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The Bluetooth and GPS Tracking System: Comparison and Analysis of Technique

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Abstract: In recent years, tracking system is a popular approach to detect misplaced objects due to the availability of related systems in the market. The common technologies used are RIFD, Bluetooth, WIFI and GPS. Following framework more often than not consolidates the utilization of an electronic gadget (equipment) with portable application (programming) that tracks the missing objects. Numerous structures likewise join verbal trade parts together with satellite TV for pc transmitters to communicatewith equipment's for a distant client. Google maps are utilized to observe the equipment's region. This examination is centered around two administrations in following lost question. The first one is GPS and the second one is Bluetooth. The ascent of Bluetooth Low Energy (known as BLE or Bluetooth 4.0) opens up to unlimited potential outcomes of Bluetooth following applications. On the other hand, GPS is a service that communicates with satellites, provides location on the globe, and gives coordinates of the location tracker.

Keywords:Tracking System, Bluetooth, GPS, Google Maps, Android

1.0 Introduction

A tracking system is used to observe persons or objects on the move and give a timely ordered sequence of location data for further processing. There are pile following framework(Gavalas & Economou, 2011; Yaacob, Ghani, & Basari, 2013). Some are 'slack time' markers, that is, the data is assembled after a thing has passed a point. An institutionalized tag is an example of a slack time marker. Others are 'progressing' or 'close nonstop resembles Global Positioning Systems depending on how frequently the data is reinforced. There are scanner label structures which require a man to channel things and modify ID (RFID auto-id)("Bluetooth wireless technology basics," 2004). Generally, the accompanying scenes are made of discrete gear and programming structures for different applications(Chang, 2014; Lodha, Gupta, Jain, & Narula, 2015).

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That is, institutionalized recognizable proof structures are separated from Electronic Product Code (EPC) frameworks, and GPS frameworskare detached from dynamic continuous discovering systems or RTLS(Kamel Boulos & Berry, 2012). An uninvolved RFID system, for instance, could be used as a piece of a dispersion focus to channel the compartments which are stacked on a truck. Then, the truck itself is taken after on a substitute structure using GPS (Shen & Stopher, 2014)with its own component and programming(Gavalas & Economou, 2011).

2.0 Literature Review

The Global Positioning System consists of 24 satellites that orbits the earthto give data on the overall position, time and speed data. GPS (Mulla, Baviskar, Baviskar, & Bhovad, 2015)makes it conceivable to distinguish effectively areas on the earth by estimating the separations from the satellites. GPS enables individuals to document or make places from places on this planet and help them explore to and from the any areas(Feldmann, Kyamakya, Zapater, & Lue, 2003)

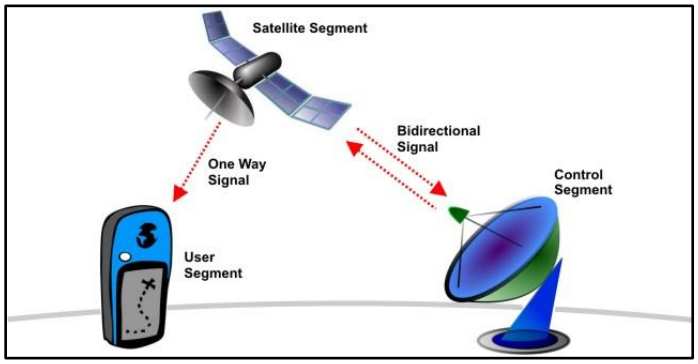

Figure 1 Concept of The Global Positioning System

GPS is divided into 3 segments:

i. The Space segment: the space area incorporates 24 satellites revolving around the earth at 12,000 miles in elevation. This high altitude lets in the markers to cover more area. The satellites are organized in circles so a GPS receiver on the earth can always get signals from a minimum of 4 satellites at any given time("Bluetooth wireless technology basics," 2004; Padgette & Padgette, 2017).

ii. The Control segment: The oversee segment tracks the satellites after which gives them with corrected orbital and time statistics. The control area comprises of four unmanned control stations get hold of statistics from the satellites and then ship that statistics to the grasp control station in which it is corrected and despatcher lower back to the GPS satellites("Bluetooth wireless technology basics," 2004; Padgette & Padgette, 2017)

iii. User segment: The client segment integrates clients and GPS receivers. The scope of concurrent clients is incalculable.

