



# Augmenting Yosemite's Paper Maps

*Creating a combined analog and digital navigation experience*

# Abstract

Using an unconventional combination of new information technologies, I will introduce a concept that brings paper maps and digital tools together and leverages the strengths of both in a powerful combined experience.



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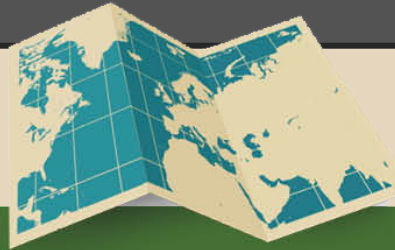
# Case Study



## Case Study: National Park System Maps

- NPS has a long cartographic history and publishes well-refined map products.
- Visitors will likely encounter numerous NPS map products throughout the park during their visit.
- Additional information products are available, such as seasonal newspapers, historical pamphlets, and weekly bulletins to help in planning activities.
- The NPS also maintains a modern website with a wealth of information and resources.

# Background: Juxtaposition of traditional and digital maps



## PAPER MAPS

## DIGITAL MAPS

### PROS

- Portability
- Easy to manipulate
- Good for collaborative planning

- Easy to use while moving
- Can offer localized info
- Instant geo-location
- Dynamic information
- Searchable
- Accurate for navigation
- Can capture geo-tagged info

### CONS

- Difficult to use while moving
- Not localized
- May be out of date
- Generalized, not activity specific
- May not be accurate for navigation
- May require additional information and materials for trip planning

- Small screens
- Limited battery life
- Poor visibility in sunlight
- Not weatherproof
- Poor for collaborative planning

# Research

- Augmented reality is a visual tool grounded with spatial roots. Information is overlaid in the user's field of vision when looking through a camera-equipped device. The device can detect cues in the environment using any of the following tools.
  - GPS references
  - camera to scan unique markers
  - specialized sensors to detect the proximity of hi-tech tags
- Augmented reality has grown to maturity from gaming and augmented viewfinder applications into powerful advertising tools and navigational aids.
- Over the past eight years, studies have been done on augmented paper maps, by using camera-equipped phones to detect special printed markers or tags. When the phone passes over a marker, additional information would be revealed to the user.

# Related Works

## Examples of Augmented Paper Map Studies and Products

- **RFID tag/readers (Reilly)**
  - Electronic ID tags are added to a paper map
  - Additional information is displayed when scanned with a mobile device capable of detecting the ID tags
- **Anoto Positioning Technology (Anoto)**
  - Use of an infrared pen to detect small markers to initiate the display of additional information
- **Embedded Media Markers (Liu, Liao, Wilcox, Tonyd, Bee)**
  - Integrated into the design and printed as part of the final product
  - Markers tend to be obvious throughout the design

## Example of Using Augmented Reality with Paper Products

- **Layar**
  - Augment printed materials with digital content by uploading the printed material, programming the augmented content, and publishing it to the Layars database
  - User can visualize augmented information when looking at the original, static, printed material

# Related Works

## Examples of Using Paper Maps with Digital Products in a Combined Experience

- **PhotoMap: Manual referencing of imagery (Schöning)**
  - Geo-reference any photographed map by manually marking three locations on the map as the user arrives at them
- **Walking Papers and Field Papers (Stamen Design)**
  - Implements QR code and embedded media markers to geo-reference a printed map or atlas
- **PDF Maps (Avenza)**
  - QR codes used to download specific map content in geospatial PDF format to run in Avenza's PDF Map App for iOS or Android

## Examples of Using GeoRSS technology (Geo-referenced RSS feeds)

- **Geonames' RSS to GeoRSS Converter**
  - Reads RSS feeds searching for place names that are in the GeoNames database, then encodes location data into the feed
- **RSSMapper**
  - Application that combines google maps with the GeoNames web services to help their clients provide geo-tagged news feeds to a target audience.



