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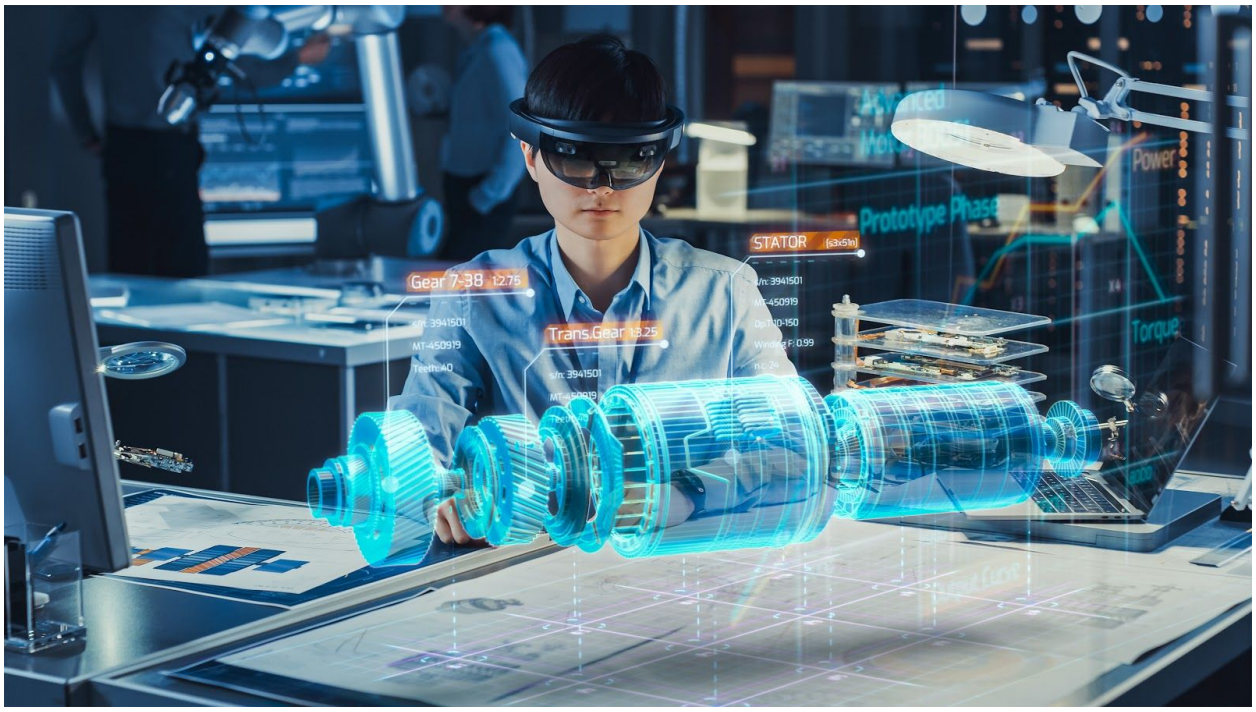

A Mobile Application to Log and Recall Location-Based Information in a Manufacturing Setting

Experience Design Document

This describes a prototype to be developed as part coursework for the XR Terra March 2020 Cohort VR/AR Developer Certificate Program in cooperation with industry partner PTC Inc.

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Overview

Successful communication of issues with industrial manufacturing machinery can help decrease the downtime from equipment repairs and promote smooth productive conditions for factory floor workers. It is essential for the health and safety of those workers to understand the status and condition of the equipment from one shift to the next, and is critical to maintaining high productivity.

Having easy access to the machine's reported issues and relevant resource materials while at the particular machine would help expedite the necessary repairs. Machine manuals and maintenance records need to be on hand so that workers can better understand how to approach the current issue and to facilitate the ordering of replacement parts so that production can continue with ease.

Some common issues that arise on factory machinery typically involve a broken part, regular maintenance, a machine coming on line for the first time, or being decommissioned. It would be useful for workers to capitalize on a template for reporting and recalling issues while they are at the scene, and a UI layout that allows for easy attachment of supplemental materials and references spatially linked to a particular machine. Multimodal information in the form of text, imagery, audio, etc., can greatly help others understand the current state of the machine's issues and pass on that knowledge between workers.

Goals

To support frontline shift workers both to methodically log multimedia-supported pertinent issues and to permit quick and easy access to those same issues, with an Augmented Reality mobile application for phones.

Our goal is to create a prototype exemplifying some of the features that would be useful in such an application.

