



# Interactive Tactile Maps

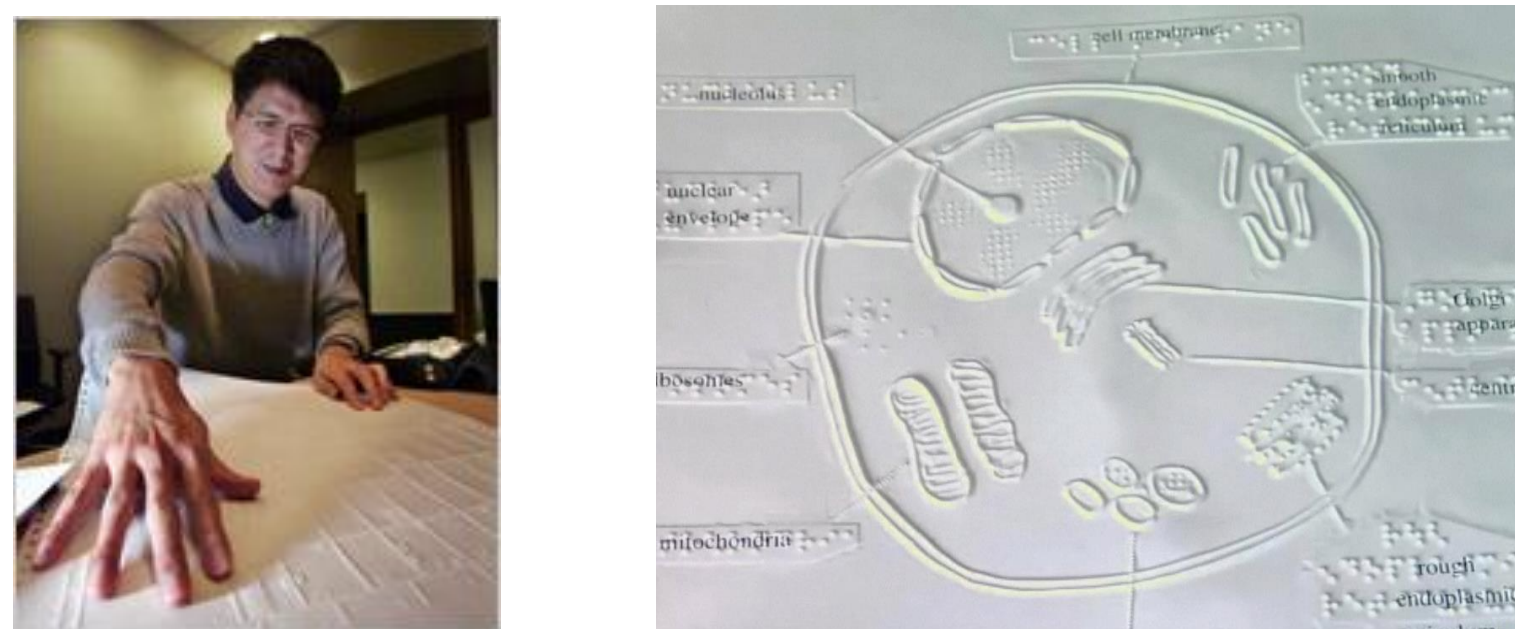
## Siddharth Shah, Aravind Selvan, Shekhar Sharma

*Mentor: Brandon Taylor*

## INTRODUCTION

### TACTILE GRAPHICS

- ❑ Accessible images that use **raised surfaces** so that a visually impaired person can feel them.
- ❑ Convey non-textual information.
- ❑ Tactile maps are a subset of tactile graphics.



### TACTILE MAPS

- ❑ Provide visually impaired individuals with a practical knowledge of their environment, but their widespread adoption is limited by:
  - ✖ The **cost** associated with manufacturing maps.
  - ✖ The **complexity of designing** such maps, which generally required 3D modeling software.
  - ✖ The **static nature** of the maps limit interactivity and in-the-field application.

