Augmented Reality for Hydrology

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OBJECTIVE

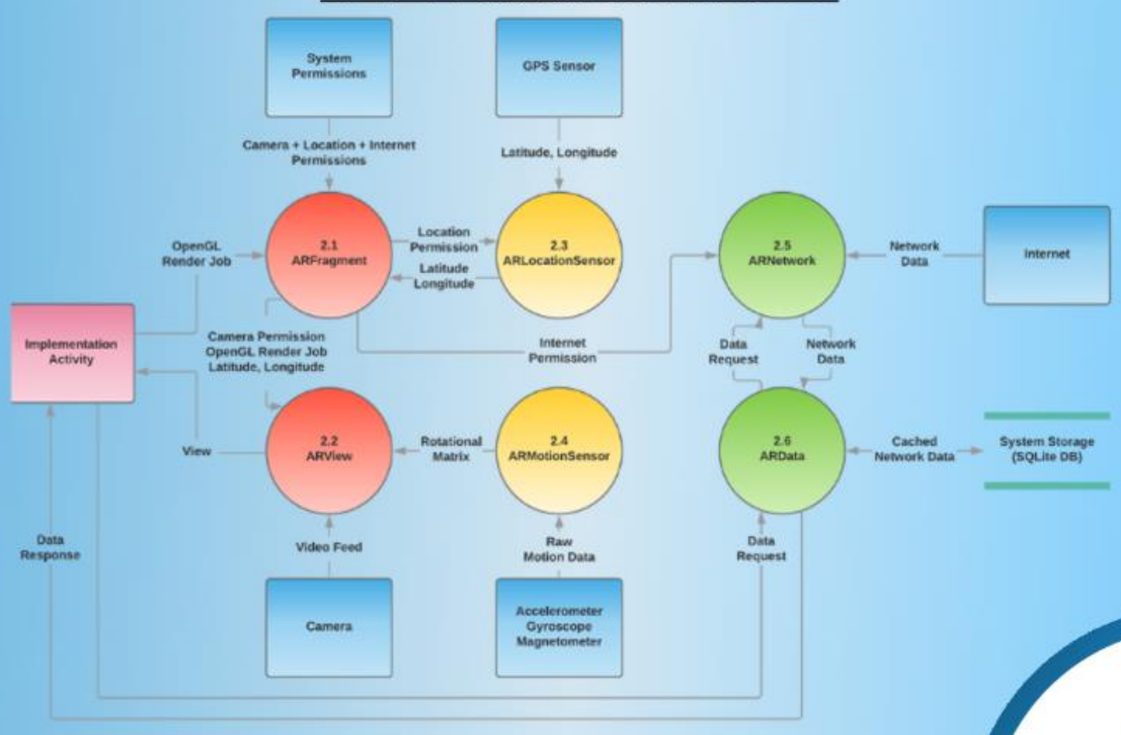
Sponsored by JPL, this project aims at building a general frame work for Augmented Reality (AR) mobile applications that provide visualization for JPL's Watertrek data. The app and framework will be prototyped for Android for this project. In the future, it is expected for JPL to add support for iOS and the DJI drone platforms.
In order to showcase the features of our developed framework and test its capabilities in the real world, the team created an application that tested all the modules currently with functionality. This produced an application that could receive real time data from JPL's REST api, display on a 2D map (Google maps) and at the same time have 3D objects superimposed fulfilling the Augmented Reality component of the project.

BACKGROUND

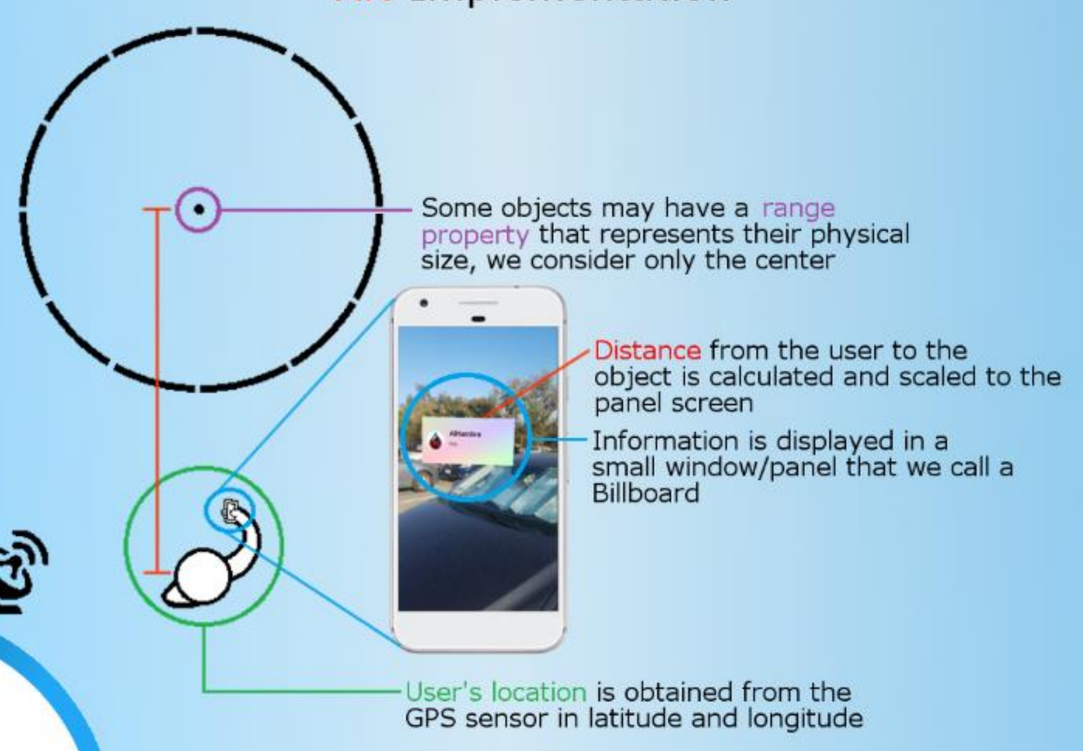
Jet Propulsion Laboratory (JPL) is world famous for contributions to space exploration, but also does significant work related to Earth Science. Much of the earth science data that JPL has access to is made available on the web and through REST API calls. One example is JPL's Watertrek system. JPL's Watertrek keeps track of various water data such as well locations and levels, river flow, snow pack, reservoir levels, aquafer boundaries.

