch

.196 (5.0)

Cost Estimate

Budget	Essential Total Cost	Remaining Budget	
$500.00	$150.87	$349.13	

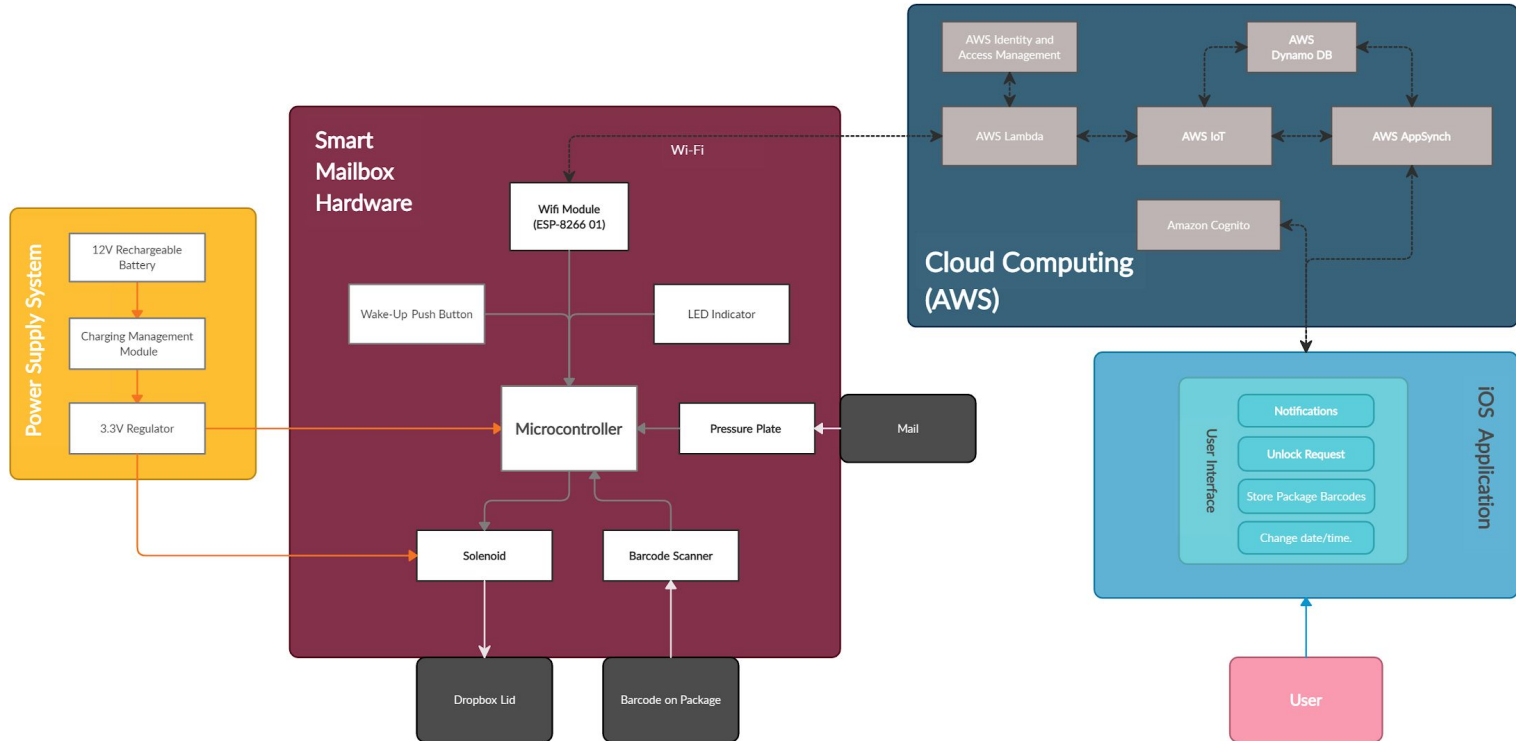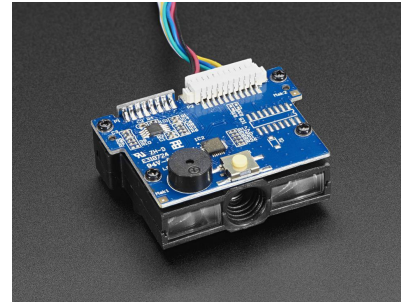| Necessary Parts	Link	Costs	Voltage Threshold	Current
Box Container		?		
Hinges w/ mount screws	https://www.amazon.com/Tulead-Non-Mo	$10		
Microcontroller	https://store.arduino.cc/usa/arduino-uno-sr	$21.90	3.3 V - 5V	
Solar Panel	https://www.amazon.com/AOSHIKE-Elec	?		
Rechargable Lithium Battery	https://www.homedepot.com/p/MIGHTY-	$17.50	12V	
Scanner	https://www.adafruit.com/product/1202?g	$70	3.3 V - 5 V	
USB host BOB-12700	https://www.digikey.com/product-detail/en	$4.50		
Pressure Plate	https://www.mouser.com/ProductDetail/A	$7.00	<1	
ESP8266	https://www.ebay.com/itm/ESP8266-ESP-	$2.49	3.3V - 3.6V	
Solenoid	https://www.digikey.com/product-detail/en	$2.50	9v-12v	450ma-650ma
LED lighting				
LD1117V33 voltage regulator	www.sparkfun.com/products/526	$1.95		
Friction Lid Support	https://www.amazon.com/VOCOMO-Sta	$7.99		
Tactile Switch "Wake up button"	https://www.digikey.com/product-detail/en	$0.10		
MOSFETS	Nmos/Pmos	$5.00		
Alternative of resistive sensing	Magnetic flag pole			
optional scanner	Barcode option 2 link: $70 per piece			
chosen uC has inbuilt wifi module				

