Trekking Recording System Using Smart Phone Sensors

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Abstract

In this paper, we present a trekking recording application system that easily can be able to record and provide the trekking information for travelers using a variety of sensors of Smart Phone. This presented system has various functions for recording and showing information such as current position, trekking path, direction, velocity, distance, and current time. Also we included the camera and memo functions although these are so heavy in software view to operate simultaneously all these functions.

Keywords: *trekking, recording, smart phone, sensors, application system..*

1. Introduction

In recent, travelers want to have a smart software and hardware system to be able to provide very useful information to accomplish their travel safely. This can be implemented easily by utilizing various sensor functions provided from their own smart phone. Of course, in order to realize these functions it needed to use a variety of software APIs from the related software companies. In general the commercial smart phones have several types of detection sensors as shown in table 1.

Table 1: Detection sensors of smart phone.

Sensor Types	Sensor Types
Gyroscope sensor	Atmosperic sensor
Geomagnetic sensor	Proximity sensor
Acceleration sensor	Motion awareness sensor
Gravity sensor	Compass sensor
Optical sensor	RGB color sensor

GPS function is mainly operated using the geomagnetic sensor and is used as location detection and trekking navigation. And using compass sensor and acceleration sensor we estimate the distance and direction of trekking in real time. We present structure of the proposed system in chapter 2, implementation in chapter 3, and experiments and results in chapter 4, and conclusion in chapter 5.

2. System structure

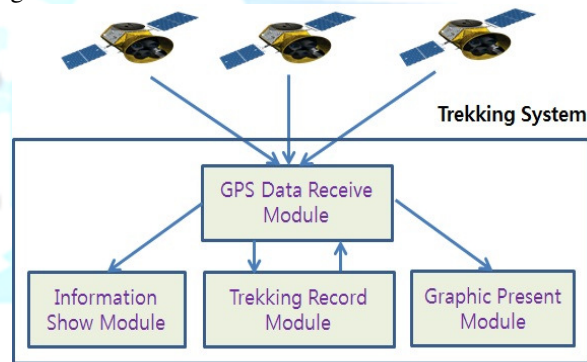Overall structure of the proposed system is shown in Figure 1.

Fig. 1 Structure of the proposed system.

In Figure 1, the trekking system is consists of four modules of GPS Data Receive module that receives GPS data from several satellites, Trekking Record Module that records a variety of trekking data such as direction, velocity, and elevation, Graphic Present Module that presents the elevation information in graphic, and Information Show Module that shows the real or recorded data during trekking.

3. System implementation

In order to implement the proposed system, several adaptive APIs to interface the smart phone and the application software are needed. We used GoogleAPIs provided from Google and its version 2.2 is compatible for most smart phone devices. We use three APIs of android.location API to earn the current location information, google.android.maps API to provide the interface to access to Google Maps Service, and

android.hardware API to control the hardware for the smart phone sensors.

3.1 Location API

In order to present the current location of the traveler android.location class package is used among the APIs provided from Google and this package provides the function to get the current location information using GPS or wireless LAN information. LocationManager class, Geocoder class, and GpsStatus class are mainly used.[3] Figure 2 shows the flow diagram of Location API.
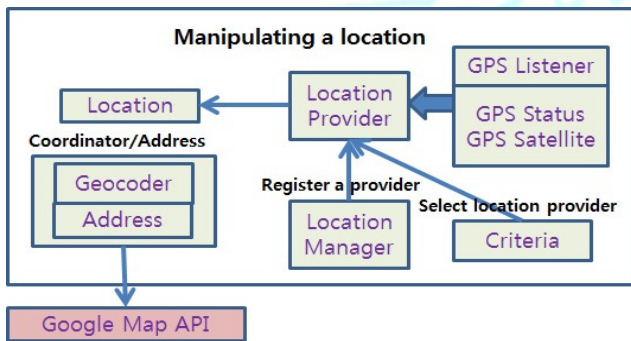

Fig. 2 Android.location class packages and flow diagram.

3.2 Map API

Using com.google.android.maps class package the map and the surround information can be represented. This package provides an interface to access Googlr Maps Service. MapView class to mark the map and Mapactivity class to manage the activities are mainly used. Figure 3 shows the flow diagram of Map API.
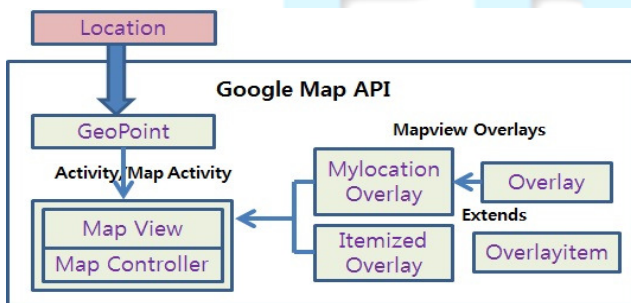

Fig. 3 Google.android.maps class packages and flow diagram.

