CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Anurag Singh; Kaushik Tandon

Project Number

34844

Project Title

Parking Pigeon: Application for Enhanced Localization in Multi-Story Parking Lots

Abstract

Objectives/Goals

People forget where they parked their car in multi-story parking lots, and parking levels sometimes look alike. GPS systems do not work well inside buildings, or provide parking level information. Parking Pigeon, our Android application, uses built-in pressure sensors in smartphones to lead the user back to the correct floor.

GOAL: Design a smartphone application to locate the parking level of a car in a multi-story parking lot.

DESIGN CRITERIA

1. Easy to use smartphone app - guides user to correct parking level 2. Resolution better than 3 meters height of parking levels 3.Works in above and underground lots 4. No special equipment needed for the car

Methods/Materials

Parking Pigeon works in two steps. When parking the car, the app uses built-in pressure sensors to record the atmospheric pressure at the parking level. When locating the car, the app uses the pressure measurement at the current location of the user to guide them back to the correct parking level, by minimizing the pressure difference. To estimate the naturally occurring drift in atmospheric pressure from the time the car is parked to the present time, we query the regional weather station over the internet. This drift correction is applied to the current pressure measurement before converting it to altitude.

We used three smartphones for testing. Eclipse IDE was used for the Android development. We tested our application at 4 different multi-story parking lots on multiple days.

Results

Excellent correlation ($R^2>0.99$) between the height predicted by the pressure sensor and the actual heights of the parking levels. The average error of .1 meter does not affect our results as typical parking levels are separated by 3-5 meters in height. In contrast, GPS data showed no correlation with actual height, and was inadequate for our purposes.

Our novel method of querying weather services for atmospheric pressure is successful in correcting for natural pressure drift. We have shown an excellent one-to-one correlation ($R^2>0.99$) between the regional atmospheric pressure with measurements from 3 separate smartphones on 4 different days.

Parking Pigeon was verified to work inside buildings and in underground parking lots

Conclusions/Discussion

Parking Pigeon is a successful prototype that met our engineering goal. It demonstrates an innovative problem solving algorithm using pressure sensors, weather stations and web query APIs.

Summary Statement

Parking Pigeon is a smartphone application to locate the parking level of a car in a multi-story parking lot, utilizing built-in pressure sensors.

Help Received

Mr. Prateek Tandon mentored on Android Programming. Mr. Pankaj Tandon and Mr. Ajay Singh helped with transportation and printing of the poster.