Software Diagram - Hardware Side Functionality

UMassAmherst

Once mail compartment function ceases, we return to sleep state.

Mail Compartment
If pressure pad detects that there is an object in the compartment, it records the resistance and sends it to ESP to communicate with AWS

If weight is detected on pressure pad.

Sends change in resistance to communicate with AWS.

Sleep Mode
uC always on
ESP on standby
Pressure pad and Solenoid latch off
LED indicator initially red, indicating sleep

If wake up button is pushed.

Wake Up:
Power on systems.
Establish Wi-Fi connection via ESP.
Once all systems are ready, LED indicator turns white (which also acts as a light for night-time barcode scanning.)
Acts upon given event.

ESP
uC instructs ESP to establish connection with AWS IoT Core in the cloud and publish event data from pressure pads.

AWS

If no action is detected within 30 sec. timer, reenter sleep mode.

Sends barcode to ESP and communicates with AWS.

AWS then communicates with ESP and returns results on whether the barcode is successfully recognized

If a barcode scanner recognizes a code.

Package Dropoff Compartment
If barcode is scanned, we send the barcode to ESP to communicate with AWS. If the barcode matches with the user's expected packages, the solenoid unlocks and produces a sound, indicating positive results. The solenoid is only powered for 15 seconds before the lid starts closing by itself (simply by gravitation) from our angled hinged..

Backdoor
If the system fails, the user may open the package drop off compartment through a key and lock backdoor.

Once package drop off compartment function ceases, we return to sleep state.

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Software Diagram - Software Side Functionality

ESP

AWS Identity and Access Management
Constantly verifies identity roles in case of misuse.
Promotes Security

Amazon Cognito
Handles authentication and allows users to log-in and access their respective data.

Constant Communication with Lambda, to verify identities.

Allow user authentication system.

AWS IoT Core
Receives published event data and handles communication with hardware.

Along with having topics to communicate with the IOS Application and receive unlock requests.

Forwards data to Lambda to handle.

