

Product Requirements Document

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Project Name: AR-chitect

Revision History

Version Number	Version Description	Date Complete
1.0	Initial Version with User Stories, Glossary, and System Architecture	11/2/26

Introduction

There is currently no existing, unified platform that provides dedicated services to assist construction building contractors with performing on-site walkthroughs, pointing out and handling construction site flaws, and easily facilitating subcontractors with performing location-specific tasks. Currently, on-site evaluations are performed by contractors using a myriad of services: on-site evaluations are performed by taking large sets of photos on a daily basis using a camera, notes regarding tasks to perform on a construction site (known as “punch-items”) are tagged on two-dimensional schematics using excel spreadsheets, text-to-speech transcriptions are used to make audio recordings of a construction site’s status, and the same two-dimensional schematics are constantly analyzed in order to self-track motion within a construction site. Contractors want a unified, user-friendly platform by which daily photo logs, punch-items, and job site evaluations can be created and updated efficiently in a job site atmosphere.

AR-chitect is an Android application that will run on Google’s Project Tango tablet and will provide contractors with the all of the tools they need to perform construction site evaluations. AR-chitect will provide a unified platform by which contractors can track their motion on a construction site and add punch-items to a schematic in real-time using an augmented reality camera view. The motion tracking feature of the application will be provided for using a combination of the sensors onboard the tablet as well as dynamic schematic and position calibration features in order to provide a user either a first-person or a third-person view of their positioning relative to a schematic. The augmented reality camera view feature of the application will allow for a user to place 3D-respective markers on a viewed surface - as well as add organized annotations in the form of punch-items to the camera view.

Glossary of Terms

Android - an open-source operating system developed by Google used for smartphones and tablet computers

Area Learning - the process of remembering the visual features of the area that a device is moving through and recognizing when it sees those features again - by saving these features within an Area Description File (ADF)

Augmented Reality (AR) - a live direct or indirect view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics, or GPS data

Motion Tracking - the process of recording the movement of objects or people using multiple cameras performing high-frequency environmental position samplings

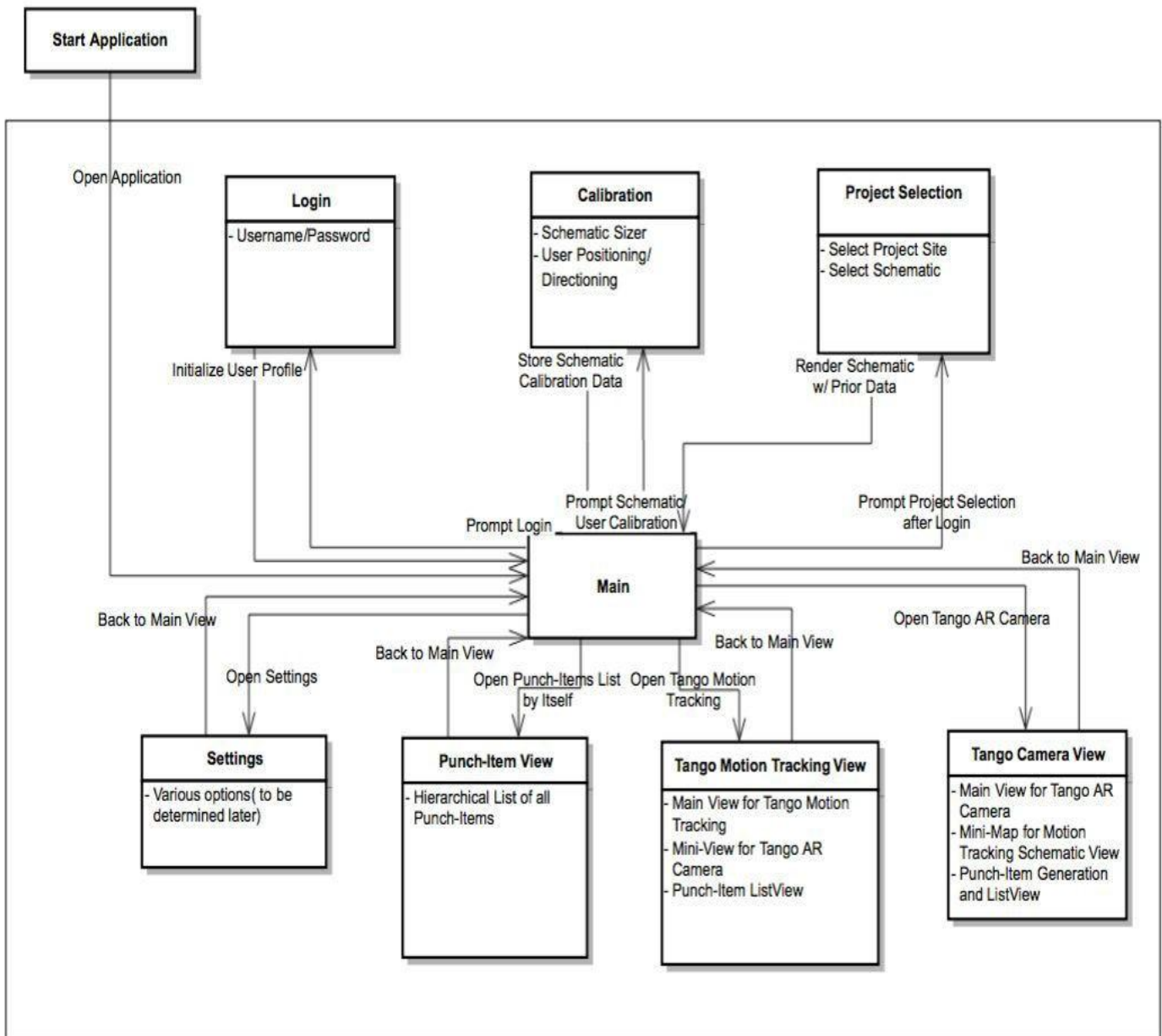
OpenGL - an application programming interface (API) which interacts with a graphics processing unit (GPU) in order to render two-dimensional (2D) and three-dimensional (3D) vector graphics.