A Bluetooth with various forms give the furthermostdiverse range of reaches. It relies on what an adaptation utilized. For the latest version is Bluetooth version 4.0 it

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supports up to 50 meters in diameter. The principle Bluetooth will send a flag to the point, and then, the flag will return to the fundamental(Miller, 2011).

2.1 Bluetooth

Bluetooth trackers consist of a primary device and a tag, like RFID systems. Bluetooth communications are two-way connection, though; once the devices are paired, they can remotely access the hardwareof others(Bluetooth Special Interest Group (SIG), 2016; Yan & Shi, 2013). This means that with a Bluetooth tracker, you can use either the tag or the primary device to find the other hardware. Each device should be equipped with a microchip (transceiver) that transmits and gets within the frequency of 2. 4 GHz this is available in the entire world (with some variations of bandwidth in specific nations). Except the statistics, there are 3 channels of voice available.The records may be exchanged to speeds of up to at least 1 megabit for 2nd (2 megabits for 2d in the second generation of this era). A scheme of "frequency hop" (jumps of frequency) permits to the devices to speak inclusive n regions in which a remarkable electromagnetic interference exists. Besides that, is supplied with schemes of encryption and test(M. Doheir, Kadhim, Samah, Hussin, & Basari, 2014; Fernandes, 2011)

2.1.1 Types of Bluetooth

There are three types of Bluetooth which is Bluetooth BR/EDR, Bluetooth with low vitality usefulness (LE) and Dual-Mode. Double Mode is a mix between Bluetooth BR/EDR and Bluetooth with low vitality usefulness (LE). Double mode is appropriate to be used for applications that incorporate utilized cases.

i. Bluetooth BR/EDR-Bluetooth core Specification version 2.1, called simple rate/enhanced records price (BR/EDR), made it less complicated for consumers to attach Bluetooth gadgets. With the advent of simple, cozy pairing, model 2.1 allowed customers to choose "upload Bluetooth tool" from a connection menu to let devices routinely locate and hook up with every other. Bluetooth Specification Version 2.1 + EDR can increase battery life in devices such as mice and keyboards by up to five times. For pairing scenarios that require user interaction, eavesdropper protection makes a simple six-digit passkey stronger than a 16-digit alphanumeric character random PIN code. Version 2.1 also offers man-in-the-middle protection that eliminates the possibility for an undetected third party to intercept information. Pairing enhancements in Version 2.1 enable the use of near field communication (NFC), allowing communication between devices when touched together or brought into proximity (Feldmann et al., 2003; Yaacob et al., 2019)
ii. low energy functionality (LE)-Bluetooth low electricity (LE) is the electricity model of Bluetooth that turned into constructed for Internet of things (IoT). (Altini, Brunelli, Farella, & Benini, 2010)The electricity-performance of Bluetooth with low power capability makes it ideal for gadgets that run for long durations on energy sources, along with coin mobile batteries or strength-harvesting devices. Local aid for Bluetooth era on every most important working device allows improvement for an extensive variety of linked gadgets, from domestic

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appliances and safety systems to fitness monitors and proximity sensors.

Bluetooth with its low power usefulness controls the web of Your issues. You wake up and run for a keep running with a coronary heart charge screen that discusses together with your savvy, at that point focus on melody through your shower head. You free up your entryways, set the temperature, switch on the lights and control your TV the utilization of the cell phone or tablet you effectively own one of a kind. These sorts of wirelessly connected devices make your reality wealthier through the straightforwardness, strengthening and flexibility of Bluetooth innovation.

Key features of Bluetooth with low energy include:

i. Industry-favoured remote convention that takes into account interoperability all through stages.
ii. Ultra-low pinnacle, normal and sit out of gear mode control utilization.
iii. Standardized utility advancement engineering facilitates change and arrangement time and cost.
iv. Allowance of a few specialists review insurance with 128-bit AES records encryption.

