

A.R.T.I.M.U.S.

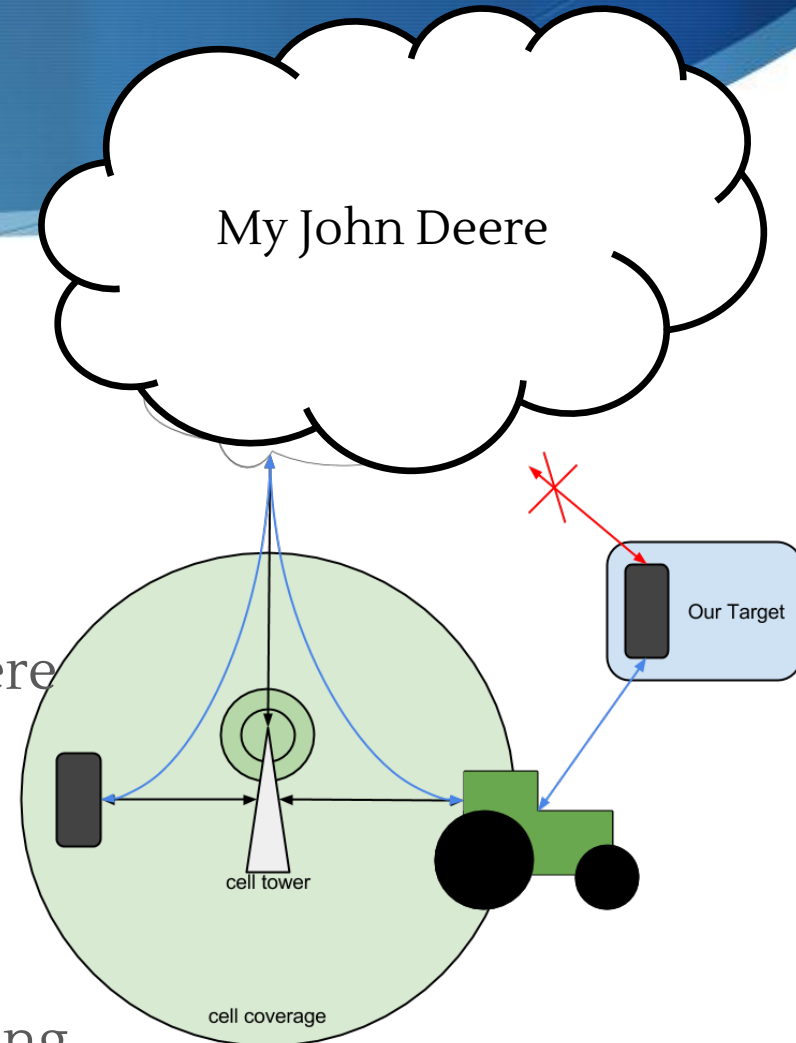
Augmented Reality Tractor Information Management Utility System

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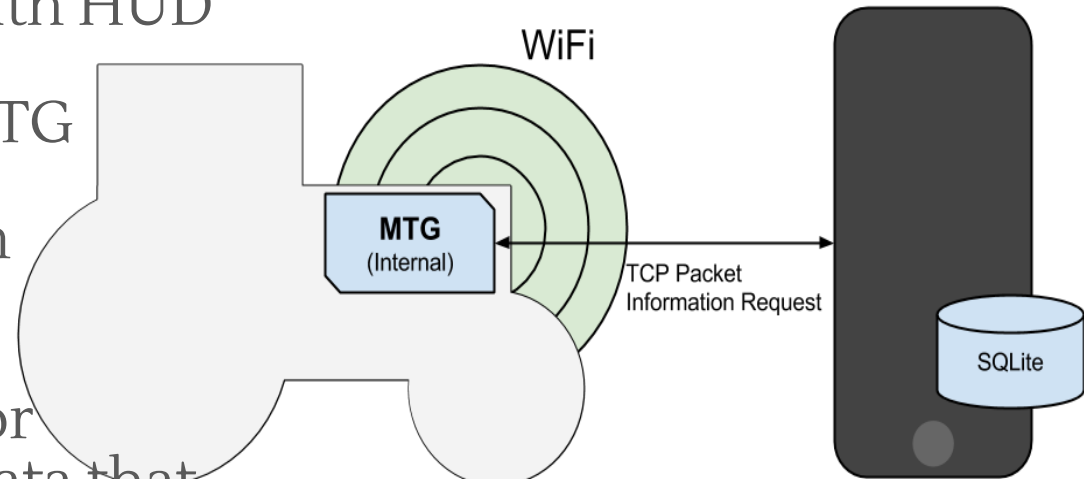
Background