Project Tango (Tango) - a tablet project by Google's Advanced Technology and Projects group (ATAP) which is an Android device which tracks the 3D motion of the device, and creates a 3D model of the environment around it.

Punch-Item - an annotation made within a construction site by a contractor in order to mark out a defect or component which needs to be worked on.

3D engine - a 3D engine for Android based on versions of OpenGL (ES 2.0/3.0) used to create graphics-intensive applications. (<https://github.com/Rajawali/Rajawali>)

System Architecture



Requirements

1. As a user, I can login to AR-chitect via Procore account.
2. As a user, I can receive all schematic and punch-item information associated with my Procore account.
3. As a user, I can choose a schematic to generate a motion tracking view from.
4. As a user, I can scale a chosen schematic proportionally to my motion and real-world characteristics.
5. As a user, I can position and angle my initial position within a schematic's motion tracking view.
6. As a user, I can rescale a schematic in order to account for prior inaccuracies in resizing.
7. As a user, I can track my motion efficiently within a construction schematic floor plan.
8. As a user, I can create surface-respective objects using the Project Tango tablet's camera view.
9. As a user, I can create punch-items pointing to surface-respective objects within the Project Tango tablet's camera view.
10. As a user, I can efficiently delete unwanted objects - and corresponding punch-item annotations - within the Project Tango tablet's camera view.
11. As a user, I can efficiently track my position within a motion tracking schematic view.
12. As a user, I can utilize the motion tracking schematic view as a mini-map component running concurrently with the Tango's Augmented Reality camera view.
13. As a user, I can make punch-items hierarchically organized from the Tango's Augmented Reality camera view.
14. As a user, I can upload all object, punch-item, and positioning data to Procore's cloud services.

Prototyping Code and Test Cases

Github Repo: Private Repo Hosted Through Procore

1. Login tests:
 - a. Can users login using their Procore account?
 - b. Can we receive user information from Procore's backend?
2. Calibration tests:
 - a. Can users scale the size of a schematic precisely?
 - b. Are users able to position and angle themselves within a schematic?
 - c. Will users be able to resize the schematic based upon prior inaccuracies?
3. Augmented Reality tests:
 - a. Can users create surface-respective objects in the Tango's camera view?
 - b. Can users create a punch-item pointing to an object in the camera view?
 - c. Are users able to efficiently delete unwanted objects in the camera view?

4. Motion Tracking tests:
 - a. Can users efficiently track their position within a schematic?
 - b. Will users be able to track their position using a mini-map component running in parallel with the Tango's camera view?
5. Punch-Item Organization tests:
 - a. Can users make hierarchically organized punch-items from the Augmented Reality view?
 - b. Can we sync all created user-created punch-items to cloud services using Procore's API?

Technologies Used

Hardware:

- Project Tango Tablet (Android OS)

Graphics Libraries:

- OpenGL
- Rajawali

Mobile Application:

- Android SDK
- Java
- XML

Backend:

- Procore API
- Retrofit