Sends data to Iot core to update system.

AWS Lambda
Lambda issues GraphQL call to update DynamoDB with pressure pad data and notifies user if any change.
or
Checks with AWS DynamoDB if barcode data sent, to verify positive or negative result and returns it.
or
Sends IoT core user unlock requests.

Sends AppSynch user notifications based on rules.

Sends user unlock requests to Lambda to notify IoT core.

AWS AppSynch
If received data, executes a GraphQL mutation that updates DynamoDB and also broadcasts the change in pressure pad data to users.

Relays notifications to users,

iOS Application
AWS sends data to iOS application for to process.
iOS application provides various functionalties for user:
i.e. Notification of Mail, storing Barcode Data, and submitting unlock requests to the system.

User submts and unlock request.

If user requests to store barcode, can use PutItem API to upload to DynamoDB

AWS Lambda makes barcode and resistance comparison and returns result.

AWS DynamoDB
Stores barcode and pressure pad data for user reference and comparisons.

If data regarding pressure plates and existence of mail or package is received, data is processed and user receives notification.

User request to store barcodes for incoming packages and parcels.

User may send an unlock request to open dropbox

User

Four Backend Functionalities

**Primary Functionalities:**

1. **Notification of Delivered Mail**
   a. Event occurs at dropbox
   b. Forward event data to AWS Lambda
   c. Communication with AWS AppSync
   d. Update and notification of mail.
2. **Verification of Package Barcodes**
   a. Event occurs at dropbox
   b. Forward event data to AWS Lambda
   c. Data comparison with DynamoDB
3. **Unlock Requests to the system from the User**
   a. Publish message to IoT topic.
4. **Storing Barcode data from the User**
   a. Mobile SDK, PutItem API into DynamoDB
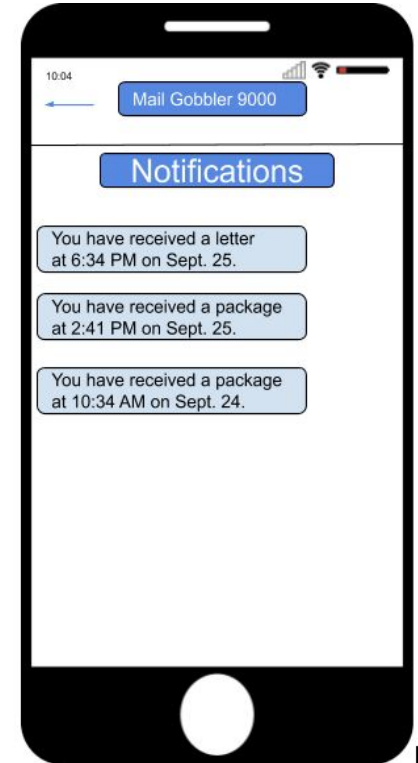
User Interface
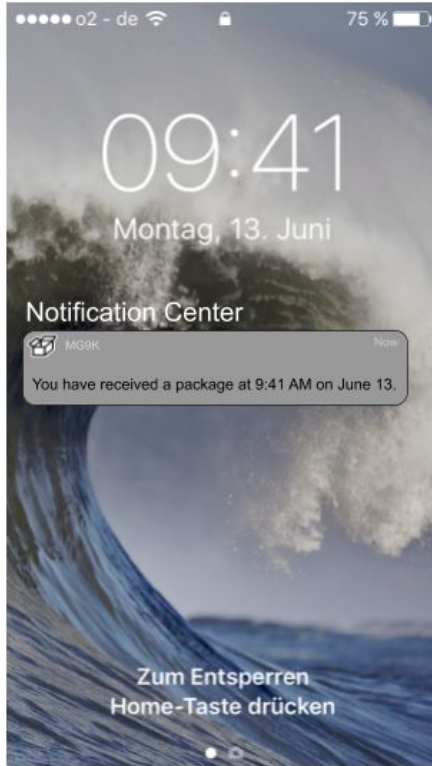
Mockup of Home Screen Notification
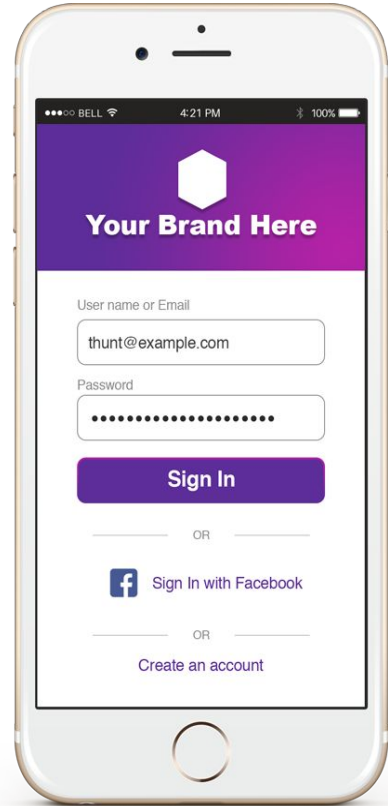
Amazon Cognito Login
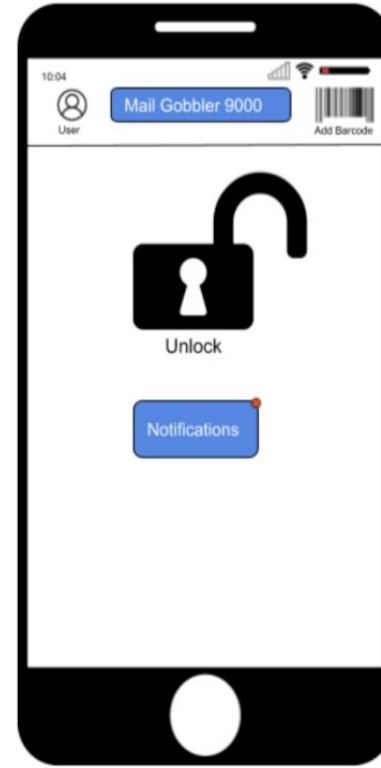
Mockup of MG9K Interface