# Analysis of Related Work

	Printing		Hardware		User Experience	
	Specialized	Common	Specialized	Common	Specialized	Common
RFID		X	X		X	
Anoto	X		X		X	
EMM	X			X		X
Photomap		X		X	X	
WalkingPapers		X		X	X	
FieldPapers		X		X	X	
Avenza PDF Maps		X		X		X
Layar AR		X		X		X
GeoRSS Mapping				X		X

# Most Notable Related Work



## Avenza PDF Maps

- PDFs
- Geo-referenced
- Simple to add new maps to Avenza's database with QR code recognition
- Offline use, no data plan required
- KML support for additional data

PROS



## Layar AR app

- Needs no data markers
- Recognizes an image instead of a marker
- Tracks the angle of a planimetric object and the distance between the image and device
- Uses simple "Creator" tools

CONS

- Limited to viewing on device screens only

- Augmented data that is pre-designed and not dynamic, i.e., cannot support a live database of thematic content or syndicated information feeds

# How is my solution unique?



## Avenza PDF Maps

## Layar AR app

### SIMILARITIES

- Scanning a unique symbol will initiate an interaction with the map that you are viewing

- Augmented data is overlaid on the image you are viewing

### DIFFERENCES

- No maps are downloaded to your device
- Augmented data is overlaid on the map you are viewing

- Augmented data is not dynamic
- Augmented data is static pre-programmed audio/visual messages for advertising purposes

# Goals & Objectives



# Goals & Objectives

1. Design and demonstrate a method using QR Codes to recognize a Yosemite park map and an associated database.
2. Design prototype application interface.
3. Design and demonstrate method to display augmented thematic information in Yosemite National Park.
4. Design and demonstrate method to use GeoRSS feeds to automatically deliver Yosemite syndicated news feeds linked to precise locations in the park.

# Goals & Objectives #1

Design and demonstrate QR Codes to recognize a map

What is a QR Code?

- Two dimensional symbol designed to be read quickly by scanning equipment
- First designed for the Japanese auto manufacturers to identify auto parts on an assembly line
- Can use your smartphone to scan a QR code
- Scanning a QR code can take you to a business's website, a home listing, a coupon deal, a map, etc.

# Goals & Objectives #1

Design and demonstrate QR Codes to recognize a map

## Who is using QR Codes?



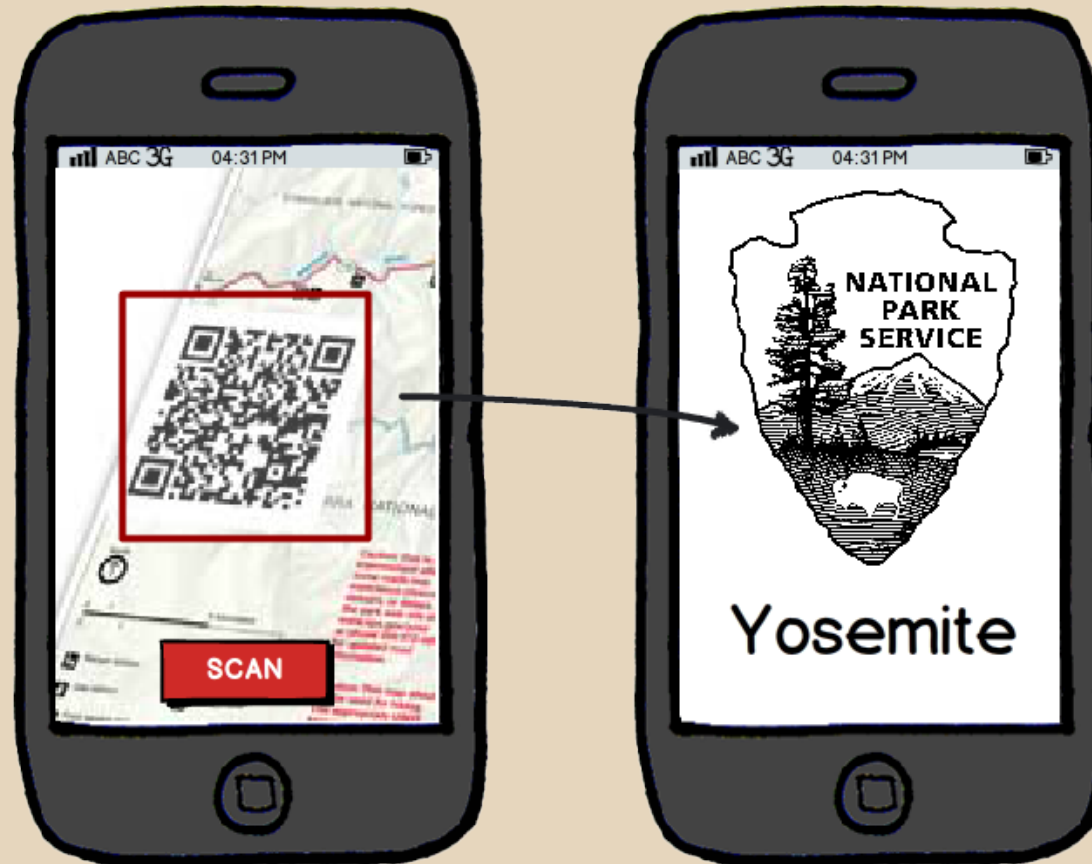
Stamen Design has released two projects, Walking Papers and Field Papers, which assign a QR code to a map area that the user has selected. After annotating the printed maps with user's notes, the user can scan it back to the website by taking a picture of the map with a phone and uploading it.