- John Deere tractors have onboard a device called the Modular Telematic Gateway (MTG)
- The MTG acts as a server to collect vehicle data and send data to John Deere over cellular
- Sometimes there is no cell connection in the field
- ARTIMUS bridges this gap by connecting to the MTG directly over WiFi

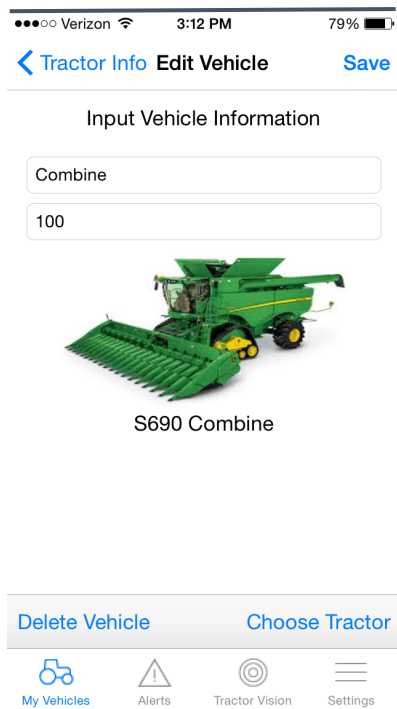


What is ARTIMUS?

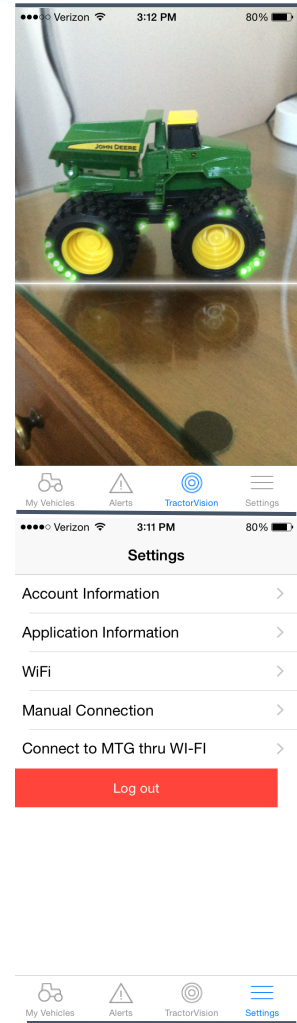
- Uses AR to “see” tractors, display information with HUD
- Connects to tractor MTG
- Pulls information from tractors
- Displays information or provides an alert for data that passes thresholds



