#### MICHIGAN STATE UNIVERSITY

# **Offline-Ready Mobile App for Delivery Optimization**

#### The Capstone Experience

#### Team Magna MADO

Chetan Chigurupati Adam Farkas Mia Granata Shrey Kohli Shane Patrarungrong Muhammad Shaikh Department of Computer Science and Engineering Michigan State University

Fall 2024



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

9:41			배 후 🗖	
M IA	AGNA		(	0
WEDNESDAY, Today	's Over	viev	/	
DRIVER ID DR 3122	BATCH ID BA-2456	URATION AM - 4 PM	SIZE	ES:
PICKU	LOCATIONS	3		
415 W	llson Rd, Troy, M	1, 48098	0	)
750 To	ower Dr, Troy, MI	48098		
DROP O	FF LOCATION	NS		
219 Wil	son Rd, Saginaw	, MI, 4860	77 ⊳	
165 Mic	ch Ave, Saginaw,	MI, 4860	7 🖻	
819 Bird	ch Rd, Saginaw, I	MI, 48607	⊳	
380 Mo	unt ST, Saginaw,	, MI, 4860	7 ⊳	
380 Crir	mson Rd, Sagina	rw, MI, 48	607 ⊳	
	BEGIN DELL	VERIES		
				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

C # https://magna.com				. d	1. 12 1
<b>MAGNA</b>	Out For Delivery	To Be Approved	Drivers In Transit		
-			-		
Batch ID: 2344123				*	Accept
Order Summary					
Order ID: 745555					٥
Order ID: 749886					۵
Order ID: 985223					
Order ID: 133599					۵
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 & https://magna.com				0 x * 0
<i>i</i> ii magna	Out For Delivery	To Be Approved	Drivers In Transit	
Delvar ID: 2049E0			1.2	
Driver ID: 394859				
Name: Mia Granata	Truck Size: 20,000 lbs	Location: Chicago, IL	Batch ID: BGJ890	
Driver ID: 098245				
Name: Adam James	Truck Size: 10,000 lbs	Location: Wilmette, IL	Batch ID: NJM220	
Driver ID: 124502				
Name: Chang Dabiel	Truck Core 17 000 lbr	Location: Term 141	Parch ID: NDED01	
Name, shane Painck	Truck size: 12,000 fbs	LOCADON, ITOY, MI	Dattri ID. NDE901	
Driver ID: 124502				
Name: Jake Williams	Truck Size: 12,000 lbs	Location: Royal Oak, MI	Batch ID: LIO602	

# Screen Mockup: Map View

IN MAGNA	Out For Delivery	To Be Approved	Drivers In Transit	
Order ID: AX58RT		Medfor	Malden	
Description: 25*14*25. From lights Location: Birston, MA			Everett Revere	
Batch ID: 0071002		Somer	ville	$\Delta r$
		Cambridg	Boston	
	BF	RIGHTON	BACK-BAY	
	1	Brookline		8
		JAMAICA PLA		1 × 1
		ROSLINDALE	DURCHESTER	

# **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?**

