

Real Time Field Survey by using various Sensors on Android based Smart Device

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Abstract— Scientists and researchers working in Geo informatics domain, carry out field survey for establishing ground truth. These field surveys are currently paper based exercise. With the current revolution of smart devices, this paper exercise can be converted to digital experience, by developing applications on these smart devices reduces the data capture time and also can synchronize collected data with server in real time thereby increasing accuracy and providing online monitoring while reducing analyzing time. Various ground information can be collected automatically using sensors available on the smart devices. This paper proposes an approach for real time field survey by using various sensors on a Android based smart device.

Key words: Field Survey, Geo Informatics, Smart Device, Sensors, Android

I. INTRODUCTION

Various research domains like, biodiversity, land use / land cover, soil science; geology / geomorphology, etc. are harnessing the capabilities of Remote Sensing (RS) and Geographic Information Systems (GIS) to derive scientific information for planning and management. However, field studies are also essential for establishing ground truth.

Currently field surveys are carried out, where field forms are used to note down various parameters. With the current revolution of smart devices, this research exercise can be converted to digital experience, for collecting field data.

A. Field Survey

Survey is a systematic process to identify places like as forest, hills, objects and sites. Survey may be organized to look at all of the resources within a fairly small geographical area, such as a residential neighborhood, the incorporated limits of a city, or a section of land.

Field Survey is an approach where the surveyors or field researcher will collect data from the field by using various devices like chain, tape, GPS, camera, compass, map etc. All this data is collected on paper and will be entered / uploaded to the computer server later for various purposes.

B. Smart Device

Smart device is generally a device with various sensors like camera, GPS, accelerometer etc. Smart Devices are designed to provide various services and services will provide different information to the user. Smart device has the capabilities to calculate and provide certain results upon the user's action.

II. RELATED WORK

Field survey is process to collect the field level data by using various devices such as Camera, GPA, Compass etc, in existing work the field survey, there is some methods are there which can be used to collect data but these methods are not efficient with the parameters which is been required for the field survey. Some of the methods will able to collect data but it will be limited with the resources, and not even efficient as the field survey point of view.

III. PROPOSED SYSTEM

The work is done in three sections;

- 1) An Android based User Interface (UI) is developed and used to collect field survey.
- 2) Middleware layer will calculate the required field survey data by using sensors data of smart device.
- 3) Web based system will synchronize the field survey data with server and display the collected data in a front end client application.

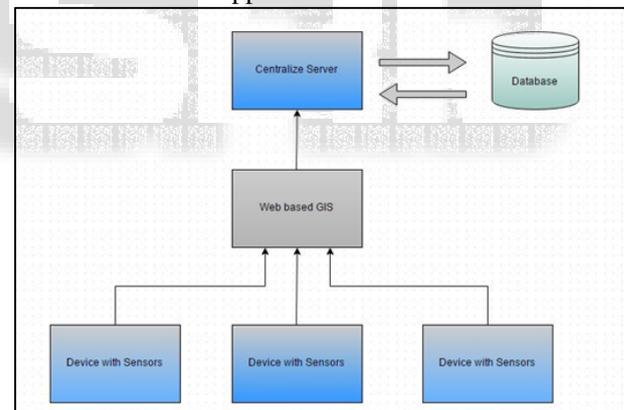


Fig. 1: Propose Architecture

In first section, an Android based user interface is used to collect field survey data by using sensors available on the smart device.

- Accelerometer measures acceleration due to movement and acceleration due to gravity which will be used to calculate distance in second section.
- Location information is provided by GPS Sensor.
- Camera is used to capture the image of the location.

In second section, distance calculation algorithm used to calculate the distance of the focused object by using the various sensors and angels. By using distance of the object, and the current GPS location, location information of far object is calculated.

In third section, the collected data will be synchronized with server. Data will be synchronized with the server when connectivity is available, otherwise, data

will be stored on local device, which can be synchronized later. Data is synchronized by using secure synchronization algorithm. A web front end application allows users to visualize their collected data.

A. Proposed Working Method:

In the proposed working method the surveyor / scientist will hold the smart device and calculate the field data by using the various available sensors of the smart device.

In the proposed method the user or surveyor will collect the data with the help of smart device. Smart device will provide the various advance options to calculate data and save it on device or server.

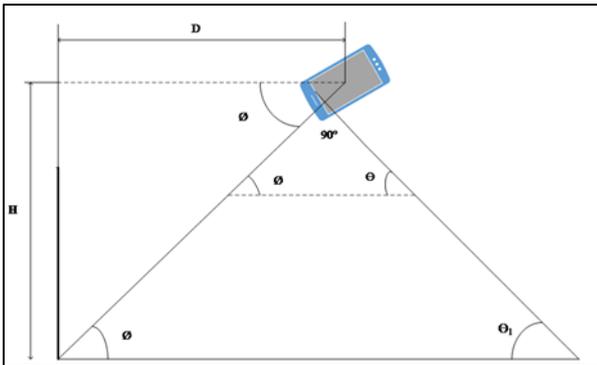


Fig. 1: Proposed Method

Sr. No	Symbol	Description
1	H	Height of the device
2	D	Distance between the user and the object
3	θ	Angle of Depression which is calculated using Accelerometer
4	φ	Angle of bent which is calculated using Accelerometer

Table 1: Description

B. Proposed Method for Collecting Data:

For the calculation of the distance and arriving at location information the following method is proposed:

- Start
- Initialize Variable as H, θ, φ
- Getting height of the device as H from user (Ground level)

Note: The ground level is where the user is standing. The accelerometer gives the value which is converted into angles for further calculations.