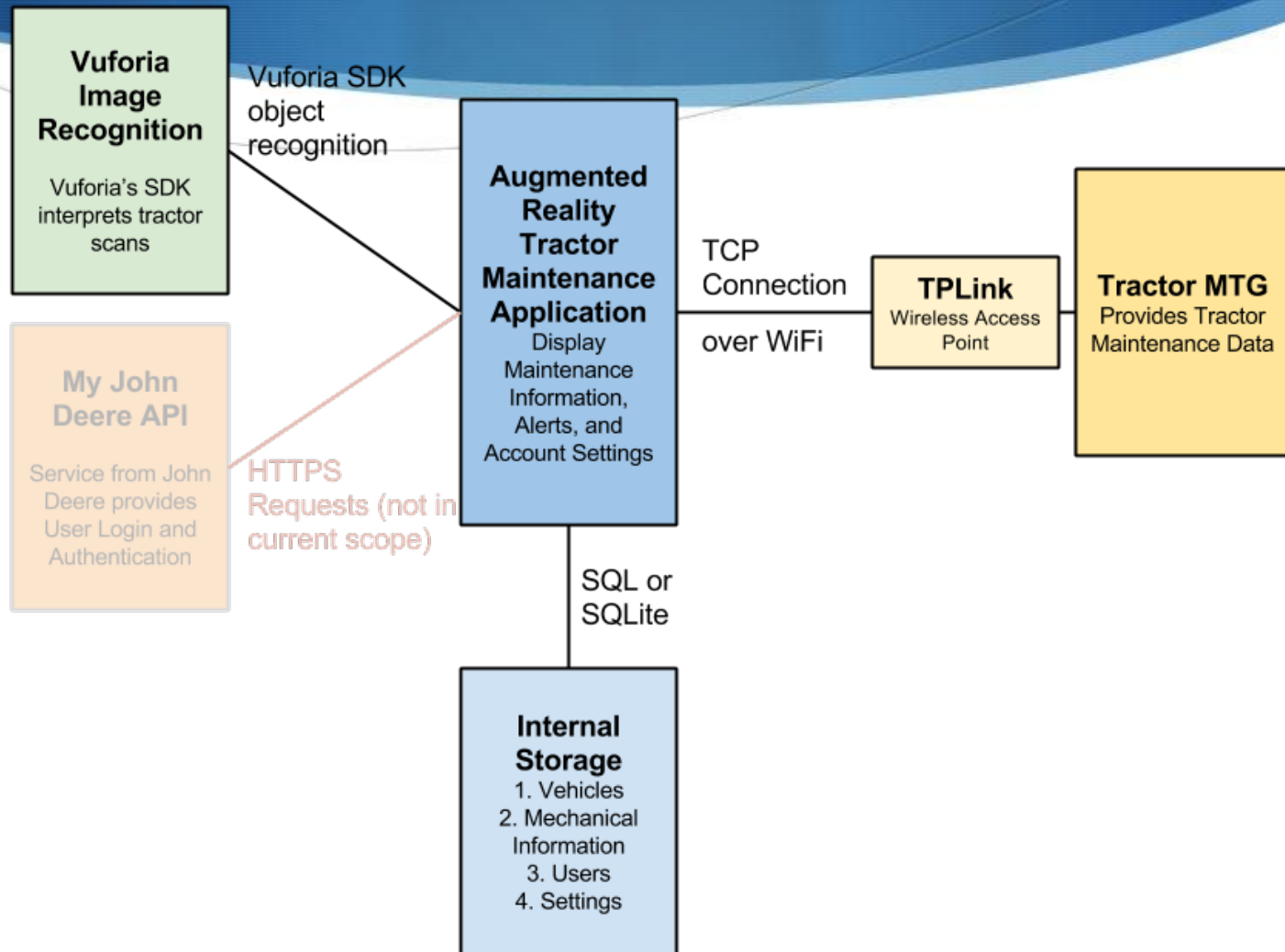
Current Design



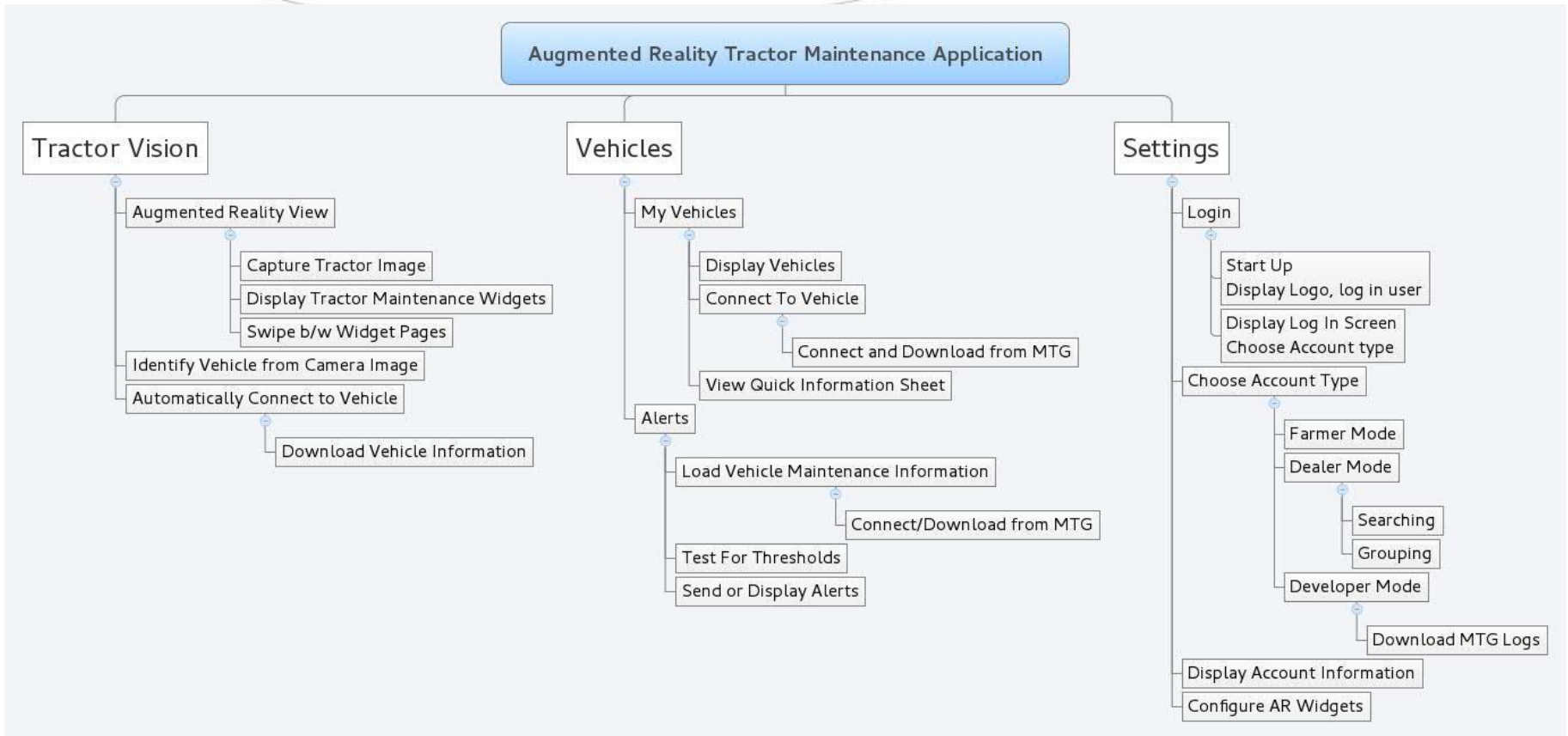
- Tabs provide easy access to the 4 main functional areas: TractorVision (AR), Vehicles, Alerts, and Settings
- Allows user to create and Vehicle entries for his/her own equipment.
- Provides intuitive list of Vehicles and quick access to connect to vehicle information
- Functional AR, recognizes small Tractor models and associated maintenance information