3.3 Hardware API

In order to control the hardware of sensors included in smart phone android.hardware class packages provided from Google are utilized. Also to present the velocity of accelerate sensor the Sensor.TYPE_ACCELEROMETER function is used and to present the direction by direction sensor the Sensor.TYPE_MAGNETIC_FIELD function is used, and to represent the elevation by atmospheric sensor the GeomagneticField class is used.
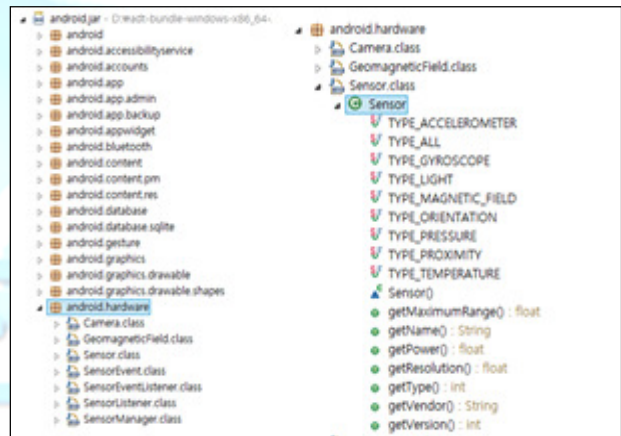

Fig. 4 Android.hardware class packages and functions.

3.4 Internal Class Diagram

Internal class diagram is implemented as shown in Figure 4 by using StarUML tool.
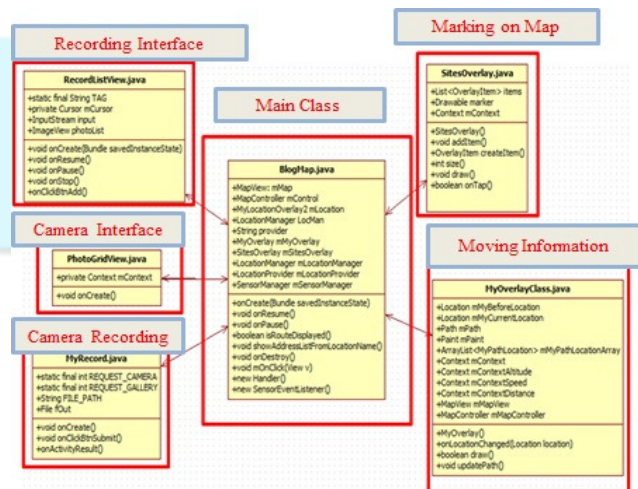

Fig. 4 Android.hardware class packages and functions.

This internal class diagram is consisted of six classes as follows:

- BlogMap.Class: Main class
- MyOverlay.Class: map, moving path, current location, moving information
- SitesOverlay.Class: marking on the map
- MyRecord.Class: record the camera image
- PhotoGrid.Class: camera interface related
- RecordListView.Class: record layout

Each related class are connected with Android.location, Google.android.maps, and Android.hardware class packages in Figure 4.

4. Experimentation and results

The development environment of the system is based on intel i5, windows 8.1 64bits, Galaxy S3, and eclipse. The result files are BlogMap.java, MyOverlayClass.java, MyRecord.java, SiteOverlayClass,java and RecordListView.java, PhotoGridView.java and APK file. Figure 5 shows the basic information display view.

Fig. 5 Basic trekking information display view.

We tested this trekking recording system with a simulated trekking scenario – starting at the back gate and returning to the back gate again through the trekking course within Gyeongsang national university in Korea. Figure 6 shows the starting application and the back gate views. And Figure 7 represents entrance view of the trekking course.

Fig. 6 Starting view and the back gate.

Figure 7 shows the view of lengthening the map size and it can be found that as the touch slide goes to right the view is lengthened. Using this function we can verify the map in detail.
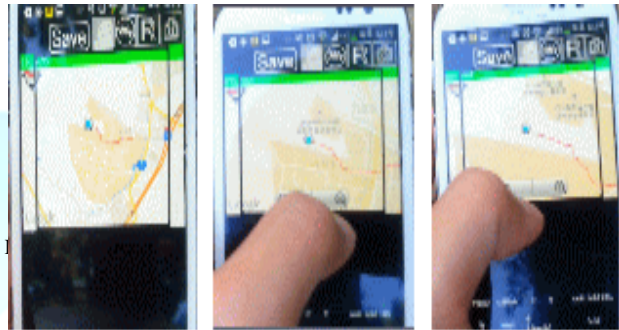

Fig. 7 Basic trekking information display view.

Figure 8 shows the statistics for all records during one travel and the traveler's activities and travel recording would be provided to other traveler's guide information as well as it could be stored in detail for all traveling.

Fig. 8 Overall records and statistics during traveling

Figure 9 represents the finishing moment after a round trekking as an example and shows the google map to display the finishing point on the map and shows the image at the last returning point.

Fig. 9 Finishing the trekking and returning the starting gate

Figure 10 presents one example of trekking using this proposed system. The left is the completed map for three trekking courses around the university and the right shows the experimental result view on smart phone.

Fig. 10 The completed trekking courses and the view on smart phone

5. Conclusion

Utilizing several detection sensors included in smart phone and a variety of APIs provided from Google we implemented a trekking recording system. Based on experiments the camera interfacing made a heavy load in operation but the long time recording and operations were possible by using a SD memory. In future it is needed to advance for smart and low power operation through more effective development software or more high functional APIs.

References

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