Geofencing:

A Generic Approach to Real Time Location based Tracking System

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Abstract: **Digitization has changed the way of thinking as well as the life style of people. With the eve of rapid invention new technology, Real time location tracking and monitoring of physical object become essential where authorized access is needed to some geographical area and unauthorized access should be restricted. Nowadays different measures for Real Time Location System (RTLS) are available. Among them the concepts mentioned in this paper is Geofencing, a virtual barrier around geographical area which allows mobile app or physical object to work on the basis of real time data provided by it. Geofencing can be implemented either with GPS or BEACONS or RFID.This paper includes the definition of Geofencing, working of Geofencing, comparisons of technology used to implement concept of Geofencing, Geofencing uses and advantages. As mentioned in this paper user can select either GPS or RFID or BECONS to implement the concept of Geofencing on the basis of requirement.**

Keywords-component;
Geofencing,RTLS,GPS,RFID,FAA,SKU

I.   INTRODUCTION

Definition:
Geofencing is virtual barrier or geographical border or virtual perimeter around a single point with predefined set of boundaries on geographical area mapped either with Global Positioning System (GPS) or RFID (Radio Frequency Identification) or beacons or some other technology available, .Geofencing can also be considered as a feature of software program of GPS with a space based radio navigation system.
Introduction:
Geo-fence apps and tools monitor when mobile devices or other physical objects enter or exit an established geo-fenced area and provide administrators with alerts when there's a change in status for a device. These alerts can take the form of text messages, e-mail notifications, phone calls or similar means of communication. Programs that incorporate geo-fencing allow an administrator to set up triggers so when a device enters (or exits) the boundaries defined by the administrator, a text message or email alert is sent. Many geo-fencing applications incorporate Google Earth, allowing

administrators to define boundaries on top of a satellite view of a specific geographical area. Other applications define boundaries by longitude and latitude or through user-created and Web-based maps.
The technology has many practical uses. For example, a network administrator can set up alerts so when a hospital-owned iPad leaves the hospital grounds, the administrator can disable the device. A marketer can geo-fence a retail store in a mall and send a coupon to a customer who has downloaded a particular mobile app when the customer (and his Smartphone) crosses the boundary. Geofencing can be typically used in a case where we need to prevent device from working when it is outside to particular area. For example .college management application restricts student or employee to access some of information when he is not present at college.
It provides a strategy where by field based operatives are tracked to ensure that they remain within their authorized geographical limits during working day.GPS provides location and time in all weather conditions and anywhere on the earth.
Working of Geofencing:
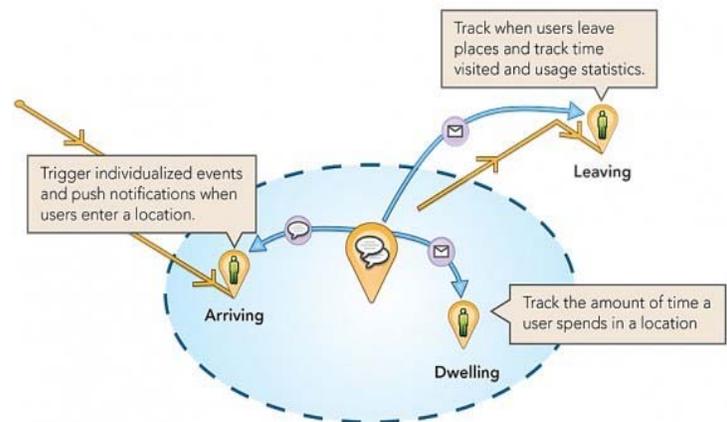
Geofencing uses GPS coordinates to encapsulate a geographic area and takes a mobile user's (who has opted in to receive push notifications) location data via GPS to determine his/her proximity to that particular region (whether they are inside or outside or if they just went in and came out of that particular area in a matter of seconds). It allows marketers to send messages to Smartphone users when they enter a defined

	BEACONS	**RFID**	**GPS**
Working	Bluetooth low energy beacons send a signal; device detects signal and acts based on data service rules	Radio tag transmit stored information to readers which record data and perform actions based on reader application software rules	Satellite radio signals. GPS devices receive the signal and determine location.
Accessibility	With smart phones primarily acting as receivers, beacons form a highly accessible indoor location technology.	The dependence of an RFID system on a number of components including basic hardware such as tags, readers, reader control and an application software, make it a difficult solution from an accessibility standpoint.	Any person with a GPS receiver can access the system, and it can be used for any application that requires location coordinates.
Range	Beacons typically have a wireless range of 1m to 70m	RFID solutions cater to different ranges based on the frequency at which they operate (low freq - 10cm, high freq - 10cm to 1m, ultra-high freq - upto 12m, active RFID tags - upto 100m).	GPS available with anyone who have GPS receiver, typically the range is unlimited *