System Block Diagram



Functional Decomposition



The design process

- Augmented Reality
 - research and testing
- iOS platform
 - research and basic app skeleton construction
- Develop a database structure and data storage methods
 - Identify critical data and develop a flexible and extendible base
- Establish communication protocol with the MTG

March 5th, 2015		MAY15-05 ARTIMUS PROJECT				
		TO DO LIST				
	<u>Issues, sorted by priority</u>	Sang	Haoyu	Tanner	Brian	Jesse
Resolve WIFI Issues	Look for in-app Wifi solution					
	Link directly to iOS WIFI settings page					
	Link to iOS Settings					
	Choose which tractor to connect to					
Connection to MTG	Make connection easier/improve connection					
	Store history for alerts (other data?)					
Alerts	Universal Alerts page for all tractors					
	Latest alerts specific to tractor in tractorInfo page					
	sortable alerts (resolved vs unresolved alerts, date)					
TractorVision	Exit button/rootViewController issue					
	Close overlay on targetLost notification					
	Clean up/improve overlay info					
	Link info with database from MTG connection					
General/misc.	Clean up code					
	Clean up app layout/look					
	Documentation					
	Weekly updates					

The design process (cont'd)

- Alerts
 - Determine applicable thresholds and application actions
- Testing and meetings
 - Regular (bi-weekly) meetings with client to review development
 - Immediate testing on simple server and regular testing using MTG provided by client

The design process (cont'd)

- MTG and MyJohnDeere API development
 - Both are a work in progress.
 - MTG will soon be moving to a new version using Linux (current Win CE)
- Dealing with Apple restrictions
 - Primarily with restrictions in switching WiFi networks.

