Programming an intelligent watch

Navik - Cycling navigation, with smartwatch compatibility

Project Plan

CSIS0801 Final Year Project, Department of Computer Science, The University of Hong Kong
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**Project Background**

There are various navigation solutions available on the market. However, for cycling? Limited.

If you look towards the ordinary navigation solutions, it does not suit very well. It is likely that you would end up finding yourself riding on a highway or into a cross harbour tunnel. Moreover, such solutions cannot satisfy your unique requirements for cycling. In addition, what if you have no data connection when you are riding in the middle of nowhere?

If you look towards bike specific navigation solutions, make sure you have a deep pocket. A bike computer with navigation functionality would probably costs more than your bike. Besides, why bother purchasing a specific navigation device when we are living in the ‘smartphone era’?

As a cycling enthusiast, I proudly introduce *Navik* to you.
Existing Solutions Analysis

Google Maps with Navigation

Google Maps is a cross platform online application with comprehensive maps throughout the globe. Voice-guided navigation is available for driving, public transit and walking. Live traffic condition, street view and point of interests information are also available.

Advantages

- **Free** of charge
- Compatible with **smartwatches**
- **Route construction** with **intermediate destinations**
- Provide **maps** and **turn-by-turn navigation** display

Disadvantages

- Cannot load **custom routes**
- No **offline navigation support** and limited **offline map data**
- Not support **round trip navigation**, which is important for cycling
- No **cycling specific navigation** and related functionalities available
Garmin Bike Computer with Navigation

Garmin produces bike computers of different levels and prices. Model with navigation functionality ranges from USD$249.99 to USD$599.99. User can connect the device for data transmission with computers via cable or the companion smartphone app via Bluetooth.

Advantages

- **Feature rich** bike computer
  - Compatible with wireless bike sensors (not included), such as speed sensor, cadence sensor, heart rate monitor and power meter
- Provide **cycling specific route construction** with **round trip** and **intermediate destinations** support
- Support **external routes import**, such as GPX files
- Provide **maps** and **turn-by-turn** display
- Provide **route analysis**, such as distance and elevation data
- **Offline map data** by OpenStreetMap

Disadvantages

- **Expensive** for casual and amateur riders
- Require **manual update** for system and map data
- **Closed** and **proprietary** system, thus the device is very specific and cannot have other use
HammerHead

HammerHead is an innovative navigation device mounted on your bike. The device will notify users with light signals when you need a turn.

Users have to connect the device with their own navigation app running on your smartphone. They offer the physical device for USD$104.99 (with mount) and the companion smartphone app for free.

Advantages

- Provide **cycling specific navigation** with **intermediate destinations**
- Support **external routes import**, such as GPX files
- Cross platform **route sharing** via iMessage, Email, Twitter, Facebook and Whatsapp

Disadvantages

- **Expensive** for the physical device with limited usability
- **Easy to miss** the turning light signals
- There are **limited information** provided on the display of the device
  - For example, map and route display would be useful
- Riders typically mounts cyclometer on their bike, having an **extra device** mounted would not be an elegant solution
  - Messy mounts, extra weights and air resistant are not preferred
- Using **online map and navigation** service
- Not support **round trip navigation**, which is important for cycling
Objectives

A fully working Android application running on smartphone

- Provide offline map display
- **Construct route** with **round trip** and **intermediate destination**
- Provide **external routes import** via GPX files
- Provide **route analysis**, such as **distance** and **elevation data**
- Provide **turn-by-turn navigation**
- Provide **real-time information**, such as speed, distance traveled and distance remaining

An Android Wear companion application

- **Turn-by-turn navigation** display with **vibration** notification
- Provide **real-time information**, such as speed, distance traveled and distance remaining
Methodology

Software Development Method

- **Incremental model** will be applied
- **Working implements** will be delivered after each **milestones**

Platform and Technologies

- The application will be implemented in **Java** for recent versions of **Android**
- **OpenStreetMap** will be used for the offline map data
<table>
<thead>
<tr>
<th>Milestone</th>
<th>Incremental Accomplishments</th>
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| Milestone 1 | Smartphone application  
- Complete **user interface**  
- Able to **load** and **display** the offline **OpenStreetMap** data |
| Milestone 2 | Smartphone application  
- Able to **import external routes** via GPX files  
Android wear companion application  
- Complete **user interface** |
| Milestone 3 | Smartphone application  
- Able to **construct routes** from destinations  
- Able to perform **route analysis** |
| Milestone 4 | Smartphone application  
- Complete **turn-by-turn navigation**  
Android wear companion application  
- **Turn-by-turn navigation** display |
| Milestone 5 | Smartphone application  
- Provide **real-time information**  
Android wear companion application  
- Provide **real-time information** |
<table>
<thead>
<tr>
<th>Date</th>
<th>Accomplishments</th>
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<tr>
<td>4 October 2015</td>
<td>Complete <strong>inception phase</strong>&lt;br&gt;● Detailed project plan&lt;br&gt;● Project web page</td>
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<tr>
<td>8 November 2015</td>
<td>Complete <strong>milestone 1</strong></td>
</tr>
<tr>
<td>6 December 2015</td>
<td>Complete <strong>milestone 2</strong></td>
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<tr>
<td>11-15 January 2016</td>
<td>First <strong>presentation</strong></td>
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<tr>
<td>17 January 2016</td>
<td>Complete <strong>milestone 3</strong></td>
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<tr>
<td>24 January 2016</td>
<td>Complete <strong>elaboration phase</strong>&lt;br&gt;● Preliminary implementation</td>
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<tr>
<td>13 March 2016</td>
<td>Complete <strong>milestone 4</strong></td>
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<tr>
<td>10 April 2016</td>
<td>Complete <strong>milestone 5</strong></td>
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<tr>
<td>17 April 2016</td>
<td>Complete <strong>construction phase</strong>&lt;br&gt;● Finalized tested implementation&lt;br&gt;● Final report</td>
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<tr>
<td>18-22 April 2016</td>
<td>Final <strong>presentation</strong></td>
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