In particular:

1. The application will allow logging of a manufacturing **issue** that needs to be communicated between coworkers.
2. The details of the issue can later be accessed by the same or by another person, using the application.
3. All issues and records associated with a particular machine are accessed by scanning a QR code on location at a machine or process.
4. The issue will allow placement of a persistent visual anchor at the location.
5. Markers representing supporting media content (text and images) for an issue can be placed in space relative to the anchor.
6. Backend database storage will be used to save and recall issue reports and assets.

Specifications

The application will be created in Unity with AR Foundation, using both ARCore and ARKit and Azure Spatial Anchors.

The expected delivery will be for either the iOS or Android platform, on recent mobile phone devices.

Images will be either .jpg or .png.

Anchors will be placed on location after scanning a pertinent QR code, implemented using Azure Spatial Anchor technology.

Asset storage will use Simple AWS, Amazon Web Services, and/or Azure cloud blob storage

Relevant sample manuals, maintenance records, and a replacement part number reference will be in .pdf format.

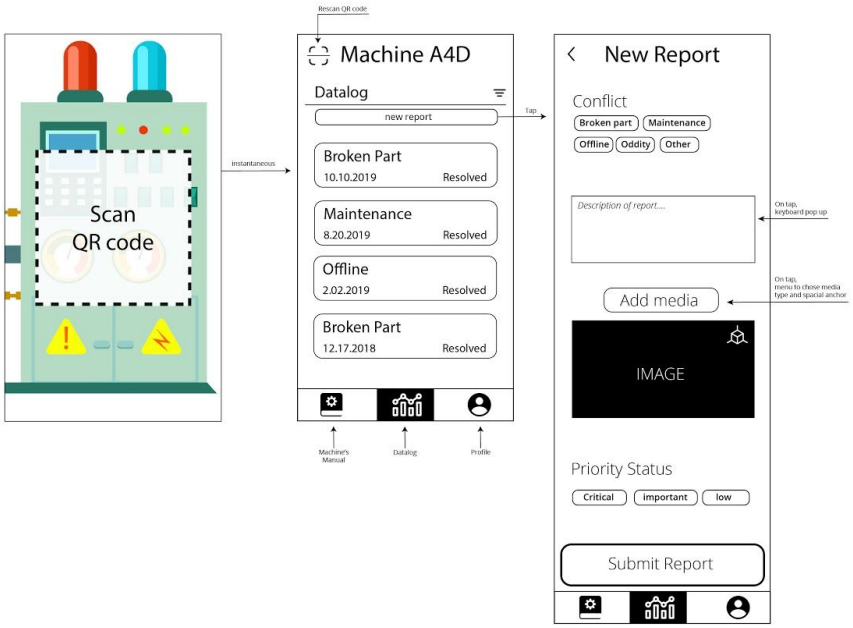
Features

1. A user can scan a QR code to access records and assets associated with a particular machine and to log an issue about an industrial manufacturing circumstance.
2. A user can create text, and save that text as part of the issue.
3. A user can take an image with their device, and save that image as part of the issue.
4. Both supportive text and photos can have markers in 3D space on location, relative to the spatial anchor.
5. A user can save and retrieve issues and assets to the cloud.
6. A user can add on to the details for a previously logged issue, including adding text and images.
7. The state of an issue will be tagged “In Progress”, “Unresolved”, or ”Resolved”.
8. Issues and edits to an issue will be given timestamps. A log for issues is maintained on a per machine basis.