Test Plan

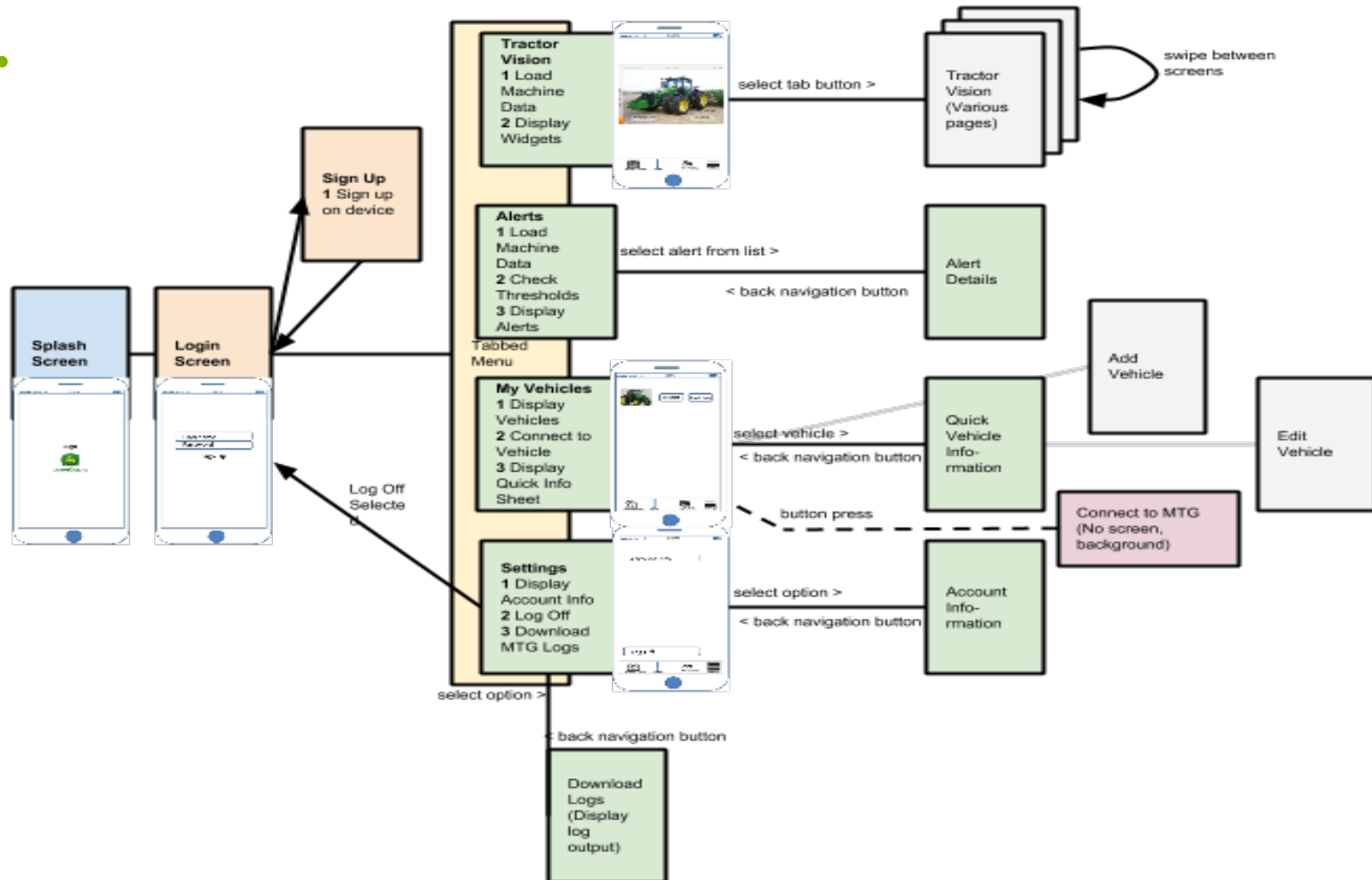
- Audits for database interaction
 - Develop 'correct' database status
 - Every update must match 'correct' state
- Simple Server emulates MTG server over local WiFi to simulate field connections for connectivity testing using a testing phone (iPhone 4).

Test Plan

- Black-box testing for design and background processes
- Individual work and testing on specific components before addition to base model
 - Particularly important for Vuforia which does not work with the iOS simulator
- John Deere provides MTG and harness for testing hardware functionality

Design Scenarios

- 3 modes: Dealer, Farmer, and Developer



Wifi Challenges

- Cannot switch Wireless connections in app due to iOS restrictions
 - Private APIs (did not work)
 - ScanLAN
 - StumblerIOS
 - Use deprecated solution (did not work)
 - CoreWANWirelessManager
 - Transition to wireless page in app (did not work)
 - InAppSettingsKit
 - Issue step-by-step instructions on how to connect (current)
 - Allow iOS to handle automatically connecting to known WiFi signals (current)
 - Bonjour

Testing Challenges

- No hardware to test on
 - Developed a simple server which could run on a laptop to simulate MTG connections
- Unit testing with XCode impractical
 - Xcode unit tests do not allow for set up-each test is isolated making tests involving our database unwieldy.
 - Each database action was tested independently by performing batch inserts/updates and auditing the SQLite database results

Other Challenges

- Vuforia Augmented Reality does not play nice
 - Complicated and young software.
 - Greater support for Android, less for iOS currently
- iOS version deprecation and developer access
 - iOS access to developer tools is limited to Apple devices and is a subscription service.
 - John Deere provided Developer account, worked on Macs in TLA



What we have done

- Implemented a connection to the MTG which can download and store Tractor Maintenance data and display them as alerts to the user
- Use Augmented Reality to detect vehicles and display pertinent tractor alerts

Future plans

- Improve the service detection to use MDNS to better find the users tractors
- Refined Augmented Reality to identify specific tractor parts
- With the new MTG the Wifi issues can be resolved

Thank You

- Dr. Benazir Fateh, John Deere Representative & Client
- Zach
- Joshua Wirth, John Deere Engineering Supervisor

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