A SURVEY ON VARIOUS TRACKING TECHNIQUES FOR LOCATION PREDICTION OF MOVING OBJECT THROUGH SMS

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ABSTRACT

With the continued advances in wireless communications, geo-positioning, and consumer electronics, an infrastructure is emerging that enables location-based services that rely on the tracking of the continuously changing positions of entire populations of service users, termed moving objects on mobile phones . This scenario is characterized by large volumes of updates, for which reason location update technologies become important. A setting is assumed in which a central database stores a representation of each moving object's current position. This position is to be maintained so that it deviates from the user's real position by at most a given threshold. To do so, each moving object stores locally the central representation of its position. Then, an object updates the database whenever the deviation between its actual position (as obtained from a GPS device) and the database position exceeds the threshold. The main issue considered is how to represent the location of a moving object in a database so that tracking can be done with as few updates as possible. Transmitting the geo-location information of a target via wireless networks is effective when both the target and the tracker are within Wi-Fi coverage area; the 802.11 wireless networks are not always accessible. When the target or the tracker is unable to access Wi-Fi, it is impossible to perform location tracking. Therefore, SMS is a relatively more reliable and flexible solution because of its widespread use. However, SMS is a user-pay service. The objective is to minimize the transmission cost of a tracking system by minimizing the number of SMS transmissions while maintaining the location tracking accuracy.

Keywords- Global Positioning System (GPS), Location Tracking, Mobile Phones, Prediction Algorithms, Short Message Service (SMS).

I INTRODUCTION

With the advent of GPS and the ubiquitous cellular network, real time tracking of object has become possible. Recent advancements in mobile technology allow Global Positioning System (GPS)-enabled mobile devices to provide a variety of real-time Location based Services (LBS). Among all those services, GPS navigation and location tracking are the most popular applications on mobile devices due to the usefulness and popularity during a trip. Formerly, a tourist has to look at paper maps or tour guide books during the trip, resulting in wasting time and easy to get lost. Therefore, electronic products embedded with navigation functions have become more and more popular. By using GPS navigation capabilities of those electronic devices, the travellers

can arrive to an unfamiliar destination speedily and effortlessly. At the meanwhile, a GPS tracking system is able to track a specific target's movement and relay information concerned where the target has travelled.

A GPS navigation device is a device that can receive GPS signals for determining the device's current location on Earth. Currently, the commonly used hardware of navigation systems includes dedicated car GPS personal navigation device PND) and GPS-enabled smart phones.

There are a number of navigation software products available. GPS navigation software usually falls into one of the following two categories: commercial navigation software and free open-source navigation software. Since the navigation systems provided by the smart phone company or telecommunication operator are commercial products, which significantly limit developing some extended functions. Also the service from these companies isn't free. Hence, there is lack of free and open-source based GPS navigation system which integrates those useful applications. Recently, Google has developed the Android platform, which is an open system, offering high flexibility on development. Due to this, it is very useful to develop a GPS navigation system on the Android platform with combing many Google resources. With Google Maps' free navigation functionality, people may prefer the costless service from Google over that of paid services. Location based services (LBS) define the broad spectrum of technologies which can calculate the position of a receiver. There are many types of LBS which function at varying degrees of accuracy and scope. E911 is the most widely used LBS in the which relays the location of mobile phone users to emergency units. The global positioning system (GPS) is an outdoor LBS which is capable of determining the location of a receiver within 15 to 100 meters of accuracy GPS tracking and monitoring describes the use of GPS to determine the location of a receiver and consequently following its movements.

The global position system (GPS) has become a common functionality in handheld devices, and therefore, several location-tracking applications have been developed [1]–[14], including continuous location-tracking of elders and children for safety reasons or to prevent them from being lost [1], [2], car monitoring and tracking [3]–[5], and intelligent transportation systems [6]. The GPS is used to obtain the location information of a target (e.g., a mobile device). However, most of the above-cited works used either an 802.11 wireless network or the short message service (SMS) to transmit the location information of a target to a tracker. For example, Lee *et al*. proposed a real-time location tracking system [1] for childcare or elderly care applications. It transmits the location information of the mobile device to a central GPS application server through the 802.11 wireless networks. This application allows the server to simultaneously monitor multiple targets (e.g., elders or children). Further, Choi *et al*. assumed that the location information of a target is transmitted through wireless networks. Their work focused on proposing a relocation update scheme to decrease the update frequency [7]. Lita *et al*. proposed an automobile localization system by using SMS [3]. The proposed system, which is interconnected with the car alarm system, transmits alerts to the owner's mobile phone in the event of a car theft (e.g., activation of the car alarm, starting of the engine) or provides information for monitoring adolescent drivers (e.g., exceeding the speed limit or leaving a specific area). Hameed *et al*. proposed a car monitoring and tracking system that uses both SMS and GPS to prevent car theft [5]. Anderson *et al*. proposed a transportation information system [6]. In this system, a hardware device called StarBox, which is equipped with a global system for mobile communications (GSM) modem and a GPS unit, is installed in a vehicle to track the vehicle's location. StarBox transmits short messages containing its GPS coordinates to the server at 30-s intervals. The users can send short messages to the server to determine the expected arrival time of buses at their locations.

