Software Engineering Project 2019-20

Software Requirements document

Version 2.0

For John Deere

Android Auto & Apple Car Play

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# Project Drivers

## The Purpose of the Project

John Deere is one of the world’s leading manufacturing companies that connects agriculture with technology and provides world class machinery for farming, construction, forestry and more. Their hardware products, coupled with software, allow an efficient management, monitoring and scheduling of agricultural business, conducted from home or the office.

Driving to work, or to the fields for inspection or exploration, can sometimes take up hours. To be disconnected from work for such long hours is not only a waste of time but it also keeps the user unaware of the work status, critical situations that may arise or any anomalous behavior of their work system. To help our clients utilize this time in a more efficient and productive manner, where he/she can stay connected to his work in an albeit limited manner, we   aim at delivering a mobile application, for both iOS and Android which can be used from the headset of the car and enables the interaction with the application while driving.

The goal of this project is to provide users with a mobile application for monitoring and documenting observations and receiving work-related notifications and information for on-field machinery status, at any time, outside the office. Connected to the car’s headset, this application will be equipped with voice interactions to minimize the need for touch-based user’s intervention with the on-screen icons. Such availability of information and access to work will help users in making informed business decisions any time, from anywhere.

## The Client, The Customer, and Other Stakeholders

This project is being developed for John Deere.

The stakeholders involved in this project are progressive farmers, agronomist, managers, dealers and other customers of John Deere. The targeted customers are assumed to be familiar with the related technology and are accustomed to using tools and applications in their daily business.

Other identified stakeholders are the project managers, system architects, developers, and testers, whose involvement is crucial for deciding the flow of the project as it influences the outcomes of this project.

## Users of the Product

Following are the main users targeted for this application:

* Progressive Farmers - A term used for farmers who have high level knowledge on farming and agriculture, but may not be the experts. From technology’s point of view, progressive farmers are advanced users of technology and can easily adapt to novel tools and features incorporated in their work. They see and value the benefits that technology brings.
* Machine Operators – They are responsible for handling the jobs scheduled for the machines and ensuring that the machines on the field function accordingly. They have enough knowledge on farming and technology and require no additional training or tutorial.
* Agronomists – Experts in soil management and crop production, who can give opinions in the science of agriculture when needed. Issues beyond the scope and knowledge of farmers are taken up to agronomists for possible solutions. An agronomist is assumed to have technical know-how, who does not need extensive guidance or tutorials.
* Managers - Responsible for overlooking the work going on at a farm and supervising the machine operators, farmers and other technical and non-technical staff directly involved in the farm project. All logistics and decision-making falls under this role.
* Dealers – People involved in the selling of John Deere’s machinery to other customers, responsible for ensuring that the customers’ experience with the machinery is satisfactor

# Project Constraints

## Mandated Constraints

### **2.1.1 iOS version**

Description: The mobile application built for iOS devices will operate using the version of the iOS – iOS 13.  
Rationale: Given the time constraint of the project, there will be not enough time to develop the application to be supported on multiple version of operating systems.  
Fit criterion: The built product shall be usable by all users that use iOS version 13 on their devices.

### **2.1.2 Android version**

Description: The mobile application built for Android devices will be supported on the most used operating system for Android – Android 7.0 Nougat.  
Rationale: Given the time constraint of the project, there will be not enough time to develop the application to be supported on multiple version of mobile operating systems.  
Fit criterion: The built product shall be usable by all users that use Android 7.0 Nougat on their devices.

### **2.1.3 Collaboration with existing John Deere API**

Description: The product will use the services provided by the existing John Deere API.  
Rationale: By using the existing API, it speeds up the development and testing process and gives access to the data we need.  
Fit criterion: The application should use the API provided by John Deere.

### **2.1.4 Designed to be used in a car**

Description: The mobile application shall be used in a car attached to the car head display. Aim is to minimize user’s on-screen interaction that may disrupt user’s attention to driving.   
Rationale: The client and the customers want to utilize their time while driving the car, in an effective manner.   
Fit criterion: The product has to comply with the legal constraints for CarPlay and Android Auto applications.

### **2.1.5 Final deadline of the project**

Description: The final version of the project will be presented before the 20th of December 2019.  
Rationale: The project is a student project with a time limit aimed to gather experience in developing a project and teamwork, and to create a working prototype for the client.   
Fit criterion: The product shall be finalized before the 20th of December 2019.

