LIFE ‘N TOUCH

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Team Winner

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Overview

- Introduction
- Design Specifications
- Design Overview
- Design Alternatives
- Demonstration
- Questions

Introduction

- Problem:
  - Information is readily available but requires a translation to reality
- Solution:
  - To create a platform from which applications would dynamically interpret data for the user

Design Specifications

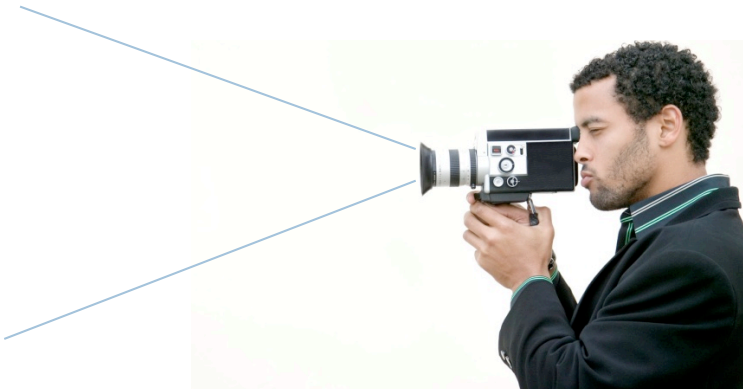
- Implement a platform to retrieve and interpret data on the request of the user
  - Limit application to dynamic street navigation for non-vehicular travel
- Create prototype demonstrating proof of concept:
  - Small embedded system similar to cellular phones
  - Automated retrieval and display of data

Design Specifications – Operation

- Capture user's environment
- Retrieve abstract route data
- Transforms data into intuitive format

Design Specifications – Display

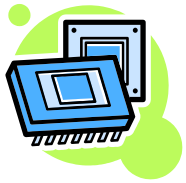
- Overlay the route on the captured environment of the user given an orientation of the device
  - Scene with > 50° field of vision
  - Resolution greater than 320 x 160
  - Update rate ≥ 30 fps



Design Specifications – Display

- Capture environment and orientation
  - GPS receiver
  - Camera
  - Accelerometer
  - Digital Compass



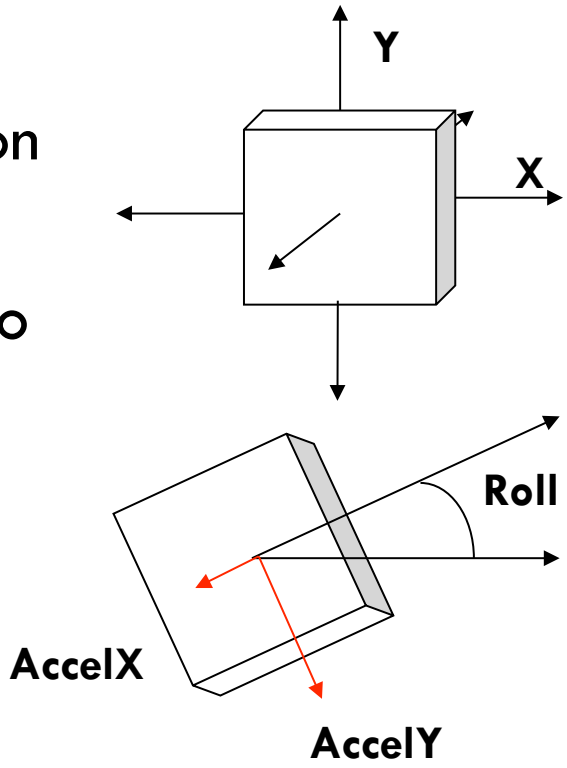



Design Overview

- Utilize hardware to capture user's environment:
  - Orientation: Accelerometer & Compass
  - Position: GPS
  - View: Camera
- Utilize internet to retrieve route data
  - Destination: Web interface
  - Route: Google Maps service
- Integrate abstract data into intuitive display
  - Convert hardware data into orientation information
  - Utilize 3D libraries to visualize information

Design Overview – Capture Environment

- Obtaining Roll and Pitch
  - Accelerometer returns acceleration in X, Y, and Z direction.
  - Transformed trigonometrically into Pitch and Roll angles
- Obtaining Yaw
  - Compass data is returned in degrees from North