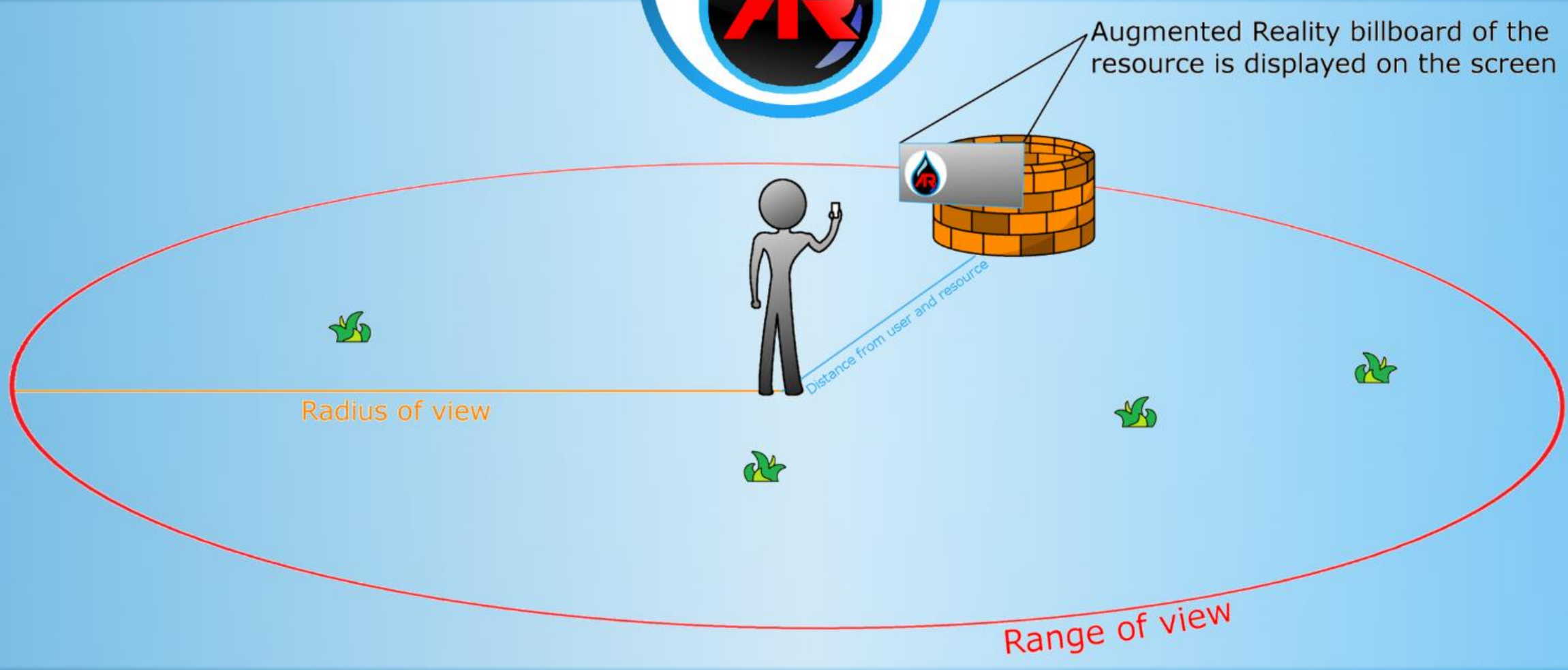
The developed framework provides the ability to display data using Augmented Reality (AR) techniques. This allows the user to point their smartphone at their surroundings to see them with superimposed data and graphics that relate to the surrounds projected on their smartphone. In order to accomplish this, the framework is able to (1) collect appropriate scientific data that is to be displayed for the surrounding area (from JPL's Watertrek or other sources), (2) generate and load graphic items to be displayed on top of the surrounding area (such as text, 2D images, and 3D meshes), (3) detect the physical location of key features in the surrounding area with respect to the phone, (4) keep the graphics items lined up with the key features from the surrounding area, even when the device is moved/rotated, (5) and allow the user to interact with the graphics itemsm or the surrounding terrain (by tapping, scrolling, etc). All the components of this framework have been built from scatch.

JPL-1 AR Framework DFD-1



AR Implementation





Framework Base Features

Platform Support
- Android

Sensor Access
- Latitude, longitude, Alitude
- Magnetic field, compass direction
- Gravity, angles

Rendering Surface
- Allows camera and 3D to be drawn on top of each other

Tracking Device Movement
- Allow automatic updates of 3D drawing when device is in motion

Billboard Objects
- Specify lat, lon, altitude
- Specify what is drawn
- Automatically drawn in 3D world
- Clickable

Watertrek Access
- Query items using location and radius
- Filter by type
- Access and local storage

Math Support Libs
- Vector Math
- Geographical Math

Future Objectives

- DJI/Drone Support
- iOS Support
- Instrument Filtering for Stabilization
- Generating Terrain Mesh
- General 3D Rendering
- Computer Vision for tracking
- Additional Interactive Elements

Technologies