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Augmented Reality Tractor Maintenance Application

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Problem Statement

What Problem the Project Solves

We propose a smartphone app for a farmer to review the status of their machines via a touch screen interface. Such an app would allow for farmers to interact with their vehicles to know the fuel levels and other important information about their vehicle. If this app is brought to completion it could be expanded to go cross platform and have other utilities as well.

Our primary customer is John Deere and their clients and employees. It would be targeted to three main users owners, dealers, and developers. Given the app works on one platform of smartphone , we would focus on making the app mutli-platform to reach the maximum amount of people.

What Value the Project Offers

This application is aimed at providing the owners of John Deere tractors with an easy to access resource for checking the status of their vehicles. It will allow the owners of the tractors to quickly look up maintenance information, location, vehicle identification, and other miscellaneous data on the tractor. Using image recognition software and Augmented Reality libraries the process should provide a simple point-and-shoot style of look up to make operation easy for tractor owners.

Developers will find use in the applications ‘Developer Mode’ which will allow a developer to connect directly with the tractor in order to communicate important status information. The developer would then be able to perform administrative and debugging tasks such as remotely update and reset the tractor’s internal MTG and download log files.

Vehicle dealers are intended to benefit from having a convenient method to look up, sort, get alerts, and quickly display information about vehicles they have registered. This application will allow them to manage their vehicles remotely and stay up to date on their condition at all times.

Is this Project Feasible

This project is entirely feasible to complete given the resources and timeline available. Much of the required data is available through John Deere’s developer API and the constant connection with their tractors. Our team will not have to make any changes in hardware and will be focussed primarily on communication with the API data provider and tractor internals. Modern mobile applications are powerful and many resources are available to support developers; the development community for our primary development platform (Apple iOS) is large and experienced and will provide a solid foundation build this application.

Deliverables

First Semester

Design Plan

Monthly demos

Prototype iOS Application and Demonstration

Second Semester

Final Working iOS Application

Specifications

This application will work on the Apple iOS platform, minimum version 07, and operate in these modes and conditions.

Owner Mode

The owner mode should provide the following features to the user:

Augmented Reality View for Tractor Maintenance: this feature will attempt to automatically detect the owner's vehicle and download and display the most up to date mechanical and maintenance information for that vehicle in an augmented reality environment. Information may be displayed as widgets in full augmentation or, if the user chooses, in a simpler mode to conserve battery.

Maintenance Information: display information relevant to the owner in a low battery consumption/simple view mode.

Locate Tractor: This feature will use GPS/maps to determine the location of a vehicle or set of vehicles and display these locations and the user's distance to them.

User Account: This feature should allow the owner to securely log in to MyJohnDeere and provide the user with information their account and vehicles as well as any other administrative information.

Developer Mode

The Developer mode will connect directly with the MTG device onboard the tractor using wireless. Once connected the capabilities of the app will be limited by what the MTG is capable of.

The app may be will be able to download logs and reset the MTG remotely.

Dealer Mode

The dealer mode will work much the same way that the owner mode works but it will be optimized for handling larger lists of data. This mode will allow a dealer to quickly sort, classify, tag, and search for vehicles he has registered on his app.

Security

This application must make use of best practices in order to avoid transmitting sensitive data over unsecured networks and take steps to protect any data that does pass over a network through any medium. The applications operation must not expose or real any sensitive information to anyone but an authenticated user.