### **2.1.6 Language**

Description: The mobile application built for iOS/Android devices will use English as a language for all the voice commands and also the user interface will be shown in English only.  
Rationale: Given the time constraint of the project, there will be not enough time to develop the application to support multiple languages.  
Fit criterion: The built product should use English as the language for display or for performing any actions like voice commands.

## Naming Conventions and Definitions

A glossary to be filled when the document is finalized

## Relevant Facts and Assumptions

Corporate design/Wireframes should be taken into consideration while designing the user interface. Moreover, assuming that the users of this future application are already using the tools developed by John Deere, there shall be a consistency between existing application and the new application being developed. Also, the future users won’t need any training in order to be able to use the application.

# Functional Requirements

## The Scope of the Work

During the periods of the year when planting and harvesting is done, farmers have to go and inspect the fields while monitoring the ongoing work across their organization. Driving from field to field, they don’t have the access to their office or computer. Additionally, the data consumption and the interrupted connectivity in some field locations can also be an issue. With the mentioned issues, it is difficult for farmers to manage taking notes about important observations and monitor the tasks simultaneously while driving. Given the current problems, this project aims at solving them, by providing a platform for the user to perform all relevant operations, while dealing with issues like connectivity.

With this project the CarPlay and Android Auto features will be explored and used in a way that our client can benefit. Everything done during the project will provide an insight to the client how this car technology could be used at its best and in the most efficient way that their customers can benefit. This project will integrate the existing John Deere functionality with creativity and innovation by transferring it to the new platform which can be used in a different setting than what the current users are used to. The application to be built will use the data provided by the John Deere API to enable the users with much needed on-the-go information. Additionally, the functionality of taking notes and voice memos, implicitly connected to the field, through the application will save the user from the trouble of forgetting important facts or linking the observations to the object of interest.

Remotely controlling the machines, as well as building the application to be used in an agricultural machine is out of scope of this project.

## The Scope of the Product

The scope of the product includes a mobile application for iOS and Android (for versions refer to [section 2.1](#_Mandated_Constraints)). The specific functionalities of the mobile application shall be propagated to be used from a headset of the car (CarPlay for iOS and Android Auto for Android). Common functionalities may differ based on the platform they are used on.

As far as the offered functionalities on the iOS and Android is concerned, it is important to note that the core functionalities will be the same but the addition of possible platform specific functionalities could be there. In that way, broad range of functionalities can be explored on both platforms together.