Design Overview – Capture Environment

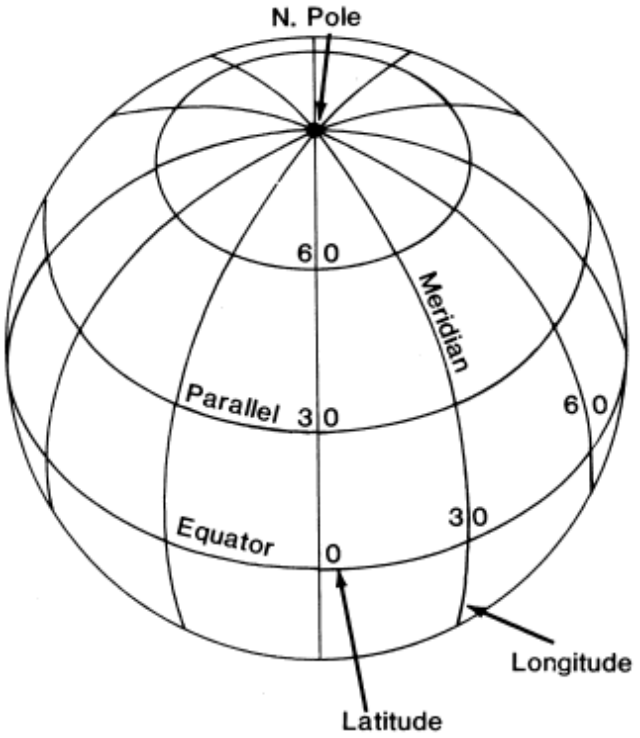
- GPS Device returns Lat Long
- Converting Lat Long to Meters
  - East – West distance:

$$Distance_{EW} = \Delta Long \, R_{Long} \frac{\pi}{180°} \cos(Lat)$$

  - North – South distance:

$$Distance_{NS} = \Delta Lat \, R_{Lat} \frac{\pi}{180°}$$

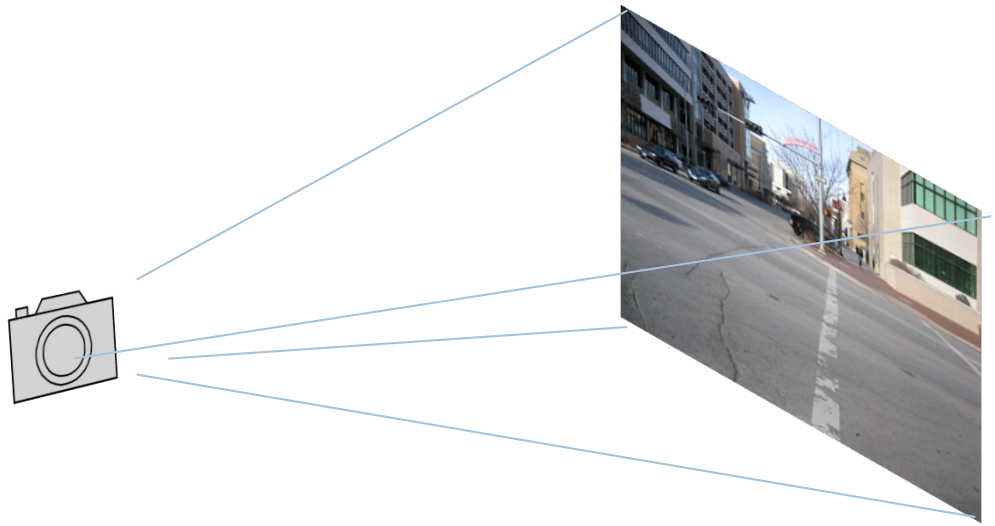
  - Radius Latitude: 6367.38 km
  - Radius Longitude: 6388.84 km



http://www.landtrustgis.org/images/GIS%20Technology/GIS%20data%20basics/5longitudelatitude.png/image