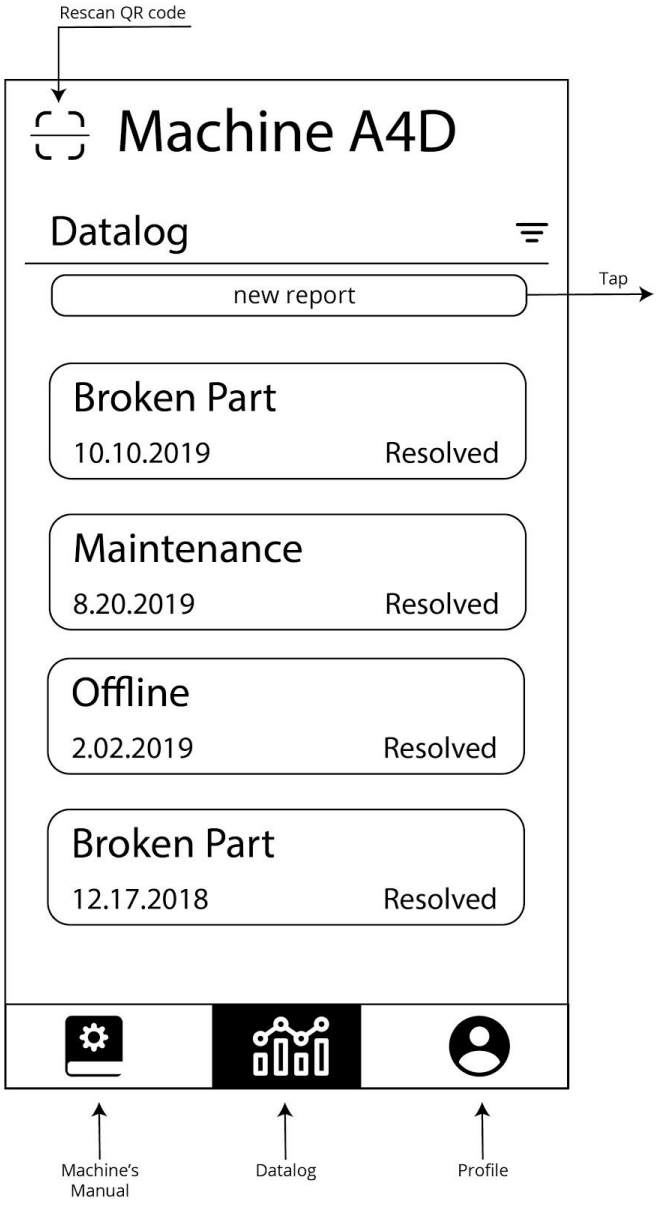
Mockups/ User Flows

Create New Report

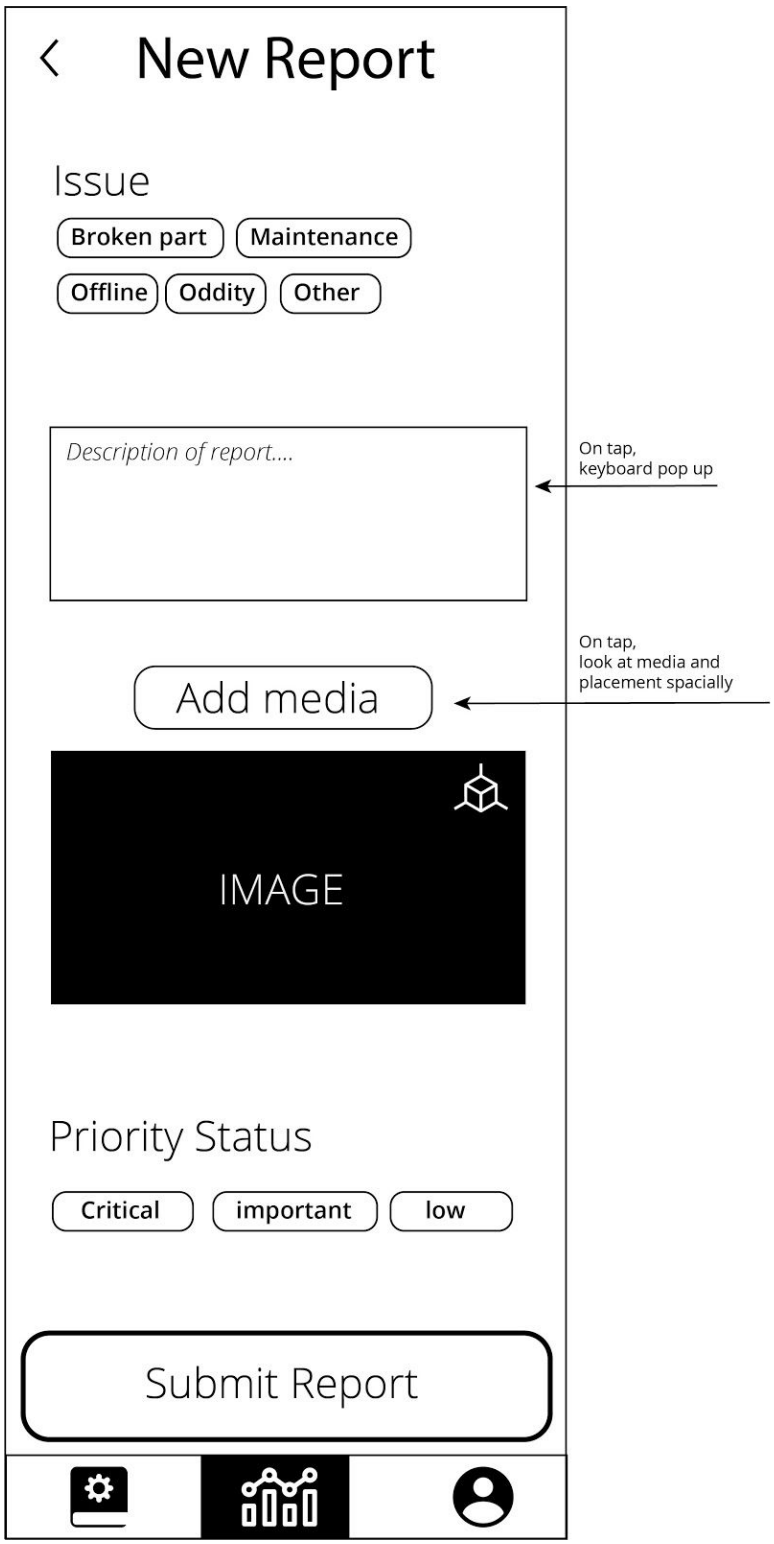
This is the user flow for creating a new report for an issue with the machine.