3.3 Functional and Data Requirements

The following table elaborates the functional and data requirements. Since this is an experimental project, the functional and data requirements may change according to the progress of the product development and will be added accordingly.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Req No. | Description | Rationale | Fit Criterion | Priority |
|  | Application should be able to take input commands and give output using voice. | Driver should not be distracted by the use of application. | The devices in use should be compatible with Android/iOS voice recognition features. | High |
|  | Application should show user’s current location on a map | User should be able to see where he currently stands so he knows which direction he should head in | The application should support google maps/apple maps feature ~~and shows the location zoomed in to the user~~ | High |
|  | Application should update the user’s location as the car moves. | User should be able to see where he is heading, and where he is at that point in time | The application should support google maps/apple maps features ~~and the map should update a location pointer as the car moves.~~ |  |
|  | Application should show the area in the user vicinity on the map | User should be able to check which area he is in and plan as per the locations within vicinity | The application should support google maps/apple maps features ~~and the map should be zoomed in such that the user’s location is centred and the area within the vicinity of~~ **~~XZY~~** ~~km should be visibly labelled.~~ | High |
|  | Application should show custom field boundaries of the farms on the map | User should be able to instantly locate the fields over the basic map. | The application should support google maps/apple maps features and overlay feature libraries | High |
|  | Application should allow navigating to a custom field boundary | User should be equipped with the possibility of selecting fields he wants to drive to | The application should support google maps/apple maps features and overlay feature libraries. | Medium |
|  | Each field should have a proper name given to it that user can use to navigate to | It should be made easier for the user to point out the field he wants to drive to using verbal commands rather than selecting the area on map by touch | Proper naming conventions as per John Deere’s API should be followed | High |
|  | Application should allow the user to take notes verbally | User should not be distracted with typing notes while driving and hence minimize screen interaction by taking voice input | The car device in use should be compatible with Android/iOS voice recognition features. | High |
|  | Application should allow the user to save notes against a specific field | User may want to have the note for a specific farm area, so he can easily view his notes later categorized as per field |  | High |
|  | Application should allow the user to save general notes regardless of field. | User may want to have notes irrespective of field, like general reminders or points etc |  | High |
|  | Application should allow the user to discard the note | User may have created a note he doesn’t need or given wrong information that he does not want saved |  | Medium |
|  | Application should read out the notes to the user when asked for | User should not be distracted with reading the text off the screen while driving |  | High |
|  | Application should confirm if the note taken should be saved or not | User may want to discard a note in case its not correct, important or relevant |  | High |
|  | Application should ask which field note does the user want it to read | There could be multiple fields in the vicinity and user may want to read his notes for specific field only |  | High |
|  | Notes for a specific field should be saved with the field’s geo tag. | When user saves a notes for a particular field, the location tag is required to fetch field info |  | high |
|  | Application should read back the note to the user when taken | User should be allowed to ensure whether its correct or not |  | Medium |
|  | Application should only read back the note to the user before saving if its length is less than **x** characters | Reading long notes is not aesthetically pleasing, wastes times and delays the process of saving or discarding the note | Length of the notes should measure to less than **x** characters | Medium |
|  | Application should immediately save the notes locally on the device | Data loss should be avoided and notes should be readily available for later use | The devices in use has storage capacity. | High |
|  | Application should be able to detect if there are any fields within the user’s vicinity | User should be equipped with maximum relevant information regarding his surroundings, so he may schedule and plan things accordingly | The application should use John Deere’s API for the custom field maps and fetch data to see if there are any matching coordinates in the current vicinity |  |
|  | Application should be able to give information about the fields in the user’s vicinity | User does not need to go outside the car and inspect the field. | The John Deere’s API’s have all relevant data and is accessible by the application. | Medium |
|  | Information about the field and the machinary should be date specific | User should know how old the information is and has the situation changed over time or not |  |  |
|  | Application should provide the latest information about the field and machinery first | User would be more interest in knowing the latest updates rather older one |  |  |
|  | Application should be able to provide information about the machinery being used in the fields in the user’s vicinity | 1. User does not need to go outside the car and inspect the machines. 2. User may want to schedule some tasks or take some notes as per the information he receives regarding the machines | The machine/Equipment information provided by the API in use is accurate. | Medium |
|  | Application should allow the user to ask if there is any important information regarding the field or the machinery | User should be allowed to check if there is any information rather than rely on guesses or assumptions |  | High |
|  | Application should provide the information field and/or the machinery only when asked for | User should not be flooded with information all the time, uninformed but should only have to know the information when desired |  | High |
|  | Application should colour the areas within custom field boundary as per priority of information about the field and the machinery within that field | User should be able to quickly pick the visual ques about which field needs more attention and hence prioritize the order of listening to information about the fields/machinery |  | High |
|  | Application should change the colour of the field area once the priority of information changes | The map should remain updated all the time so the user is aware of the current situation and remains updated at all times |  | High |
|  | Priority of information changes if : |  |  |  |
|  | Application should provide information about the nearby field/machinery through voice. | To be able to know about important information while driving the car without interacting with the mobile. | The application should be able to give information on the car device and read them out to the user | High |
|  | Application should allow dropping flags in custom field boundaries | User may want to drop a flag that’s related to a particular field |  | Medium |
|  | Application should show a flag in a field boundary every time someone creates a **---------** |  |  | Medium |
|  | Users of the application can see flags pinned by other users. | User should be able to see if other users have found some information worthy of notifying |  | ?? |
|  | Application should show a tractor icon in the custom field boundary every time someone reports an issue with the machinery in that field. | User should easily be able to identify that  the nature of the problem pertains to machinery and may want to contact the operators in that field |  | ?? |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Notes added shall be synchronized with JD Database. | The user can access or refer the notes in a later point of time. | The notes added by the user is stored in JD database for longer time periods. | Medium |
|  | When the data connectivity is limited, store the data in local device and upload when back online. | The user can use the product in locations with poor internet connection or of no connectivity. | The devices in use has storage capacity. | High |
|  | App should provide synchronization between Local Database and API | Changes made in Local Database should be reflected in API and vice versa | APIs and Database should be synced so that no information is lost or is redundant | High |

Application should use the existing John Deere’S APIs for all data regarding the fields, machinery and boundaries.

