MICHIGAN STATE UNIVERSITY

Offline-Ready Mobile App for Delivery Optimization

The Capstone Experience

Team Magna MADO

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From Students... ...to Professionals

Project Sponsor Overview

- Magna is a global leader in automotive technology, with over 174,000 employees in 28 countries
- Its diverse portfolio includes automotive parts, powertrain systems, electronics, ADAS (Advanced Driver Assistance Systems), electric vehicle (EV) technologies, and mobility innovations.
- Magna's New mobility wing drives innovation in mobility and sustainability, shaping the future of the automotive and supply chain industry.





Project Functional Specifications

- The Mobile App for Delivery Optimization enhances delivery efficiency by optimizing routes for drivers and providing offline functionality to ensure continuous service in areas with poor network connectivity.
- For fleet operators to view the status of operations, a web application offers a dashboard that provide Comprehensive view of the current status of deliveries:
 - Displays the real-time location of the drivers.
 - Displays the status of each order/consignment.

Project Design Specifications

- The mobile app equips delivery drivers with the most optimal route to efficiently complete a batch of orders along with in app Navigation provided by NextBillion AI. It features a userfriendly interface that displays key details, including delivery ETAs and comprehensive order information, ensuring drivers have all necessary data at their fingertips for seamless deliveries.
- The web app designed for fleet operators provides a detailed look into current orders out for delivery and drivers in transit. The web app also allows for fleet operators to make new order batches for drivers and view current locations on the map overview page.

Screen Mockup: Welcome Page

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wednesday, Today	's Over	viev	v	
DRIVER ID DR 3122	The second s	URATION 7 AM - 4 PM		ZE oxes
PICKU	LOCATIONS	3		
415 W	lison Rd, Troy, M	11, 48098	0)
750 To	wer Dr, Troy, MI	, 48098		•
DROP O	FF LOCATIO	NS		
219 Wil	son Rd, Saginav	v, MI, 486	07 🖹	
165 Mic	h Ave, Saginaw,	, MI, 4860	7	2
819 Bird	ch Rd, Saginaw,	MI, 4860)	7	9
380 Mo	unt ST, Saginaw	, MI, 4860	7 B	
380 Crir	mson Rd, Segina	rw, MI, 48	607 🖹	9
	BEGIN DEL	IVERIES		
				5

Team Magna MADO Project Plan Presentation

Screen Mockup: Order Overview



Team Magna MADO Project Plan Presentation

Screen Mockup: Navigation Screen



Team Magna MADO Project Plan Presentation

Screen Mockup: To Be Approved Page

ni magna	Out For Delivery	To Be Approved	Drivers In Transit		
ALMAGINA	out of bennery	To be applicated	Diversiti Hansie		
Batch ID: 2344123					
batch ib. 2344123					Accept
Order Summary					
Order ID: 745555					Ō
Order ID: 749886					Ø
Order ID: 985223					
Order ID: 133599					
Driver Details					
Driver ID: FNWEOIDF					
Batch ID: 12423214				*	Accept

Screen Mockup: Orders View

🔊 MAGNA	Out For Delivery To Be App	proved Drivers In Transit
${f Q}$. Beautify by defer number		
Order ID: 567AGH		
Description: Headlamps	Location: Lansing,MI	Batch ID: BXD123
Order ID: 678IJN		0
Description: Turbocharger	Location: Chicago,IL	Batch ID: ERT188
Order ID: 779TYI		
Description: Fuel Pump	Location: Atlanta,GA	Batch ID: QWE789

Screen Mockup: Drivers View

Fleet Operator C	* +				0 * * 0
Aİ MAGN	A	Out For Delivery	To Be Approved	Drivers in Transit	
Driver ID: 394859					
Name: Mia Granata	True	k Size: 20,000 lbs	Location: Chicago, IL	Batch ID: BGJ890	
Driver ID: 098245					
Name: Adam James	Tru	ck Size: 10,000 lbs	Location: Wilmette, IL	Batch ID: NJM220	
Driver ID: 124502					
Name: Shane Patrick	Truc	k Size: 12,000 lbs	Location: Troy, MI	Batch ID: NDE901	
Driver ID: 124502					
Name: Jake Williams	Truc	Size: 12,000 lbs	Location: Royal Oak, MI	Batch ID: LIO682	

Screen Mockup: Map View

n'i Magna	Out For Delivery	To Be Approved	Drivers In Transit	
Order ID: AX58RT			Malden 1	1
Description: 25*14*25, Front lights		-Medfor	Everett Revere	7
Location: Birston, MA			Lvelett	8
Batch ID: 0871582		Somer		
	1	Somer	Ville	~ 1
		Cambridg	je	
		00	Boston	
	BF		BACK-BAY	
			5	
		Brookline		e-71
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		JAMAICA PLA		1
	1		DORCHESTER	

Project Technical Specifications

- A Flutter-based cross-platform mobile application is designed to optimize delivery routes for drivers. It leverages MongoDB Realm for offline functionality, ensuring continuous operation in areas with limited connectivity.
- A Flutter web application allows fleet operators to track the realtime status of consignments.
- The back-end is built with Node.js, enabling interaction between the web application and the MongoDB Atlas database.
- MongoDB Atlas serves as the central database, utilized by both the mobile and web applications.
- Route optimization and map integration are powered by NextBillion.AI, ensuring accurate navigation for drivers.

Project System Architecture



Project System Components

- Hardware Platforms
 - None
- Software Platforms / Technologies
 - Flutter
 - MongoDB
 - NextBiilion.Al
 - Node.js

Project Risks

NextBillion.AI

- Unsure if NextBillion.AI can display a map when not connected to the network.
- If NextBillion.AI does not support offline navigation capabilities, then we plan to have Google maps free API as a back up if the mobile application loses connectivity.
- Offline Capabilities
 - We are unfamiliar with NextBillion.AI's geocode data processing, this has created uncertainty around the best approach for storing geocode data offline and syncing it with the database when back online.
 - We store location data from the mobile device every few milliseconds in an offline database (Realm). Upon connection, the system will automatically sync the data to the online database, ensuring seamless updates without relying on NextBillion.AI's specific geocode processing.

Syncing Common Databases Between Two Different Apps

- This project involves both a mobile application and a standalone web application, both of which connect to the same database. Our concern is maintaining the integrity of our database with simultaneous connections.
- We will implement a Node.js-based queue that holds database write commands from both the mobile and web applications. This queue will process requests sequentially, ensuring consistent communication with the database and maintaining data integrity across both platforms.
- Database Being Stored Locally
 - With MongoDB realm storing data locally on the device this is a security risk and could be exploited.
 - To ensure secure storage, data encryption will be implemented across all platforms. Additionally, we will utilize Keychain for iOS and Keystore for Android to securely store sensitive information.

Questions?

