Mini Project Report On

Global Positioning in IIIT-Allahabad using Image Processing.

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Index

1. Introduction

1. Overview

In this modern era of technology people uses online maps and GPS Services to get their way to desired location. In past few decades, researchers have embedded such software in smart phones and cars. For using GPS Services they need some GPS Device as well, but the services can't be used without such devices.

2. Objective

This project aims to develop a software which is independent of GPS Device and Internet to provide the GPS Coordinates to a person. We assume that a person is having a camera with him and he will click the picture of surroundings of his current location, then after providing the image he should get to know the place where he is standing, or what are is Coordinates.

In this work, we introduced a novel concept, predominant correlation and propose a faster image matching method that can run this software with minimum amount of time. The GPS value thus obtained by our algorithms would be much precise and accurate than using an actual GPS Device.

2. Literature Survey

2.1 What is GPS? :-

The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS.

2.2 How GPS works? :-

GPS satellites circle the earth twice a day in a very precise orbit and transmit signal information to earth. GPS receivers take this information and use triangulation to calculate the user's exact location. Essentially, the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is. Now, with distance measurements from a few more satellites, the receiver can determine the user's position and display it on the unit's electronic map.

2.3 Accuracy:-

Today's GPS receivers are accurate in a **range of 7.5m to 15m at a 95% confidence level**, due to their parallel multi-channel design. Garmin's 12 parallel channel receivers are quick to lock onto satellites when first turned on and they maintain strong locks, even in dense foliage or urban settings with tall buildings.
But these values get effected by factors outside the control of the technical knowledge like atmospheric pressure, sky blockages and receiver quality.

2.4 Image Matching and Scaling algorithm:-

(A)Run an intensity thresholding on the Image:

The image is converted in RGB pixels and the pixels with very less difference with the background are treated same as background.

(B)For simple image manipulation, binarize the images:

Background is represented by BIT 0 and Foreground is represented by BIT 1.

(C) Extract 2D array "Character Maps" for various images:

Grid of RGB pixels of images is extracted and embedded into the source code.

3. Proposed Methodology

Part – 1 Image Matching Algorithm: -

The Algorithm to match the acquired image with the image database is described below in 2 steps ---

Step – 1 Creation of image database

1. First of all, we take the images and convert those images in their pixel values using RGB pixel method.
2. Now we scale the larger pixel grid of images to a grid of size 50 X 50 to enhance space complexity and time complexity of finding the result.
3. Finally, grids of all images are embedded with the source code of the program that will match the given image to the images of database.

Step – 2 Matching the given image

1. Firstly we scale the given image to a size of 50 X 50 as done previously.
2. Now we check the pixel by pixel values of the given image with the images stored in our database.
3. For a particular image in database, if the pixel matches we increment the counter.
4. Finally, the database image for which the counter is maximum, is selected as the image matched with the given image.

Thus, image matching part of the procedure is done.

Part – 2 Finding GPS value

The algorithm to find the GPS value of the place found by the image matching, is described in following 2 steps –

Step – 1 Creating a map of the campus

1. We take the GPS values of some major places inside IIIT-A Campus with help of existing GPS values.
2. The GPS values are stored with respective images.

Step – 2 Calculating precise GPS value

1. To calculate precise GPS value of the given place, we divide the region between two major places in 10 parts.
2. Now, for a part P between 2 major places A and B,

   Latitude_p = latitude_a + (latitude_b – latitude_a) / 10

   longitude_p = longitude_a + (longitude_b – longitude_a) / 10

Thus, the precise GPS value of any place inside IIIT-A is found.

4. Requirements

1. Microsoft Visual Studio 2013 as IDE for C#.
2. Images of various places inside IIIT-Allahabad (Jhalwa Campus).
3. Online sources to find approximate GPS coordinates of various places inside IIIT-Allahabad (Jhalwa Campus).

5. Status Report

1. Work done till Mid-Semester :-

1.1. Studies done on GPS co-ordinates and latitude and longitudinal values.
1.2. Learning and Implementation of IMAGE matching algorithms.
1.3. We have tried to grab some images of Jhalwa campus from Google street view.
1.4. We have tried to match the given image with the images in our database.
1.5. Tried to calculate the more precise values of the GPS co-ordinates of the places corresponding to the images in our database.
1.6. Tried to learn basic C# syntax.

2. Work to be done after Mid-Semester :-

2.1. Research on the precision of GPS values.
2.2. Searching for options to match night images with our present image database.
2.3. Enhancing the prototype for larger database of images.
2.4. Creating the GUI for our software to find GPS values.
2.5. Finalizing the project. ☺

6. Limitations

1. We have used specific collection of images to match the user's image with our collection, in our case images of IIIT-Allahabad are used, so images outside the scope won't yield any result.

2. Images have been scaled to 50x50 resolution so, the accuracy is not 100% (actually it comes out to be around 85%).

3. The actual GPS device gives coordinates accuracy of 15 meters, although we have improved this accuracy to 5 meters but images below this difference won't get accurate result.

4. Multiple images may yield different coordinates but same name for the place depending on camera direction for same place.

7. References

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8. Suggestions

9. Remarks