1. Non-Functional Requirements
   1. Look and Feel Requirement:
      1. The product shall comply with the corporate branding standards which will be given by John Deere.
      2. The look of the product used in cars shall not be distractive to the driver and follow the Android Auto / Apple CarPlay product design guidelines.
      3. The application should provide visual clues that stand out, through icons and color scheming, to identify important information without having to interact much
      4. The application layout should be compatible for car devices
   2. Usability Requirement:
      1. The product shall be readily available to use in both smartphones and car devices.
      2. ~~Important notifications regarding the fields shall be displayed when the device (phone and car play) starts.~~
      3. Possibly, the product should be simple enough in language context so that people with limited understanding of English face no difficulty.
      4. The product shall use symbols and words that are naturally understandable by the farming community.
      5. The product shall hide the details of its construction from the user.
      6. The product is not concerned with the users with disabilities as of now.
      7. The system should be able to recognize voice commands even to open the application without touching screen or pressing button when the hands-off functionality on the device is switched on.
      8. The system should be able to respond to voice commands even when the app is currently not running. (By implementing a service running in the background)
      9. Voice responses by the application should be precise enough to avoid long dialogues and task delays.
   3. Performance Requirements
      1. The product shall consider the working conditions with low network bandwidth.
      2. There shall be provisions for storing data with poor data connectivity and upload data automatically while back online.
      3. The product shall consider the limited usage of internet data.
   4. Operational Requirements
      1. The application shall be used by a user in all weather conditions in which a smartphone can be used.
      2. The product shall be used hands free in major share of time (I/O by voice).
      3. The product shall interface with other applications like maps for navigation and camera for pictures.
   5. Maintainability and Portability Requirements
      1. The product shall be able to be maintained by John Deere developers other than original developers.
      2. The product shall be given support by the John Deere support team if implemented in the user environment.
      3. The product is expected to run on Android (refer to [section 2.1.2](#_2.1.2_Android_version)) in phones and all android auto versions.
      4. The product is expected to run on iOS (refer to [section 2.1.1](#_2.1.1_iOS_version)).
      5. The product is intended to run on Mobile devices and automobile head up units.
      6. We are not concerned about the subsequent releases now, but the product shall be compatible with future updates.
   6. Security Requirements
      1. The product security shall be compatible with the security features of “MyJohnDeere” application.
      2. A John Deere user account is needed for using the application.
      3. The user account is protected by John Deere’s privacy policy.
      4. The user authentication shall be done based on the data available from John Deere’s database(s).
      5. The data shared through the application shall be protected according to EU regulations and will be stored in John Deere databases.
      6. The product shall make its users aware of its information practices before collecting data from them.
      7. The product shall notify customers of changes to its information policy.
      8. The product shall reveal private information only in compliance with the organization’s information policy.
   7. Cultural and Political Requirements
      1. The product shall not use offensive or abusive content in any formats.
      2. The product shall be able to be used in all countries where John Deere products are supported.
      3. The use of the product shall not be limited to any specific device manufactures, but the product shall be liable to Android or iOS regulations.
   8. Legal Requirements
      1. Personal information shall be implemented so as to comply with the Data Protection Act.
      2. The product shall be developed according to Android/ iOS development guidelines and shall not include any copyright infringements.
      3. The product shall comply with the European Union and United States laws and regulations.

5. Project Issues

5.1 Open Issues

* Our studies shows that the use of Android Auto requires considerable amount of internet data which might affect the internet usage of application.
* The limited knowledge and experience of the development team along with time constraints may affect the quality of the product developed.
* Since it is a student project which involves students from different backgrounds and limited knowledge of agriculture industry, the naming conventions used may not be suitable for the end users.
* Performance of the application may be limited by the device being used and the performance of the existing John Deere API’s that are used in the development of the project.

5.2 Off-the-Shelf Solutions

To be determined later.