### EXISTING ALTERNATIVES

#### Braille displays:

- ❑ High resolution, refreshable displays, connected to a camera.
- ❑ Cheapest model: weighs **2.5 kg** and costs **\$7,000**. (Tactisplay Corp, June, 2015)

#### TMAP and related services:

- ❑ Users enter an address on a website and are sent a printed version of the surrounding area.

#### Zoom maps methodology:

- ❑ Maps from a macro to a micro scale, with each new map more detailed than the previous.

#### Tactile tablets:

- ❑ Touch-sensitive tablets capable of holding a tactile graphic sheet motionless in place.
- ❑ Again cheapest model starting at **\$800**. (Tactisplay Corp, August 2015)

## IMPLEMENTATION

### OUR IMPLEMENTATION

- ✔ **Cheap map fabrication** by utilizing the increased availability and reduced costs of **3D printers**.
- ✔ An **accessible web tool** designed to allow visually impaired users to generate customized 3D map models for fabrication.
- ✔ A **companion Android application** that provides helpful, location-aware cues.

### WEB INTERFACE

- ❑ User registration and login in a secure manner.
- ❑ New map creation with points of interest and an investigative area - a region for which the user would like a second, more detailed map.
- ❑ Single-click download of 3D printable representations.
- ❑ REST endpoints accessible by the Android application.
- ❑ Voice commands to make all of this accessible.