	BEACONS	**RFID**	**GPS**
Accuracy	Beacons being radio transmitters are not very accurate as they stand the chance of interference, as radio signals can be absorbed by different media, such as water, air, human bodies or even metallic surfaces	Accuracy of RFID systems vary depending on the frequency of operation, the kind of tag antenna, reader and reader antenna.	The accuracy of a GPS receiver can vary based on multiple factors beyond coverage, like sensitivity, sources of interference, and the kind of satellites in view The actual accuracy users attain depends on factors outside the government's control, including atmospheric effects, sky blockage, and receiver quality. Real-world data from the FAA(**Federal Aviation Administration**) show that their high-quality GPS. SPS receivers provide better than **3.5 meter** horizontal accuracy.[6]
Security	Beacon Hacking, a common threat to beacon security occurs when beacons with weak security measures are discovered by hackers who then change their UUIDs(Universal Unique Identifier), Majors and Minors to leverage the beacon network without prior permission. Most beacon manufacturers have now put some measures in place to prevent this from happening.	Common forms of data security threats associated with RFID systems are rogue/clone tags, unauthorized riders, and side-channel attacks (interception of reader data by an unauthorized device).	Common threats to GPS security system are system degradation, natural phenomena, electromagnetic pulse, nuclear explosion in space, terrorist attack, intentional jamming etc.[2]

[8],[10]

geographic area, such as a retail store, stadium, shopping mall etc.[4]

Though, Geofencing is popular among marketers as a way to send offers or coupons to their customers, it does not end here. Retailers could even use Geofencing to provide a more personalized experience.

Generally speaking, there are three types of Geofencing action triggers:

(1) Static: This is based on the position of a mobile user with respect to a fixed area. For example, the messages that are sent to opt-in users when they enter retail store.

(2) Dynamic: This is based on the position of a mobile user with respect to a changing data stream. For example, the "open parking space" notification that is sent to mobile app users who happen to be driving nearby.

(3) Peer-to-Peer: This is based on the position of a mobile user with respect to other users. For example, the check-in notification of nearby friends on a social mobile app likes Yelp, Face book, or Foursquare.

Another important thing to note here is that Geofencing using GPS has a huge impact on the battery life of your customer's mobile device as it requires satellites and cell phone towers in order to pinpoint their location.[3]

Comparision with other available technology used to implement the concept of Geofencing.

Geofencing has many uses including:

Use	Example
Fleet management	When a truck driver breaks from his route, the dispatcher receives an alert.
Human resource management	An employee smart card will send an alert to security if an employee attempts to enter an unauthorized area.
Compliance management	Network logs record geo-fence crossings to document the proper use of devices and their compliance with established rules.
Marketing	A restaurant can trigger a text message with the day's specials to an opt-in customer when the customer enters a defined geographical area.
Asset management	An RFID tag on a pallet can send an alert if the pallet is removed from the warehouse without authorization.
Law enforcement	An ankle bracelet can alert authorities if an individual under house arrest leaves the premises.

[11]

Advantages of Geofencing

Geofencing can be used for child location *services* that can notify parents if child leaves a predefined area around school or any other location.

In some organizations, Human Resource department can use Geofencing for monitoring employees that works in special locations and mostly for those who do field works. An employee can also log his attendance using Geofencing tool in a GPS enabled device, when they are present in a designated perimeter.Use of Geofencing in security strategy model gives security to wireless local area networks.With the popularity of smart phones and mobile advertising, Geofencing is also being used for sending location specific notifications to customers on their mobile devices, when they enter in that pre-designated zone.[7]

Conclusion

Even though still unfamiliar to many people, Geofencing is a natural expansion of our desire for our devices to do more (and to do more automatically) and to decrease the abrasion with which intermingle with our environment. As devices become increasingly primitive and more elements of our home, vehicles, and workplace enter the ever growing unwavering of "Internet of things" objects anticipate to see Geofencing applied to more and more devices and environments.

REFERENCES :
1. Sergio Tenreiro de Magalhaes, Hamid Jahankhani, Ali G. Hessami,EdGlobal Security, Safety, and Sustainability: 5th International Conference, ICGS3 2009, London, UK, September 1-2, 2009, Proceedings
2. American centre for democracy . http://acdemocracy.org/gps-vulnerability-options-and-alternatives/
3. All about beacons,https://blog.beaconstac.com/2015/09/beacons-vs-Geofencing-which-location-aware-technology-should-your-business-use/
4. Biznesapps.https://www.biznessapps.com/blog/how-to-make-Geofencing-work-for-your-small-business/
5. Brickhousesecurity.http://www.brickhousesecurity.com/category/gps+tracking/how+does+gps+tracking+work.do
6. Official U.S. Government information about the Global Positioning System (GPS) and related topics.http://www.gps.gov/systems/gps/performance/accuracy/
7. Krify.https://krify.co/tag/Geofencing-and-rfid/
8. RTLS and workforce management platform.https://lighthouse.io/indoor-location-technologies-compared/
9. Montana state university.http://www.montana.edu/gps/understd.html
10. Quora –The best answer to any question,https://www.quora.com/What-is-the-difference-between-RFID-and-a-Beacon
11. Computer Glossary ,Computer Terms-Technology definitions and cheat sheets from Whats .com http://whatis.techtarget.com/definition/Geofencing
12. http://www.webopedia.com/TERM/G/geo-fence.html