After scanning the QR code on the machine, the user will be brought to the main page showing all of the current and past issues for that specific machine.

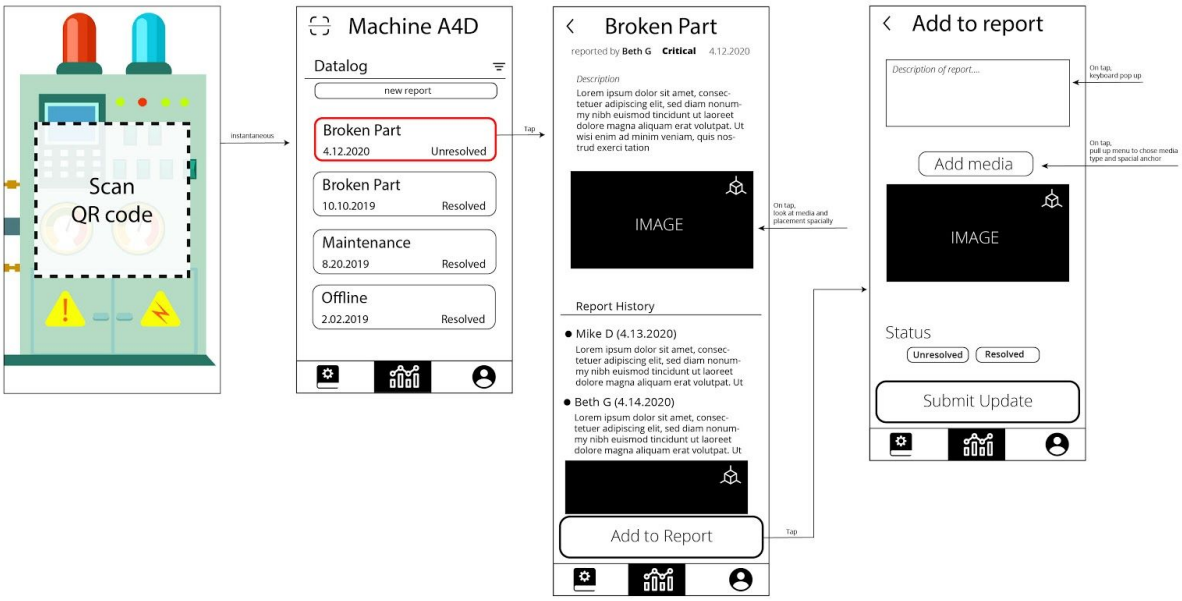


When the user finds an issue with the machine and taps " new report", they will be brought to this screen where they will input information relating to the issue.