Although transmitting the geolocation information of a target *via* wireless networks is effective when both the target and the tracker are within Wi-Fi coverage area, the 802.11 wireless networks are not always accessible. When the target or the tracker is unable to access Wi-Fi, it is impossible to perform location tracking. Therefore, SMS is a relatively more reliable and flexible solution because of its widespread use (i.e., well-structured worldwide) [6], [8]. However, SMS is a user-pay service. The objective of this study is to minimize the transmission cost of a tracking system by minimizing the number of SMS transmissions while maintaining the location tracking accuracy.

II TRACKING SCENARIOS

Movement tracking is not one, single technology. Rather, it is the convergence of several technologies that can be merged to create systems that track inventory, livestock or vehicle fleets. Similar systems can be created to deliver location-based services to wireless devices.

Current technologies being used to create location-tracking and location-based systems include:

2.1 Geographic Information Systems (GIS)

For large-scale location-tracking systems, it is necessary to capture and store geographic information. Geographic information systems can capture, store, analyze and report geographic information. A GIS is a system that incorporates software, hardware, and data for collecting, managing, analyzing, and portraying geographically referenced information. It allows the user to view, understand, manipulate, and visualize data to reveal relationships and patterns that solve problems. The user can then present the data in easily understood and disseminated forms, such as maps, reports, or charts.

2.2 Global Positioning System (GPS)

A constellation of 27 Earth-orbiting satellites (24 in operation and three extras in case one fails). A GPS receiver, like the one in your mobile phone, can locate four or more of these satellites, figure out the distance to each, and deduce your location through trilateration. For trilateration to work, it must have a clear line of sight to these four or more satellites. GPS is ideal for outdoor positioning, such as surveying, farming, transportation or military, geotagging, geofencing.

The GPS system comprises of three parts: Space segment, User segment and Control segment.

2.2.1 Space segment

The satellites are the heart of the Global positioning system which helps to locate the position by broadcasting the signal used by the receiver. The signals are blocked when they travel through buildings, mountains, and people. To calculate the position, the signals of four satellites should be locked. You need to keep moving around to get clear reception.

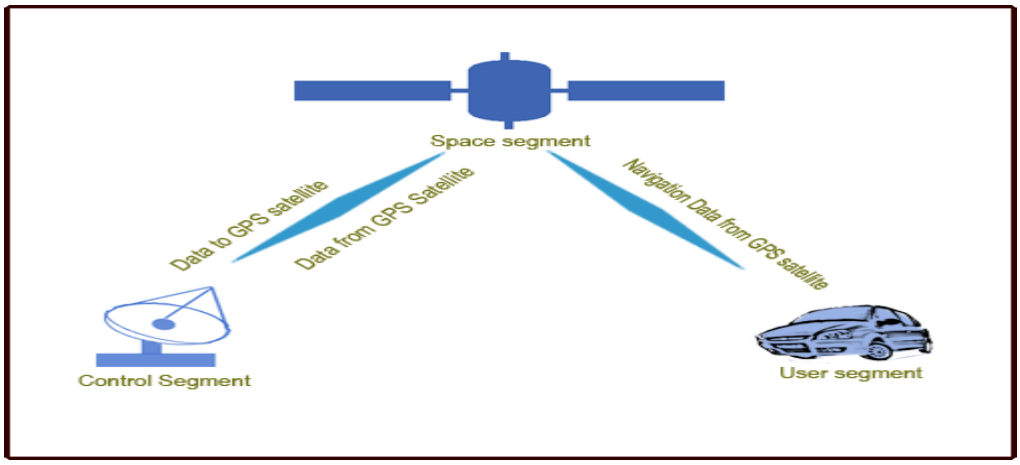
2.2.2 User segment

This segment includes military and civilian users. It comprises of a sensitive receiver which can detect signals (power of the signal to be less than a quadrillionth power of a light bulb) and a computer to convert the data into useful information. GPS receiver helps to locate your own position but disallows you being tracked by someone else.

2.2.3 Control segment

This helps the entire system to work efficiently. It is essential that the transmission signals have to be updated and the satellites should be kept in their appropriate orbits.

The diagram of the structure of GPS is given below



2.3 Radio Frequency Identification (RFID)

Small, battery-less microchips that can be attached to consumer goods, cattle, vehicles and other objects to track their movements. RFID tags are passive and only transmit data if prompted by a reader. The reader transmits radio waves that activate the RFID tag. The tag then transmits information via a pre-determined radio frequency. This information is captured and transmitted to a central database. Among possible uses for RFID tags are a replacement for traditional UPC bar codes. The RFID device serves the same purpose as a bar code or a magnetic strip on the back of a credit card or ATM card; it provides a unique identifier for that object. And, just as a bar code or magnetic strip must be scanned to get the information, the RFID device must be scanned to retrieve the identifying information.

