Gimball3000
Bluetooth Bicycle Tracker
Trillium Health

Advisor: Rick Weil
Sponsor: AJ Blythe

Team:
- Danielle Neuberger
- Randy Goodman
- Anshul Kapoor
- Tyler Schoen
Project Overview

- Race utility application
  - Locate and track status of competitors in race events via Bluetooth chips in range of iOS
- Variety of project components - web application, iOS app, bluetooth interaction
- Project had broad scope, specific use-cases
- Balance functionality with versatility
- No inherited codebase
- Increased emphasis on design
- Design decisions based on strengths
Project Overview - Domain Model

Domain Model describing the application problem space
## Project Overview - Goals

<table>
<thead>
<tr>
<th>#</th>
<th>Goal</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ensure participants’ safety during their activity</td>
<td>P1</td>
</tr>
<tr>
<td>1.1</td>
<td>Provide biker check in/check out</td>
<td>P1</td>
</tr>
<tr>
<td>1.2</td>
<td>Provide details of biker’s status</td>
<td>P1</td>
</tr>
<tr>
<td>1.3</td>
<td>Estimate biker location/arrival information</td>
<td>P2</td>
</tr>
<tr>
<td>2</td>
<td>Provide beacon tracking in a standalone fashion, and capability to share that information over cellular networks as available</td>
<td>P1</td>
</tr>
<tr>
<td>3</td>
<td>Support concurrent events</td>
<td>P1</td>
</tr>
<tr>
<td>4</td>
<td>Allow staff to efficiently communicate with each other</td>
<td>P1</td>
</tr>
<tr>
<td>5</td>
<td>Enable the system to be configured for a variety of different event types</td>
<td>P2</td>
</tr>
<tr>
<td>6</td>
<td>Provide means for event promotion</td>
<td>P3</td>
</tr>
</tbody>
</table>
# Project Overview - Non-Goals

<table>
<thead>
<tr>
<th>#</th>
<th>Non-Goal</th>
<th>Reasoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Virtual races</td>
<td>The main goal of the product is ensuring participant safety on a physical, centrally located racecourse.</td>
</tr>
<tr>
<td>2</td>
<td>Continuous tracking</td>
<td>Beacons are tracked only when proximal to a tracking device.</td>
</tr>
<tr>
<td>3</td>
<td>Fundraising Focus</td>
<td>This is not a fundraising event!</td>
</tr>
<tr>
<td>4</td>
<td>Route Creation</td>
<td>It’s not meant to alter race routes (MapMyRide can do that), and it would be a separate project in its own.</td>
</tr>
<tr>
<td>5</td>
<td>Race Timing</td>
<td>It’s meant to estimate the ETAs of racers, not time them.</td>
</tr>
</tbody>
</table>
## Project Overview - Use Case 1

<table>
<thead>
<tr>
<th>Name</th>
<th>Event Creation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td>To create events in preparation for a race</td>
</tr>
<tr>
<td><strong>Pre-conditions</strong></td>
<td>User has already registered an account on the website</td>
</tr>
<tr>
<td><strong>Post-conditions</strong></td>
<td>User has successfully created an event. Event is visible in the user's event list on the main page.</td>
</tr>
</tbody>
</table>
| **Primary Workflow** | 1. User signs into the web application  
2. User clicks the ‘+’ sign to be directed to the event creation page  
3. User inputs event information to the event form and submits  
4. User is redirected to the home page |
| **Alternative Workflow** | After step 4, the user may click the edit button on the row of the new event. At this point, they would be redirected to the edit event page and can make necessary changes. |
# Project Overview - Use Case 2

<table>
<thead>
<tr>
<th>Name</th>
<th>Racer Check-in</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td>To automatically check in a racer as they pass a checkpoint</td>
</tr>
</tbody>
</table>
| **Pre-conditions** | 1. The event was already created in with the web app prior to event start date  
                          2. Event start date has not passed  
                          3. Bluetooth chips have be assigned to registered participants  
                          4. Staff member has logged into the iOS app on an iPad in a location on the race route |
| **Post-conditions** | 1. Racer location updates on the iOS map  
                             2. Racer status updates if necessary |
| **Primary Workflow** | 1. Racer having a bluetooth passes the staff checkpoint  
                                2. System automatically detects the bluetooth and updates racer location and status |
| **Alternative Workflow** | ● If the rider takes a break at the checkpoint, the system will automatically detect that the rider has not left and will appropriately manage their status and location.  
                                      ● Staff may also manually update rider status if necessary |
Team Organization