Mockup of MG9K Notification Page

MDR Deliverables

MDR deliverable:

Luan's portion: coding uC, voltage regulator, spring loaded solenoid, push button, Altium
- Luan will make sure that the circuit is wired correctly and write the code that allows the uC to read the input from the push button and distribute voltage to required components. Wire and code spring loaded solenoid to work correctly as intended with the aid of MOSFET.
- Ensure that the device could be triggered to wake up mode via push button or app, and device base circuitry is correct and efficient.

Adam's portion: coding uC, pressure pads, scanner, ESP, (aid Altium)
- Adam will code the ESP to allow the ESP to enter standby mode, to reduce power consumption of the system. Establish connection between ESP and wireless network. Create a sample transmission between the ESP and AWS.
- Read data from the pressure pad and create a sample storage and read function.

Brendan's portion: setting up AWS Services, Roles, and Coding the backend
- Responsible for back end development with AWS i.e. setting up rules and AWS services, ensuring data storage and communications are working properly. Also responsible for establishing connections from AWS to ESP and from AWS to the mobile application, and ensuring the integrity and authenticity of information storage and flow.

Jackie's portion: creating iOS application, coding application
- Responsible for front end app management, creating a sample app that will communicate between the user's device and AWS (not with MG9K device yet). Ensure the flow of data between front end and back end is stable and authentic. Create a sample transmission between the application to AWS (to request data or to transmit data to AWS - which will later be used for opening MG9K from the app).