A significant advantage of RFID devices over the others mentioned above is that the RFID device does not need to be positioned precisely relative to the scanner. We're all familiar with the difficulty that store checkout clerks sometimes have in making sure that a barcode can be read. And obviously, credit cards and ATM cards must be swiped through a special reader. In contrast, RFID devices will work within a few feet (up to 20 feet for high-frequency devices) of the scanner. For example, you could just put all of your groceries or purchases in a bag, and set the bag on the scanner. It would be able to query all of the RFID devices and total your purchase immediately. One reason that it has taken so long for RFID to come into common use is the lack of standards in the industry. Most companies invested in RFID technology only use the tags to track items within their control; many of the benefits of RFID come when items are tracked from company to company or from country to country.

2.4 Wireless Local Area Network (WLAN)

It links two or more devices using some wireless distribution method, and usually providing a connection through an access point to the wider Internet. This gives users the ability to move around within a local coverage area and still be connected to the network. Most modern WLANs are based on IEEE 802.11 standards, marketed

under the Wi-Fi brand name.. These devices pass data over radio waves and provide users with a network with a range of 70 to 300 feet (21.3 to 91.4 meters). Figure shows Wireless LAN architecture.

The wireless LAN architecture consist of the following component

2.4.1 Stations

All components that can connect into a wireless medium in a network are referred to as stations. All stations are equipped with wireless network interface controllers (WNICs). Wireless stations fall into one of two categories: access points, and clients. Access points (APs), normally routers, are base stations for the wireless network. They transmit and receive radio frequencies for wireless enabled devices to communicate with. Wireless clients can be mobile devices such as laptops, personal digital assistants, IP phones and other smartphones, or fixed devices such asdesktops and workstations that are equipped with a wireless network interface.

2.4.2 Basic service set

The basic service set (BSS) is a set of all stations that can communicate with each other. Every BSS has an identification (ID) called the BSSID, which is the MAC address of the access point servicing the BSS. There are two types of BSS: Independent BSS (also referred to as IBSS), and infrastructure BSS. An independent BSS (IBSS) is an ad hoc network that contains no access points, which means they cannot connect to any other basic service set.

2.4.3 Extended service set

An extended service set (ESS) is a set of connected BSSs. Access points in an ESS are connected by a distribution system. Each ESS has an ID called the SSID which is a 32-byte (maximum) character string.

2.4.4 Distribution system

A distribution system (DS) connects access points in an extended service set. The concept of a DS can be used to increase network coverage through roaming between cells. DS can be wired or wireless. Current wireless distribution systems are mostly based on WDS or MESH protocols, though other systems are in use.

Any location tracking or location-based service system will use one or a combination of these technologies. The system requires that a node or tag be placed on the object, animal or person being tracked. For example, the GPS receiver in a cell phone or an RFID tag on a DVD can be used to track those devices with a detection system such as GPS satellites or RFID receivers.

III DISCUSSION

Our Discussion deals with different types of object movement prediction tracking techniques. Here RFID technique is not suitable for tracking as it implies a big delay and a low data rate. Although the RFID tag works passive, thus has low power consumption, the whole system is not as power saving trough the permanent rotating of the RFID reader. In case of wireless LAN, Although transmitting geo-location information of a target *via* wireless networks is effective when the target and tracker are both within Wi-Fi coverage, 802.11 wireless networks are not always available. Once a target or a tracker is unable to access Wi-Fi, location tracking becomes impossible. So in that case getting SMS about the location is more useful. However, SMS is a user pay so we have to minimize the number of SMS transmissions while simultaneously maintaining the location tracking accuracy. There are three different approaches for SMS delivery, time based distance based and location based delivery. Time-based delivery is used to periodically transmit location update messages for tracking [3], [6], [10]. By contrast, distance-based delivery is used to transmit location update messages when the distance between the previously reported location and the current location exceeds a fixed-distance threshold [9]. Time-based delivery is effective for tracking a target that is moving erratically. However, it exhibits a crucial flaw when the target remains stationary for an extended period, that is, it continues to periodically transmit many unnecessary short messages. LBD transmits a location update message when the distance between the predicted location and the actual location exceeds a certain threshold, rather than when the distance between two continuously reporting locations exceeds the threshold, a typical mechanism adopted by distance-based delivery. Thus, LBD can deliver fewer update messages.

IV CONCLUSION

A handful of studies have developed location tracking applications through SMS. However, SMS is a user-pay service. The number of SMS transmissions must be minimized while maintaining the location tracking accuracy within the acceptable range to reduce the transmission cost. As compared to other technologies GPS location based tracking are more beneficial as The GPS costs you very low in comparison other navigation systems. GPS works in all weather so you need not to worry of the climate as in other navigating devices. The GPS costs you very low in comparison other navigation systems. Due to its low cost, it is very easy to integrate into other technologies like cell phone. Additionally, LBD further reduces the number of required update messages while satisfactorily maintaining the location tracking accuracy because it adopts a dynamic threshold rather than the static threshold used in distance-based delivery.

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