### MAP MODEL

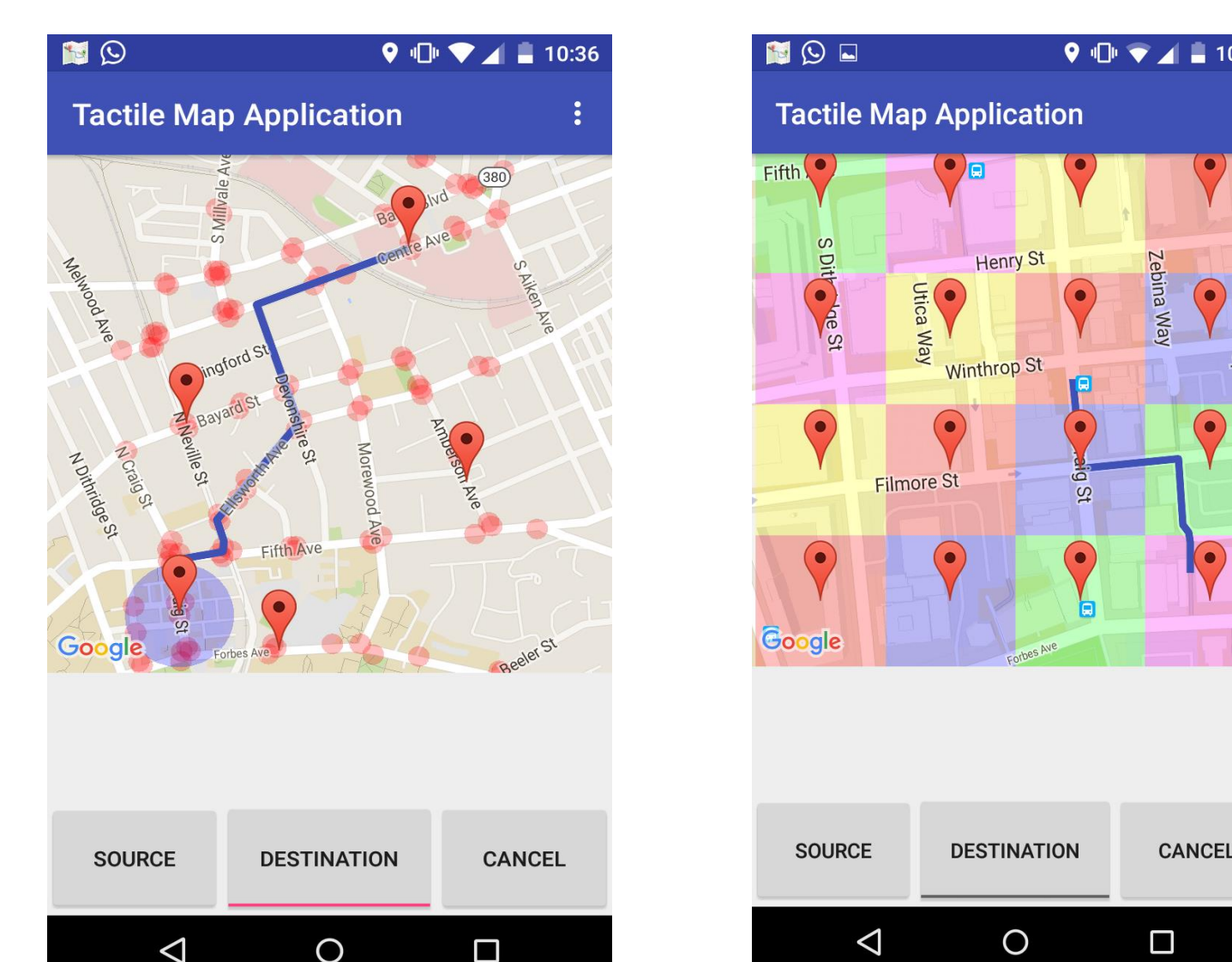
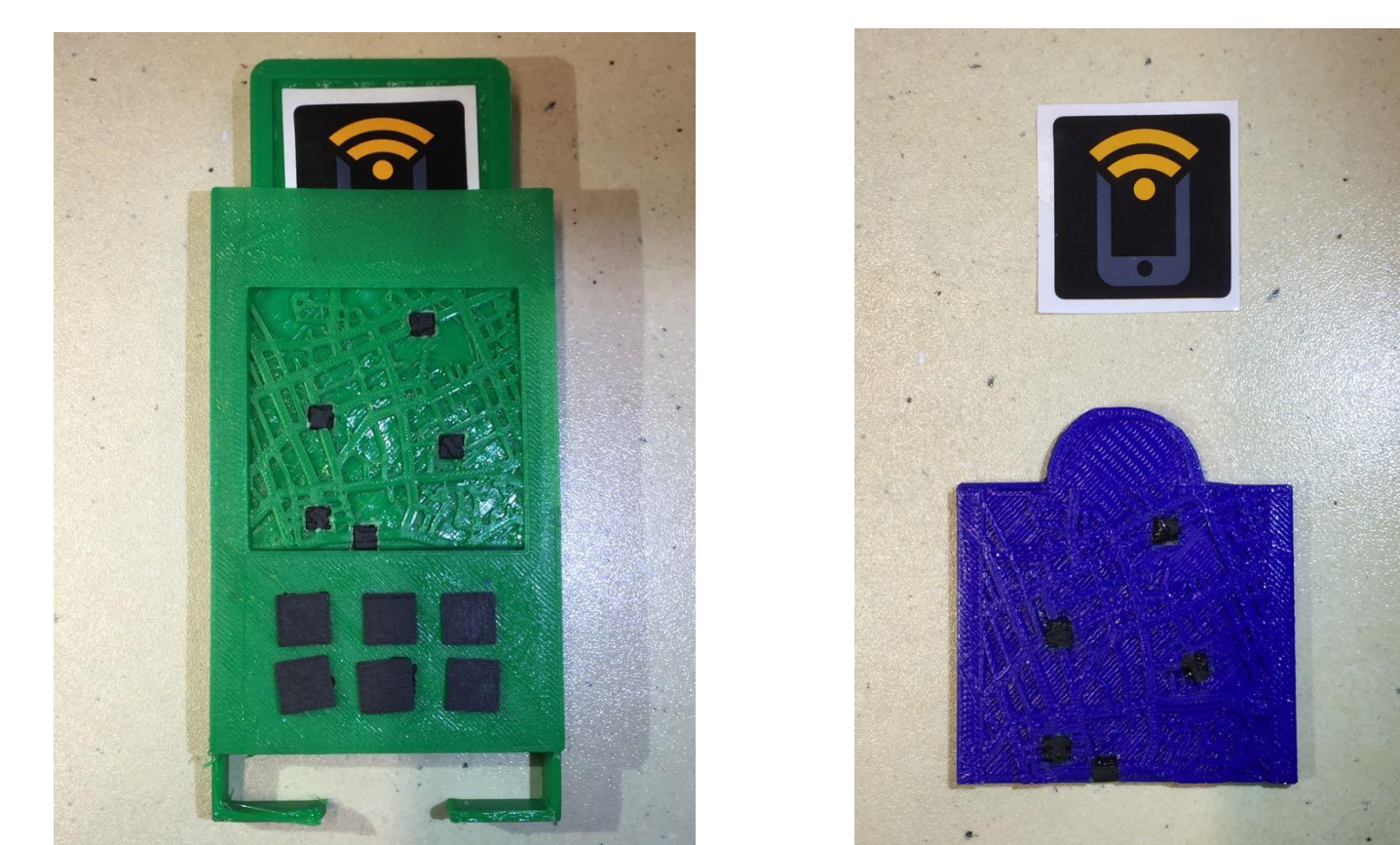
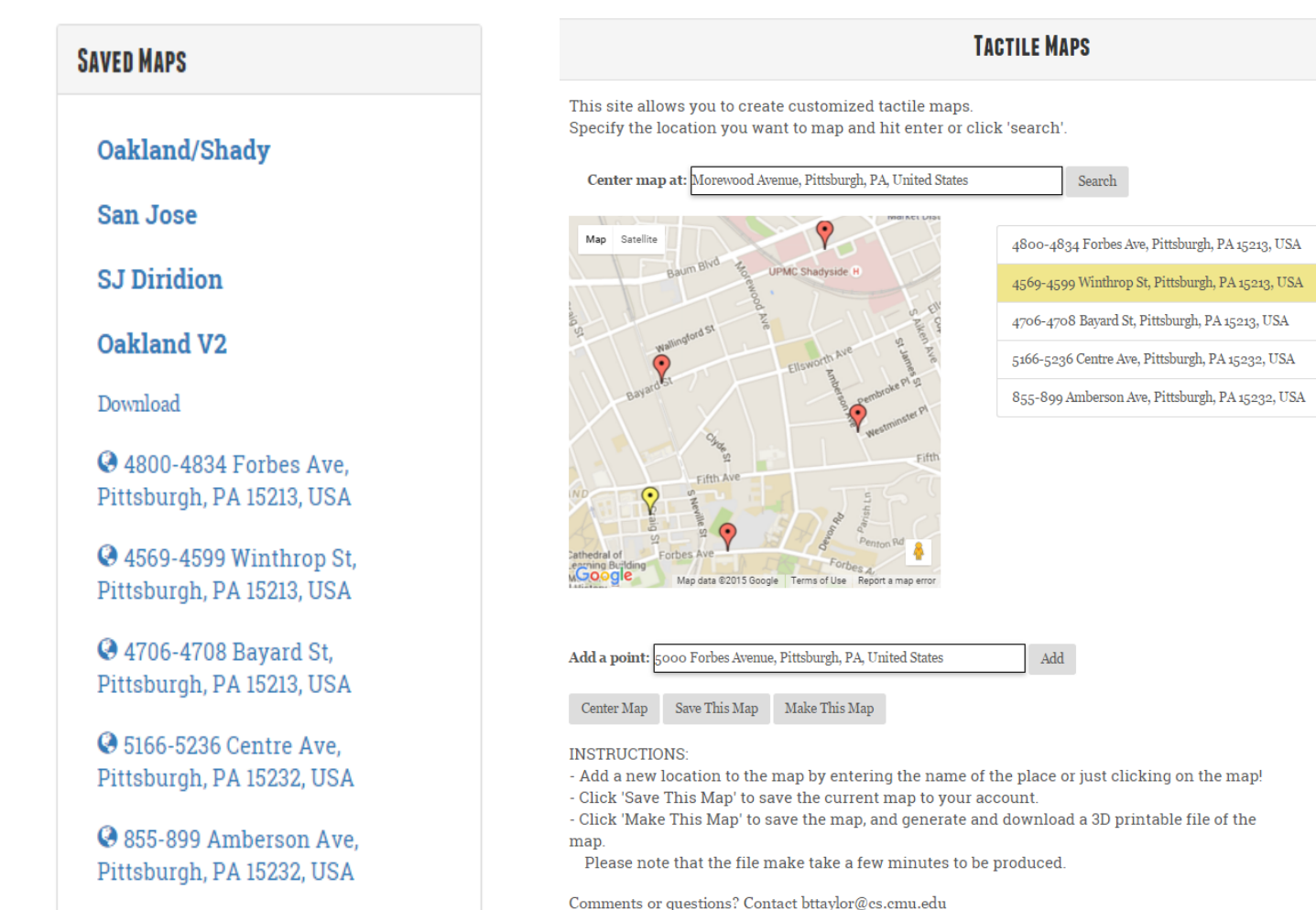
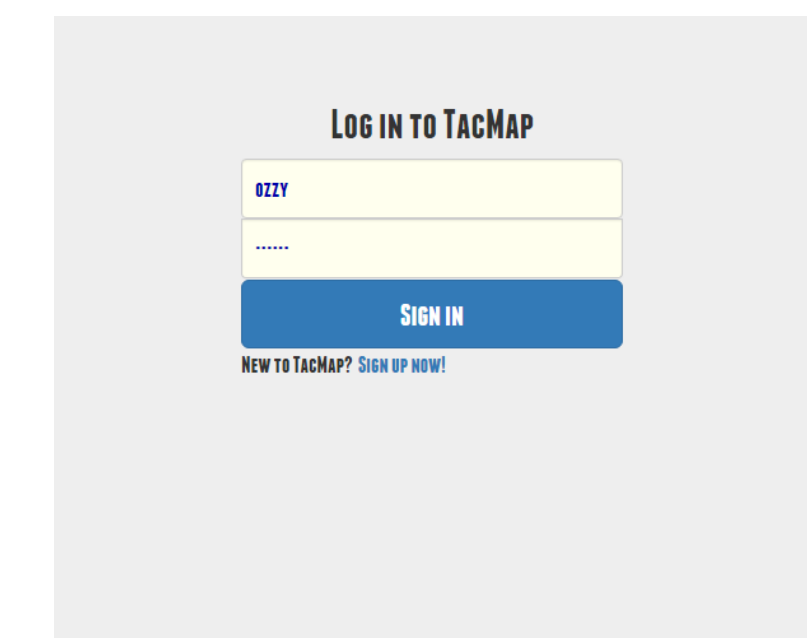
- ❑ Roads, waterways, parks, building footprints, or topographical data extruded and assigned adjustable tactile features.
- ❑ Layouts of touch-sensitive graphene points allow the user to interact with entered POIs or investigative area.
- ❑ All different features stitched together into a single .stl file