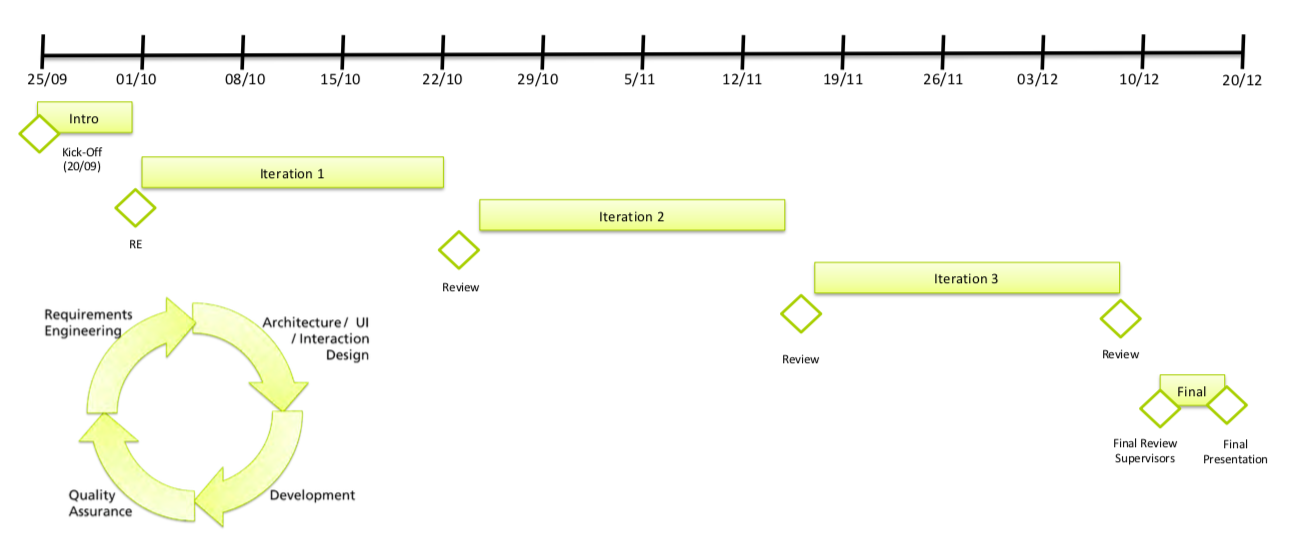
5.3 New Problems

The end users are already using different applications from John Deere so the use of multiple applications for the same purpose in different devices might cause confusion to the existing users. Moreover, since the application is required to run in multiple devices at the same time, it may affect the performance of the product.

5.4 Tasks

**5.4.1 Project Planning**

For the development of the project, we will be following three weeks sprints starting from October 1, 2019. Following is the initial sprint plan of our project.

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**5.4.2 Planning of the Development Phases**

The initial project development plan is as follows. The team members will try to strictly follow the project plan and to deliver the prototypes as mentioned in the plan in due time. Changes in requirements from the customer’s part will be also documented as the time progresses.

|  |  |  |
| --- | --- | --- |
| **Phase Name** | **Date** | **Agenda / Functionalities implemented** |
| Introduction | 25/09 | Kick off meeting, Project elicitation |
| Interview | 27/09 | Customer meeting, Gathering of project information. |
| Info Gathering | 01/10 | Collecting and sorting of requirement data among team and familiarizing with the development environment. |
| RE Documentation | 7/10 | Requirements engineering document review by the project coordinators. |
| Final SRS | 15/10 | The final RE document is submitted to the customer for validation. |
| Supervision Review | 10/12 | The product is submitted for supervision review and recommended changes are being made. |
| Final Presentation | 20/12 | The product is presented before the client and it functionalities and uses are explained. |

**Please Note:** Additions and changes to the above mentioned plan is possible as the progress of the project which will be reviewed by Fraunhofer’s support team.

5.5 Cutover / Migration to new product

We are not concerned about the future updates of the application as of now.

5.6 Risks

The risks involved with the project include:

* Lack of product functionalities as envisioned by the end user
* Lack of experience of the development team with the environment in which the product is to be used. Moreover, the time constraint of a student project may cause low productivity and quality than expected.

5.7 Costs

As this is a student project, costs are not applicable to it.

5.8 User Documentation and Training

No manuals or user documentations are maintained.

5.9 Waiting Room

The application holds a huge potential for integrating other functionalities to the existing product. Some of them according to their priority are:

* Using the product in John Deere Machine’s display units
* Controlling John Deere Machines through the application
* Capturing field data while inside the car
* Application made friendly for colour blindness users