- Calculate various angles by using accelerometer
- $\theta = \left| \sin^{-1}(\text{accelerometer value of y axis}) \right|$
- $\phi = 90 - \theta$
- i.e. = $\left| \sin^{-1}(\text{accelerometer value of z axis}) \right|$

Therefore,

$$H/D = \tan\phi$$

So,

$$D = H \cot\phi$$

- Calculate Location information by using GPS
- Calculate Directions and other information from user

And later it can be updated with the real time server.

In the above method the proposed solution is discussed, which explains the set of steps which is used to

find out the location of object. The steps are discussed below,

For calculating the location of far object the device should fulfill following conditions,

- 1) Device should have minimum Android 4.0 version installed.
- 2) Device must have Accelerometer sensor, GPS sensor, Camera and Orientation sensor,
- 3) Internet Connection (optional).

IV. RESULTS

User has provision to set height of device as input.

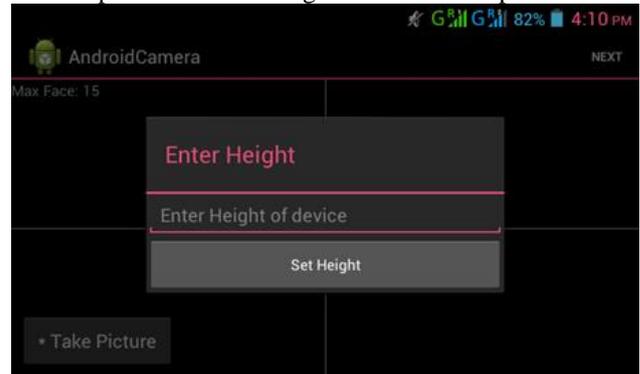


Fig. 2: User Provision

Camera cross hair is focused on a distant object and picture is captured Distance to far object, location (latitude, longitude) of far object and date, time and direction of picture is calculated automatically and populated in the digital field form.

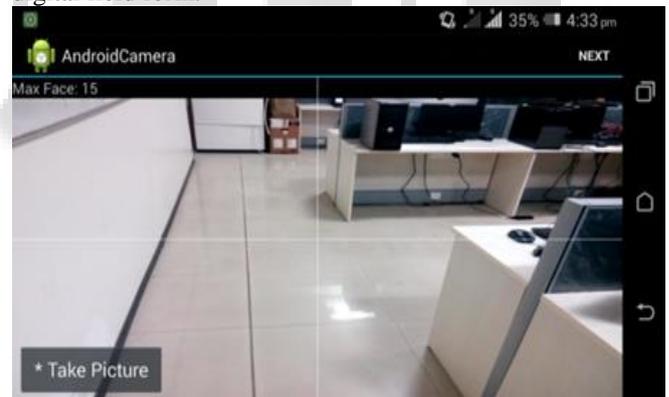


Fig. 3: Camera Cross Hair

Rest of the form fields like description, place name, remarks etc. are populated by the user.

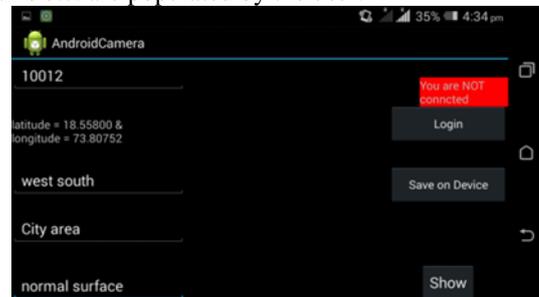


Fig. 4: Rest of the form fields like description

If Internet is available then field data along with geo-tagged photo is synchronized with server by using user authentication. If Internet is not available then data is saved locally in the device, which will be synchronized when the Internet connection is available.

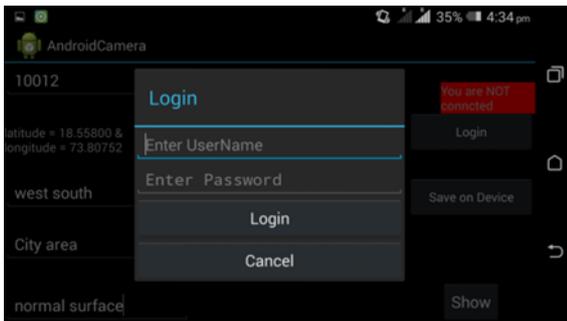


Fig. 5: Login Screen

V. CONCLUSION

This paper proposed a method to calculate the location of a far object, which is useful to collect the field survey data. Smart devices like Android based mobiles / tablets or laptops with various sensors can be efficiently used for real time field surveys using this application. Also the proposed front end client application will provide online information to monitor the field surveyor on GIS map.

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