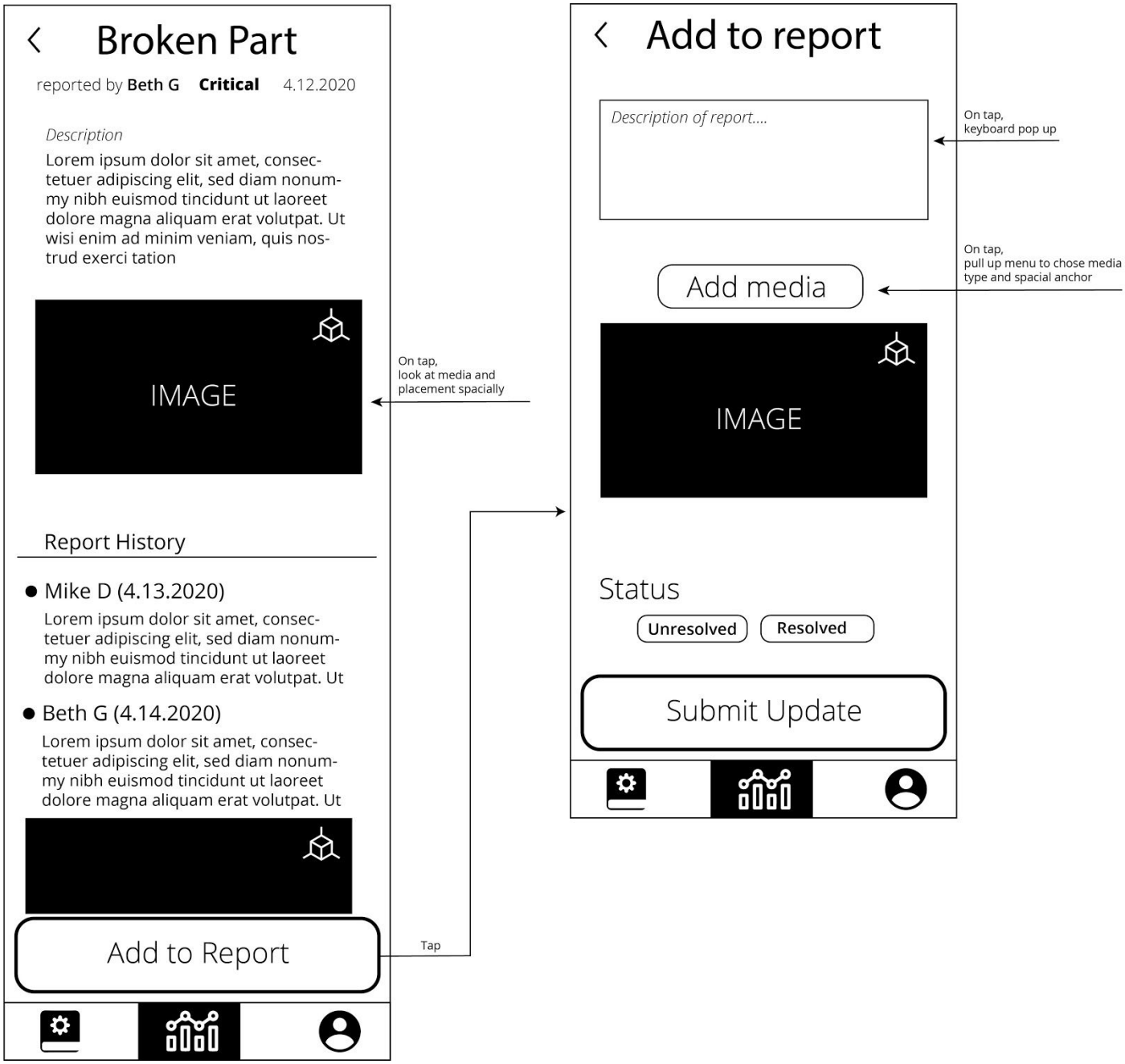
Add To Report

This is the user flow for new shift workers to get updated on the current status of issues associated with a particular machine. The user may then add to the report.