Gantt Chart

	Task Name	Start Date	End Date	Team Member	October 2nd	October 9th	October 16th	October 23rd	October 30th	November 6th	MDR November 13th	MDR November 20th
Hardware												
	Ordering Parts	September 28th	October 9th	Everyone	██	██						
	Coding and setting up uC	October 2nd	October 5th	L.V / A.C		██						
	Setting up voltage regulator and push button	October 6th	October 8th	L.V		██						
	Setting up connection to solenoid and code	October 9th	October 12	L.V		██						
	Coding hardware phases (i.e: sleep, wake up)	October 6th	October 9th	A.C		██						
	Coding and setting up ESP and Pressure pads	October 10th	October 16th	A.C			██					
	Hardware Test Run	October 2nd	October 16th	L.V / A.C		██	██					
	Altium and Integrated system for future migration	October 16th	October 30th	L.V / A.C				██	██			
	Reviewing and improving hardware	October 16th	October 30th	L.V / A.C				██	██			
Backend												
	Set up basic AWS Services	September 28th	October 2nd	B.T.	██							
	Create AWS IAM Roles	September 28th	October 2nd	B.T.	██							
	Set up DynamoDB Tables	September 28th	October 2nd	B.T.	██							
	Code AWS Lambda handlers	October 3rd	October 16th	B.T.		██	██					
	Code AWS IoT Rules	October 3rd	October 16th	B.T.		██	██					
	Code GraphQL mutation	October 3rd	October 16th	B.T.		██	██					
	Test publish/subscribe topics	October 9th	October 16th	B.T.		██	██					
	Test dynamoDB manipulations	October 9th	October 16th	B.T.		██	██					
	Test uC to AWS functionality	October 16th	October 30th	B.T./L.V./A.C.				██	██			
	Test mobile app to AWS Functionality	October 16th	October 30th	B.T. / J.C.				██	██			
Front End												
	Learn Swift	September 28th	October 2th	J.C.	██							
	Create Skeleton App on iOS	October 2nd	October 16th	J.C.		██	██					
	Implement Amazon Cognito	October 16th	October 23rd	J.C.				██				
	Establish Communication between App & AWS	October 16th	October 30th	J.C. / B.T.				██	██			
	Successful end to end communications	November 1st	November 6th	Everyone						██		
System Reviews												
	System review to be fully ready by MDR presentation	November 6th	November 13th	Everyone							██	

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Wrap Up

JCPenney Store Closings

Following a comprehensive review of our retail footprint, JCPenney made the difficult decision to announce over 150 store closures. Liquidation sales at most closing store locations are now underway. Contact your local store for more information. Temporarily reduced store hours are **Monday through Saturday, 11 a.m. to 7 p.m., and Sunday, 11 a.m. to 6 p.m.**

A handful of previously announced store closing locations may remain on hold pending further review.

More than 100 Sears and Kmart stores are in their final days.

The going-out-of-business liquidation sales at 51 Sears and 45 Kmart stores – first announced in November by parent company Transformco – are expected to wrap up by mid-February, company spokesman Larry Costello confirmed to USA TODAY Friday.

The closures represent more than one-third of its remaining large-format stores and the liquidation started Dec. 2. Additional stores also are closing, according to local media reports.

Amazon's Prime membership program continues to reach an increasing number of online shoppers. There are currently 150 million Prime subscribers, a 50 percent increase from 100 million in April 2018 (VentureBeat, 2020).

The latest fiscal numbers from Amazon show that the company made $75.5 billion in sales revenue in the first quarter of 2020, beating analysts' forecast of $73.61 billion (Amazon, 2020). Of this revenue, net income constitutes $2.5 billion.

Chinese platform Taobao is the biggest online marketplace, with a GMV of $515 billion (Statista, 2019). For comparison, Tmall and Amazon ranked second and third with $432 and $344 billion in annual third-party GMV respectively.

To put this statistic into perspective, the top online marketplaces in the world sold $1.66 trillion in 2018. Marketplace sites like those operated by Alibaba, Amazon, and eBay accounted for more than 50 percent of global web sales in 2018.

Thank You!
and
Questions?

UMassAmherst
The Commonwealth's Flagship Campus