Avenza, Inc. released PDF Maps for iOS in 2010, allowing geospatial PDF maps to be viewed in an iOS app. In 2012, Avenza began using QR codes allowing users to download maps from tourist destinations, transit kiosks, and travel magazines.

# Goals & Objectives #1

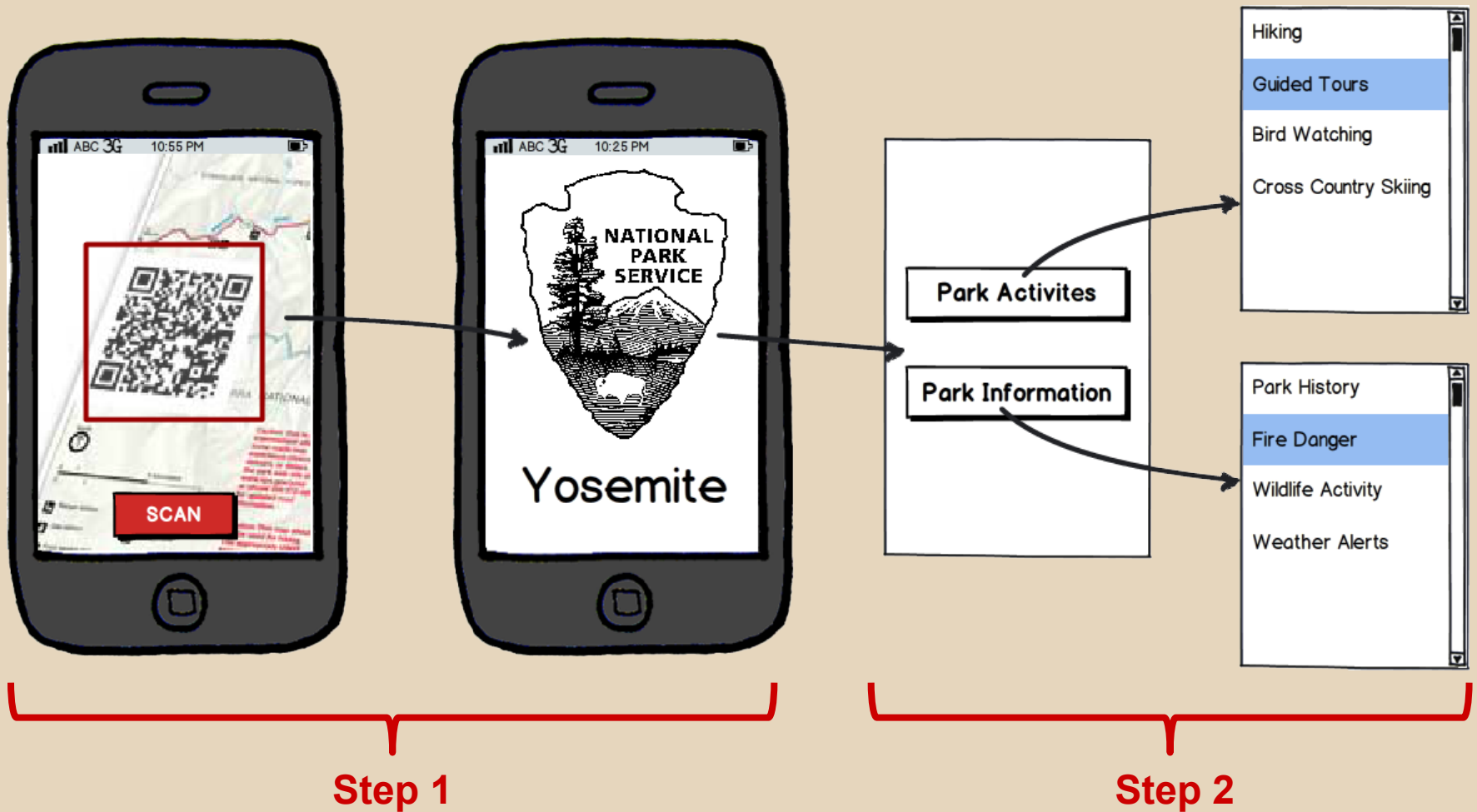
Design and demonstrate QR Codes to recognize a map