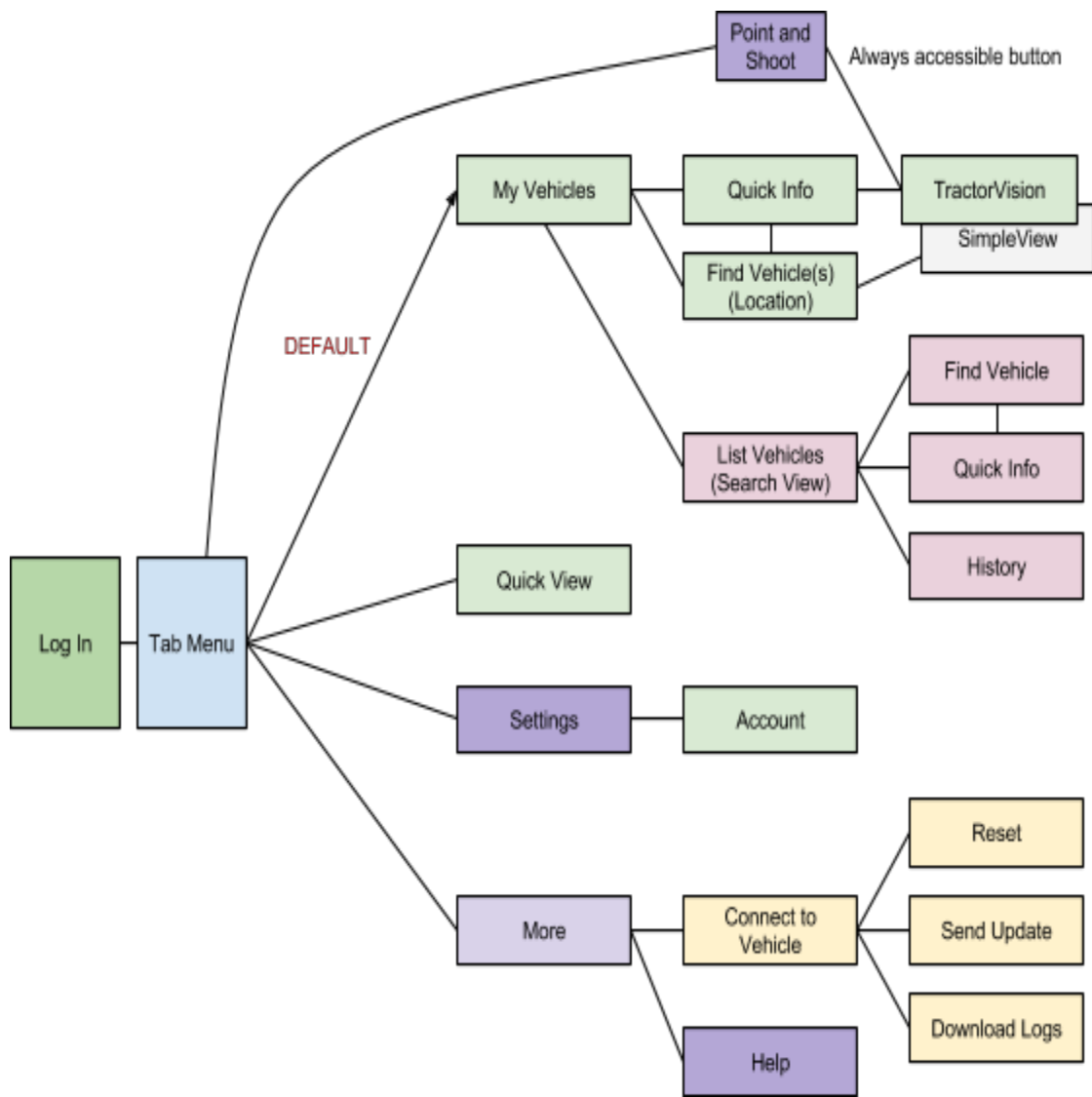
Concept Sketch/Mockup

Screenflow

The overall navigation and traversing of the application should maintain a clear and intuitive path for the user to progress quickly to the information which they are most interested in. In this way there are two primary paths to take:

Tab Button Navigation

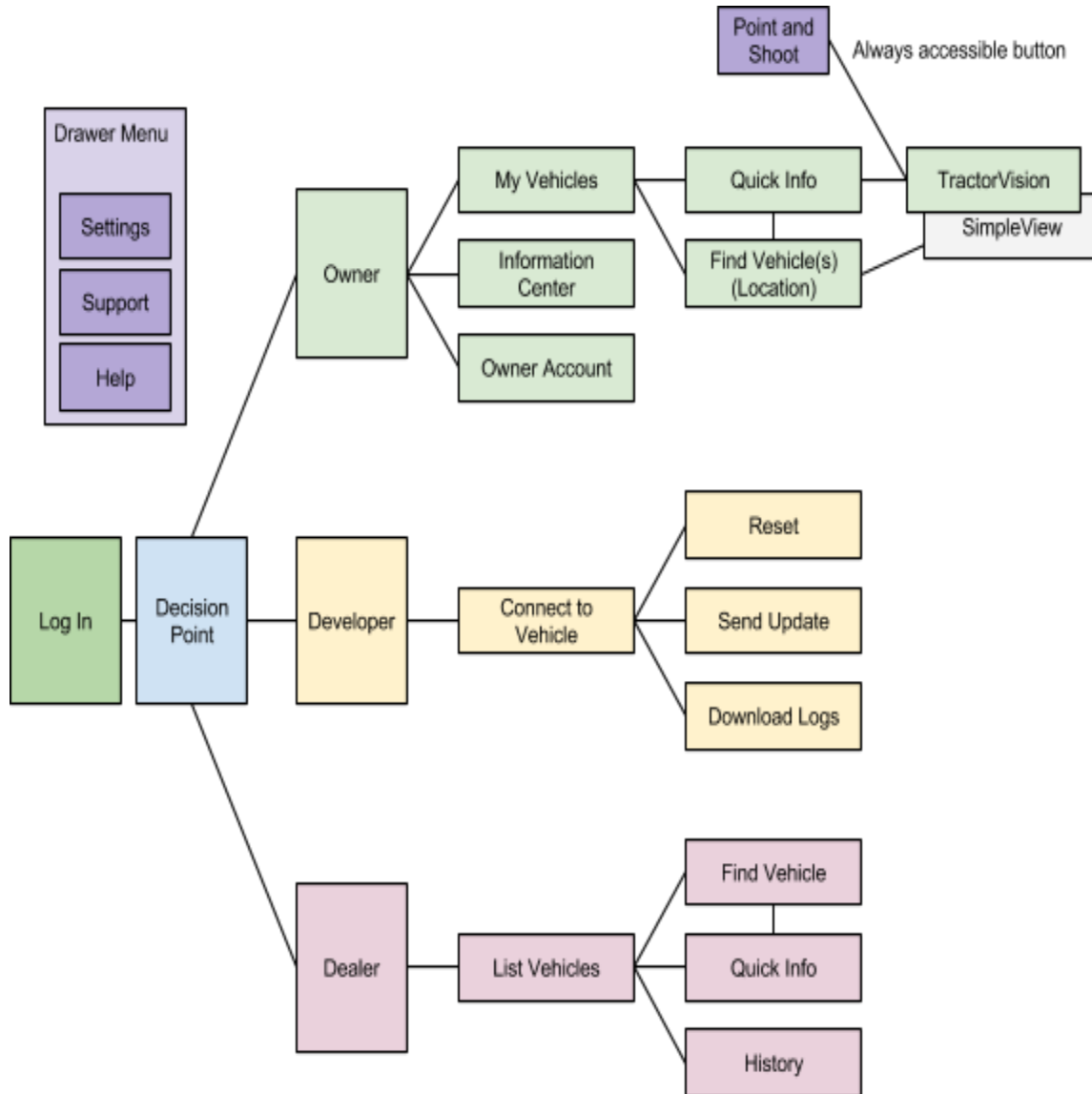
The tabbed menu navigation style puts the highest level of navigation in a small array of tab buttons which are always available to quickly switch to important views.



Tab Button Navigation

Drawer Navigation

The second option is using a 'Drawer Menu' style which puts the highest level of navigation in a sliding menu which is hidden from view unless called upon by tapping a button or gesture swiping.



Drawer Menu Navigation

Screen Concepts

Striving to maintain a comfortable and familiar user interface for iPhone users.

TractorVision

Machine Hours (24hr)
9hr 32min

Tire Pressure
Good (115 PSI)

Find My Tractors

Tractor Number One
2.4 Miles Away

My Tractors

- Tractor Number One (Model #12345678)**
Last updated 30 min ago - 2.4 mi Away
>
- Tractor Number Two (Model #87654321)**
Last updated 30 min ago - 2.6 mi Away
>

Drawer Menu

- TractorVision Mode
- Connect to Tractor (Direct Link)
- My Tractors
- My Organization
- My Account
- Find My Tractors
- Contact Support
- Settings

Add Tractor Remove Tractor Map Tractor Open TractorVision Information

Settings

- Update Interval: 15 min >
- TractorVision Settings: Fuel, Machine Hours, ... >
- Account Information: Tanner J. Hildebrand >
- Developer Tools: MTG reset, Log retrieval, ... >
- Dealer Tools: Vehicle Histories, Record reports, ... >

User Interface Description

Software

The user interface will make use of Apple iOS design guidelines in order to provide a consistent and familiar user experience and provide functionality to the application.

For more information on designing for iOS see:

<https://developer.apple.com/library/ios/documentation/userexperience/conceptual/mobilehig/>

Functional Requirements

The application must be able to meet the following requirements:

- Work for the most recent iOS versions (7 and 8)
- Securely log in a user with their MyJohnDeere account
- Display the vehicles and available maintenance information associated with that account
- Provide an Augmented Reality environment in which the owner's tractor is automatically recognized and maintenance information on the vehicle is displayed
- Operate in 3 modes: Owner, Developer, Dealer

Non-functional Requirements

In order for this application to be practical the following conditions must be met:

- The TractorVision should identify and display information for a tractor in under 5 seconds from target acquisition
- The application should not leak any sensitive data through networks or application interfaces

Additional Requirements

In order to make this application usable and maintainable it is important to us to make the code therein as portable, readable, and modular as possible for future developers to build upon the base it will provide. As we will not be the developers maintaining the application our implementation of this application must be constructed with future teams in mind.

