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On the Relative Positioning of Mobile Devices Through Bluetooth Analysis

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ABSTRACT

Currently, there is no way to accurately track a mobile devices position in a given space without the use of GPS or WiFi. This means that people who are interested in understanding where they currently are in relationship to other people or landmarks and do not have access to these technologies are not able to get accurate location information. In many cases, GPS and WiFi fail to provide the accuracy required to provide useful information as well.

The solution being proposed is a software layer that utilizes existing bluetooth hardware to create a highly accurate relative positioning system. The software layer will utilize a variety of algorithms to interpret the relative signal strength of known bluetooth transmitters and will be able to return a useful, three dimensional, representation of where a smartphone or other bluetooth device is. The proposed framework offers a software solution that will be cheap and highly distributable due to the fact that is utilizes existing technologies.

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Introduction

1.1 Motivation

Currently, there is no way to accurately track a mobile devices position in a given space without the use of GPS or WiFi. This means that people who are interested in understanding where they currently are in relationship to other people or landmarks and do not have access to these technologies are not able to get accurate location information. While most people with modern smartphones do have nearly unlimited access to GPS and WiFi, this does not necessarily exclude them from the group of people who are affected by this issue. In many cases, GPS and WiFi fail to provide the fine grain accuracy required to provide useful information. Within a building GPS and WiFi can be unreliable because their physical signature is fundamentally not designed to address the need for indoor or finely tuned positioning. This can cause the distance and elevation that GPS reports back to lose accuracy. It cannot determine what floor youre on so if youre on the second floor or the ninth floor, you would show up in the same location. In terms of distance, it could show you at least several meters off from your real world location. Best case scenario, GPS will get someone to the door of a building they are looking for, but after that the person is on their own once inside of that building. Due to their design, GPS and WiFi cannot help you determine your location once inside a building in many cases, especially if the building has multiple floors. Often times stores and campuses provide physical maps for visitors. For a physical map however, there is no map for finding the map. To use the map, a person physically has to move to it to view where they are. Also, if there is a single map for all visitors, then a person cant carry it with them once they head for their destination. This means people can get lost on the way to their destination after leaving the map. Other current solutions try to solve this issue with proximity detection technology. The problem here is that proximity based systems can only tell a person how close they are relative to something; it doesnt give information on the direction or elevation of whatever the person may be

looking for. This can cause people to waste time figuring out what direction they need to head in or even put them a floor above or below their destination.

1.2 Solution

The solution being proposed is a software layer that utilizes existing bluetooth hardware to create a highly accurate relative positioning system. The software layer will utilize a variety of algorithms to interpret the relative signal strength of known bluetooth transmitters and will be able to return a useful, three dimensional, representation of where a smartphone or other bluetooth device is. The ability to understand the location of a device in two or three dimensions as opposed to the proximity of a device in one dimension allows for an exponential increase in the possible applications for such a positioning framework. Additionally, the ability to navigate using a smartphone indoors vastly improves the currently nondigital solution of central physical maps that are currently in use in many large buildings. The proposed framework offers a software solution that will be cheap and highly distributable due to the fact that is utilizes existing technologies. This means the framework will be able to support a wide variety of applications without needing to wait around for the next breakthrough spectrum standard in positioning technology.