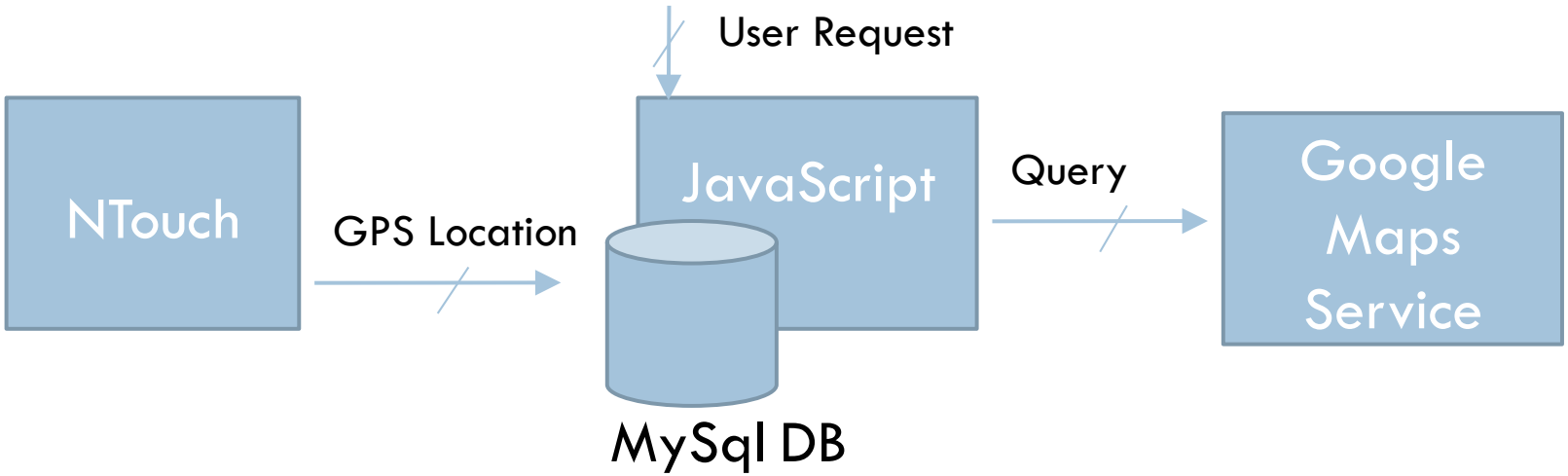
Design Overview – Capture Environment

- Camera captures view
- Video is streamed to show most recent view
- Gives a point reference for the user



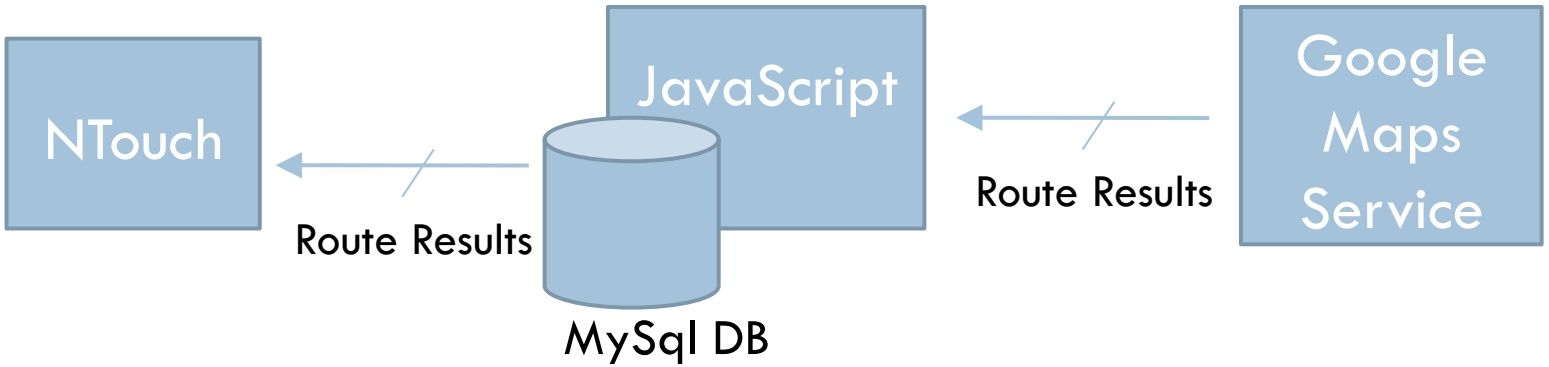
Design Overview – Retrieve Route Data

- Querying for the route
  - Current location automatically updated to database
  - Requested destination supplied to web interface
  - Query constructed from current location to destination



Design Overview – Retrieve Route Data

- Map Service
  - Geocoding: Assigning geographic descriptions to map features (addresses, land marks)
  - Routing: Calculating minimal route from origin to destination



Design Overview – Integrate Display

- Develop backscreen
  - Stream video texture on polygon
  - Set backscreen to front of view
  - Place backscreen at infinite depth
- Calculate line
  - Calculate 3D vertices of line
- Perform world transform
  - Translate line from current position
  - Rotate line from current orientation

Design Overview – Multithreading

Thread	Route	GPS / Compass	Accelerometer	3D Graphics
Hardware	Network Connection	GPS / Digital compass	Accelerometer	Camera, Graphics card
Protected data	set of route coordinates	current position / Yaw value	Pitch and Roll	Utilizes all other protected values
Update rate	30s	20s / 0.5s	<0.1s	0.03s (30 Hz)

Design Overview – Price

Component	Price
Compaq H3835 iPAQ Pocket PC	$165.00 [1]
ISM 300 GPS OEM Firmware V324 Module	$29.95 [2]
OS5000-S 3-Axis Digital Compass	$199.00 [3]
Motorola RAZR V3c OEM Camera	$18.99 [4]
ADXL320 Accelerometer Chip	$6.36 [5]
Total	$419.30

- Comparable price to iPhone ($399 [6])

Design Alternatives

- Separate digital compass and GPS receiver
  - Other compasses were too expensive
- Use tablet for additional proof of concept
  - High performance requirement of graphic library was not met by tablet
- On board GPS database
  - GIS mapping databases were too expensive for project, and Google Maps performs geocoding and routing

Demonstration

Conclusions

- Life ‘N Touch displays route in an intuitive manner
- By capturing the user’s environment and orientation, only the route immediately usable is displayed
- Overlaying the route on the user’s environment severely limits the user’s interpretation of data

Conclusion – Extensions

- Platform can be applied to many fields by adding additional software:
  - Self-guided tours
  - Star mapping registries
  - Hiking guides and maps
  - Geocaching

Questions

Sources

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