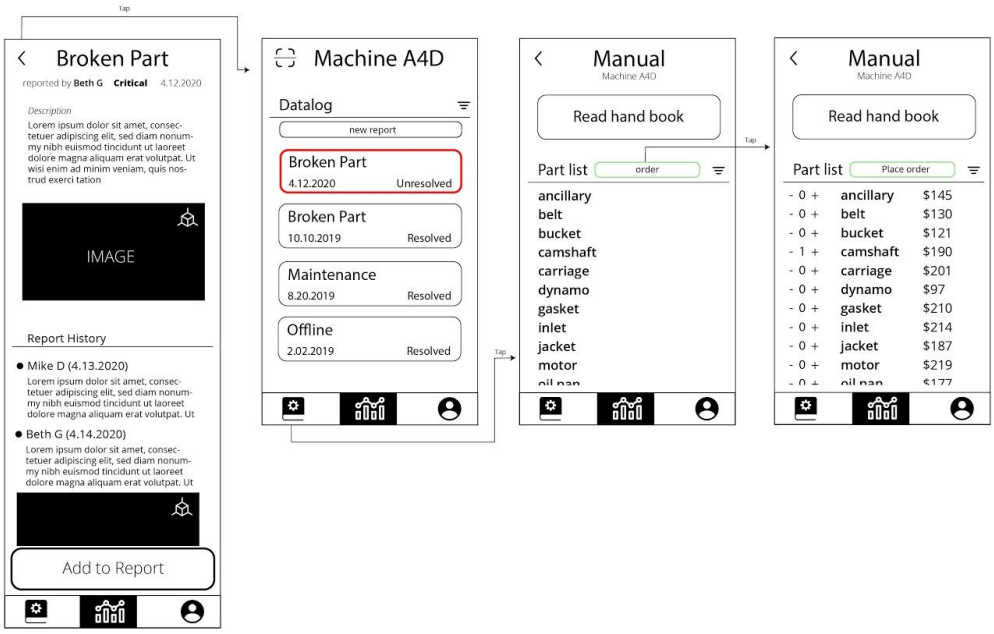
Once the new user has scanned the QR code and has tapped on the unresolved report, they will be able to see the details about the issue, view any media that has been attached, as well as all updates made by other users and the media that they have attached.

The user can then tap “add to report” to make their own comments and add their own media to the report.



Access to the Library of Ancillary Materials

This is the user flow for ordering new parts for a problematic machine.



Milestones

Scanning the QR Code

Scan a QR code to initiate creating an issue for a machine. Scan the same QR code to later recall the issue.

Spatial Anchor Saved and Retrieved from a Remote Database

Create a spatial anchor within the application; save it, retrieve it, and show it in a consistent context and location.

Creation of Library

Provide access to a library of information specific to a single machine, while in the application.

Creation of Supporting Media

Text and images associated with a machine can be created and viewed by the user. Assets are stored retrieved from a remote backend database.

Supporting Media Tied to Spatial Anchors

Text and images may have corresponding visual markers in AR. That information is stored and retrieved from a remote backend database.

Successful Testing

Successfully test the completed features on both an Android and iOS phone.

Timeline

4/13: Experience Design Document completed and submitted

4/14: Meet with PTC representative for project information

4/17: Generate a spatial anchor using the application

4/17: Add basic UI navigation

4/17: Add ability to log a new issue (without images or text assets)

4/19: Add ability to place a text or image spatial marker relative to the spatial anchor

4/19: Add text and image media types in support of an Issue

4/21: Store and retrieve a basic issue remotely (without images or text assets)

4/21: Add ability to link images and text to spatial anchors

4/22: Store and retrieve, and present all logged issues for a machine

4/23: Deliver early version of the prototype for feedback

4/30: Presentation and demo of final product to class and PTC representative

Minimal Viable Product Requirements

Bind arbitrary digital assets relative to a spatial anchor

- Assign a spatial anchor
- Media is tied to that anchor
- Media's behavior:
    - ➢ Orientation to the user
    - ➢ Interactions
    - ➢ Moveability

What Digital Assets can be used?

- How to import the asset
- Accessing the device's microphone, camera, or storage
- Downloading assets from an external source for use

Asset Storage

- Where are the digital assets stored?
- Database in the backend

Asset Accessibility

- Assets should only be accessible near the spatial anchor
- Database in the backend

Only Relevant Information

- Make sure that only the information for the machine/spatial context the user is standing in front of is given
- Don’t want to confuse the user with info from a different machine

Optional: Augment the Experience

- How can you add to the experience?
- What could be improved in this specific use case?
- Is there a tool that would be super convenient to have handy?

Wishlist

The entire maintenance history record for a machine will be available to users.

Enable incremental permanence of an issue, so the original issue is preserved and changes are logged.

Time stamp edits to an issue.

Have dropdowns, etc. for various issue scenarios, machines, personnel, common problems, common resolutions, to make “telling” a story faster and easier.

Create an alert to show a user an issue needs attention.

Set the status of an issue (In Progress, Resolved) maybe with color and shape indicators.

Attach audio clip media to an issue.

Attach video clip media to an issue.

Access user Pr

ofile Screen.