- **Team Lead**: Danielle Neuberger
- **Testing Lead**: Randy Goodman
- **Documentation Lead**: Tyler Schoen
- **Development Lead**: Anshul Kapoor
Project Methodology

Spiral Model

- Hard deadlines and Agile don’t mix
- Iterative Development Process
- Continuous Delivery and Review
- Focus on Risk Analysis & Management

Derived:

- Internal Artifacts
  - Requirements Specification
  - Prototypes
  - Architecture Document
  - Project Plan
  - Test Plan

- Schedule
Technology Stack

Application
- iOS App
  - Requirement due to sponsor experience and perceived useable interface
- Sails.js
  - Fast framework on top of Node.js, similar to rails.
- MySQL
  - SQL-like database was a requirement
  - Chosen for popularity, good documentation, and ease of setup
- Mapbox
- Gimbal bluetooth beacons

Development
- git/GitHub - version control
- Gantter - scheduling
- Slack - communication
- Waffle.io - task management
- Google Drive - document storage
- Jenkins - continuous integration

Testing
- mocha - test framework
- istanbul - test code coverage reporting
- superagent, supertest, request
Architecture - Data Architecture
Design - Associate Rider with Bluetooth
Current Status

- **Sails Application**
  - Registration, Log in/out
  - Event CRUD

- **Jenkins running tests and building**

- **Sails Application and MySQL server live on a SE Department provided VM**

- **iOS App**
  - Beacon Check-in
  - Add Racer
  - Manual Status Change
  - View Race map

- ~1/3 through P1 Requirements dev
Metrics

- # bugs/SLOC
- % program statements called during test suite execution (statement coverage)
- # commits per week
- # risks added per week
- % relevant risks
- [unofficially] requirements volatility
Metrics - # Commits / Week
Metrics - # Risks Added / Week

![Graph showing # Risks Added per week](image)

*Time (in weeks)*

*# Risks Added*
Metrics - Requirements Volatility

![Graph showing requirements volatility over time](image)
## Risks

<table>
<thead>
<tr>
<th>Risk ID</th>
<th>Risk</th>
<th>Description of Risk</th>
<th>Probability (0 - 1)</th>
<th>Impact (low, med, high)</th>
<th>Exposure</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Inadequate bluetooth experience</td>
<td>None of the team members have an expertise in BLE beacon development, which may take time.</td>
<td>1</td>
<td>high</td>
<td>10</td>
<td>quality</td>
</tr>
<tr>
<td>2</td>
<td>No experience with iOS or Objective-C/Swift for Mobile application</td>
<td>Team members have very limited experience with iOS development</td>
<td>0.8</td>
<td>high</td>
<td>8</td>
<td>quality</td>
</tr>
<tr>
<td>4</td>
<td>Difficulty connecting components</td>
<td>Connecting components representind various features may be difficult</td>
<td>0.65</td>
<td>high</td>
<td>6.5</td>
<td>quality</td>
</tr>
<tr>
<td>5</td>
<td>Manufacturing defects in bluetooth beacon</td>
<td>There may be certain issues with the hardware that the team is currently unaware of.</td>
<td>0.6</td>
<td>high</td>
<td>6</td>
<td>quality</td>
</tr>
<tr>
<td>6</td>
<td>Choosing inappropriate/inadequate tech stack</td>
<td>The team doesn't have strong experience in mobile development, due to which we may choose an inefficient tech stack.</td>
<td>0.5</td>
<td>high</td>
<td>5</td>
<td>quality</td>
</tr>
</tbody>
</table>
Demo
Future Development

- **More features**
  - Racer visibility on map
  - Staff chat
  - Racer ETA & missing notifications
  - Racer/public web-app interface
  - Superuser web-app interface

- **Enhanced testing**
  - Unit, Integration, Usability
Reflection

<table>
<thead>
<tr>
<th>What went well:</th>
<th>What didn’t go well:</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Collaboration</td>
<td>● Initial long iterations</td>
</tr>
<tr>
<td>● Communication</td>
<td>● Initial poor workload estimation per iteration</td>
</tr>
<tr>
<td>● Time dedicated towards project</td>
<td>● Mapbox SDK bugs</td>
</tr>
<tr>
<td>● Prototyping</td>
<td></td>
</tr>
</tbody>
</table>
Questions