Additional requirements may be considered iteratively while developing.

Resources

Work Breakdown Structure

Because this is a single application with five persons developing for it attention to detail and clear designation of responsibility is one of our primary focuses. Weekly coordinating meetings and open communication will continue to keep the entire team updated on the status of the project and key deadlines.

Advisor: Tien Nguyen

Team Organization

- Jesse Walther, Team Lead
- Han Sang Youn, Testing Lead
- Haoyu Liu, Webmaster
- Brian Moran, Key Concept Holder
- Tanner Hildebrand, Communications Lead

Project Organization

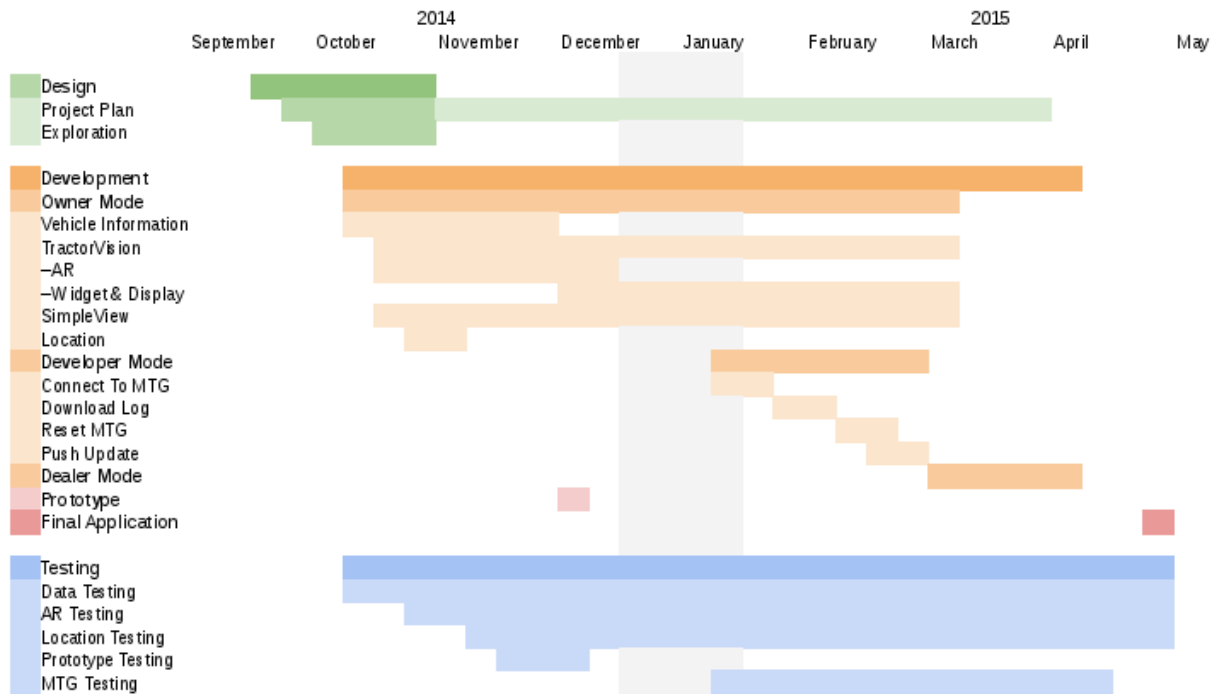
ISG has suggested that we work this project in an iterative manner, that is constantly update requirements and timelines in short term leaps. As such tasks and requirements will be divided and assigned as we see the need arise.

Resource Requirements

Resource	Acquisition	Estimated Cost
Phone 4 for testing	ISG	~\$100
Mac OS w/ Xcode	Personal or Campus	\$0
Apple Developer Account	ISG	\$0

Project Schedule

Gantt Schedule figure:



Risks

Security

The most prominent security risk is accidental data leak over wireless networks such as WiFi and cellular. Using appropriate secure protocols (HTTPS) and well tested standard libraries for the iOS platform we expect to avoid any such data leakage effectively.

Internally the application must not require any more permissions than necessary for full use of the application. Similarly, the application should not make available any information which it has stored to any outside application unless otherwise specified by the requirements.

Market Literature/Survey

Information provided by ISG indicates that the majority of the tractor owners likely to use this application tend to be iPhone users. As such our development will be focused around iOS platform development.