# Goals & Objectives #2

Design prototype application interface



# Goals & Objectives #3

Design and demonstrate method to display augmented thematic information

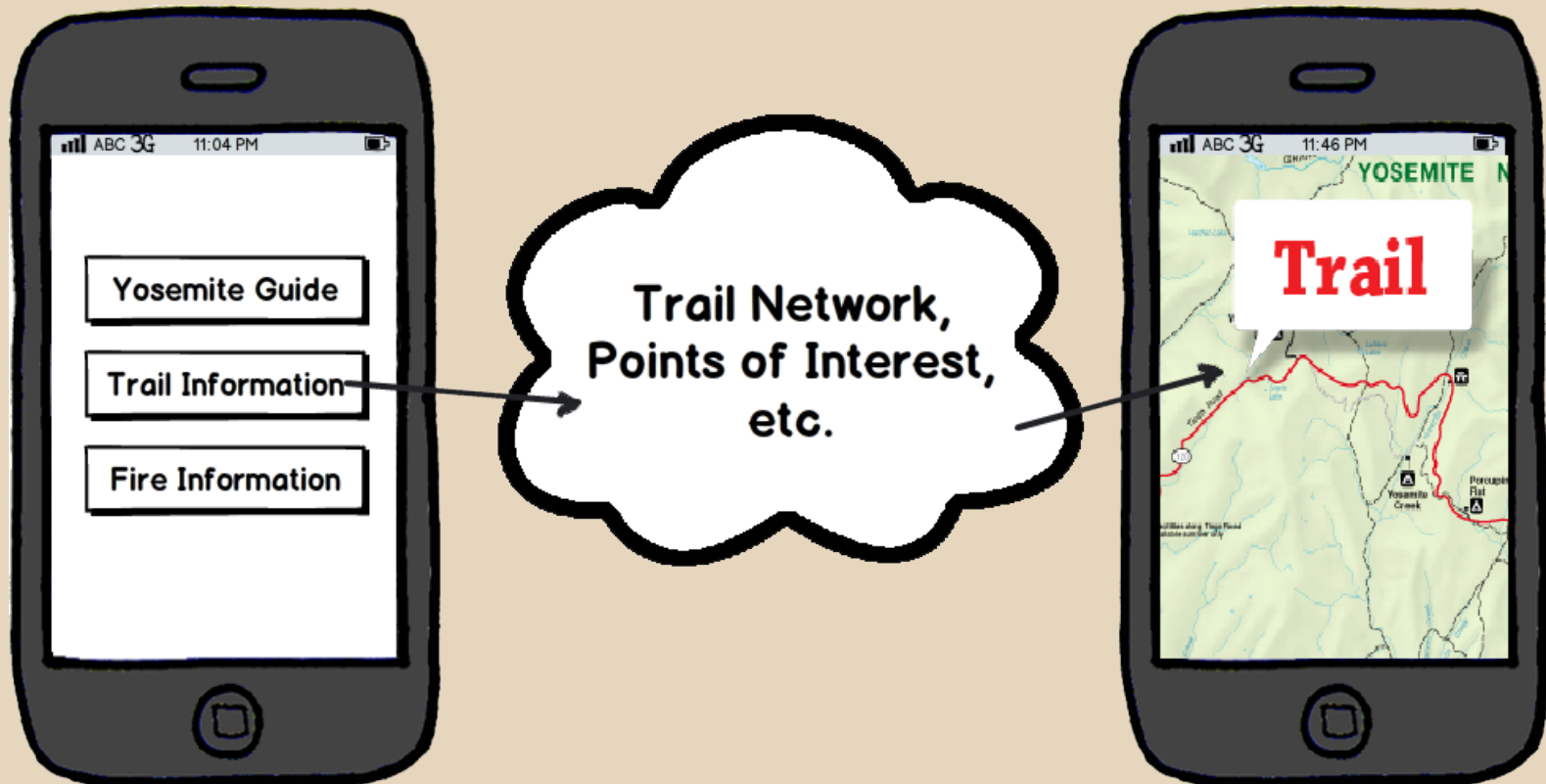
What are augmented paper maps?