### MAP CASE AND NFC

- ❑ A 3D printed case keeps the map in place over the user's phone, and also provides 3 – 6 tactile buttons.
- ❑ NFC tags encode map and user information - a user just taps a tagged map on his/her phone, and information is pulled from the server.

### ANDROID APPLICATION

- ❑ User locates his/her position on the map and identifies potential destinations through haptic and audio feedback.
- ❑ Source-destination routing with audio feedback.
- ❑ Geo-fencing to signal users when they are approaching bus stops.
- ❑ In-depth exploration of smaller, investigative areas.



## WAY FORWARD

Current implementation: **cheap, easy to learn.**

**Extensive user testing and surveying required!**

User experience and interaction can be enhanced in several ways:

- ❑ Dynamic routing which guides the user when he/she goes off-course.
- ❑ Incorporating public transport into the user navigation suite.
- ❑ On-the-fly point of interest mapping based on the user's current preferences, in investigative areas.
- ❑ Multiple investigative areas per map.
- ❑ Improved prompts when the user moves from one map area to another.
- ❑ Utilizing accelerometer and gyroscope information to point the user in the correct direction at strategic points.
- ❑ Improved accessibility for the server interface.
- ❑ Incorporating automated NFC tag writing in the app.

### Many open questions:

- ❑ Which map features should be included?
- ❑ How should we label these map features?
- ❑ How to best scale the maps?
- ❑ What information density is best?
- ❑ What audio feedback is most helpful?
- ❑ What other app interactions would be helpful?
- ❑ What else can be done?