- Looking through user's phone, augmented information about the park overlays the map that the user is viewing
- Augmented information may include detailed attribution of park features, wildlife sightings, prescribed burns, etc.

# Goals & Objectives #3

Design and demonstrate method to display augmented thematic information

Using the National Park Service app, a visitor could select an activity to visualize thematic content overlaying the park map they are viewing.



# Goals & Objectives #4

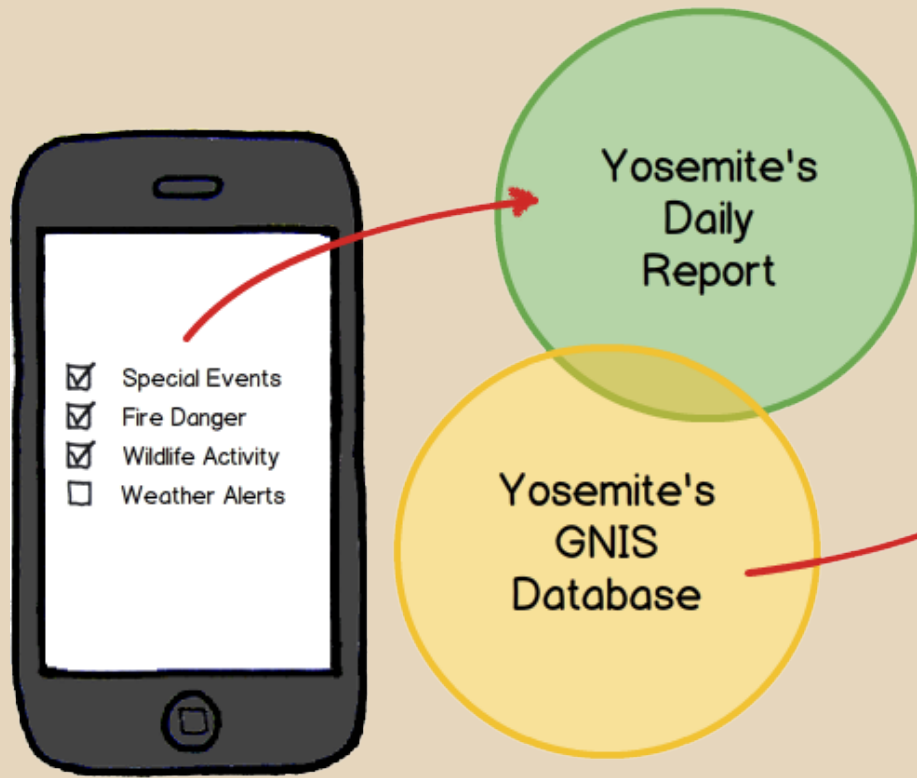
Demonstrate augmented GeoRSS information

## What are GeoRSS Feeds and GNIS?

- Really Simple Syndication (RSS) Feeds allow information to be published and syndicated automatically.
- GeoRSS feeds search the published data for place names, relating them to the USGS Geographic Names Information System (GNIS) and plot the published info at the precise coordinates of the associated place name.

# Goals & Objectives #4

Demonstrate augmented GeoRSS information



# Anticipated Results

- Capstone narrative and oral presentation
- Simulated application prototype
- Functional demonstration of QR code to recognize one of many maps and offer additional thematic layers
- Functional demonstration of GeoRSS feeds from the NPS web sources dynamically linked to the Yosemite GNIS data

# Project Timeline



Submitted presentation abstract for NACIS meeting - May 31



Project proposal presentation: June 25



Design prototype interface - July



Develop QR code prototype - July/Aug



Develop RSS mapping simulation - July/Aug



Capstone presentation preparation - Sept/Oct



Deliver Capstone Presentation: North American Cartographic Information Society (NACIS) Annual Meeting between Oct 17-19 in Portland, Oregon



Turn in capstone narrative and presentation - Nov/Dec

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