2.2 Positing techniques

The most extreme them to be had thinks about is fixated on trilateration the utilization of the RSSI sign for calculating distances even though numerous recent articles have explored a cellular primarily based technique. Studies is moreover being expert on fingerprinting techniques(Khan & Shah, 2003; Porras, 2007)

2.2.1 Trilateration and RSSI

Trilateration is (not triangulation) "The way toward deciding supreme or relative areas of pointed by estimation of separations, utilizing the geometry of circles.

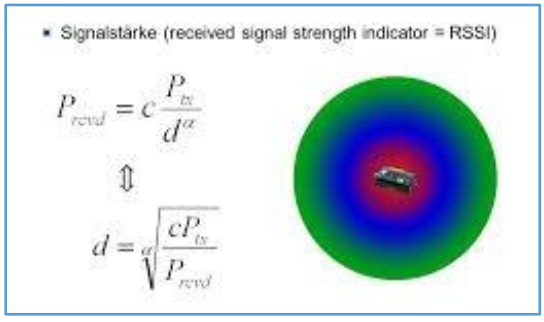

Figure 2 Signal strake RSSi

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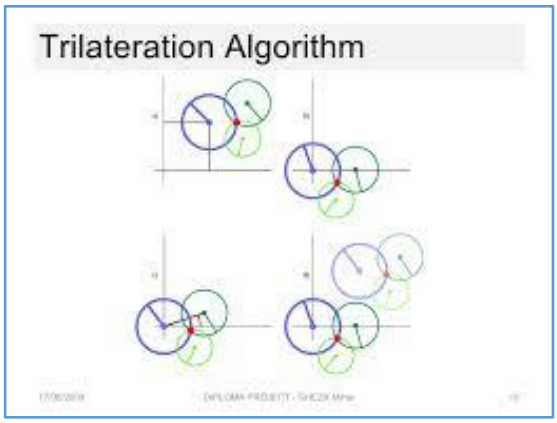

Figure 3 Trilateration Algorithm

Distance calculation through RSSI is knowledge of the transmitter output power, cable losses, and losses and antenna gains as well as the appropriate path loss model allows you to solve for the distance between two stations.

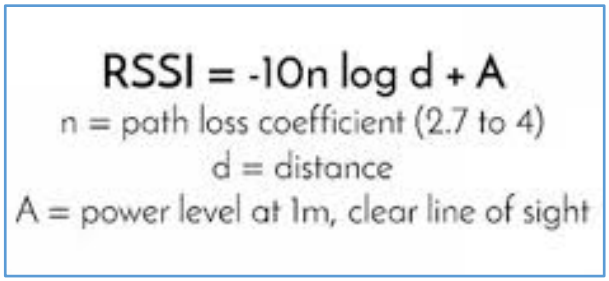

Figure 4 Formula of RSSI

Exertion is being made to enhance the accuracy of signal parameters for triangulation, as depicted in the accompanying sections(Javed, 2003; Porras, 2007; Yaacob, Samad, et al., 2017)

Table 1 comparisons of Bluetooth

Features	Bluetooth BR/EDR	LE	Dual-Mode
Support Version	2.0/2.1	4.0 and above	All Version
Range Signal	10 meter	100 meter	100 meter
Save Power	No	Yes	Yes
Support RSSI	No	Yes	Yes

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2.3Pros and Cons of Bluetooth

PROS-Bluetooth trackers' capacity to impart both courses between the essential gadget and tag is their greatest quality, and the framework turns out to be more helpful themore labels you utilize. It's uncommon to lose your keys, wallet, feline, and telephone all at the same time. Since you have one tag, you can find the essential gadget, and after the, utilization, it can be used to find the others(Dimitrova, Dias, Braun, & Staub, 2011; Mohamed Doheir, Kadhim, Samah, Hussin, & Basari, 2014)

CONS-In view of the two-route nature of Bluetooth, the labels should be more complex. Moreover, Bluetooth interfaces over a much shorter distance, just up to around 30 meters. This is a truly short range, particularly in case you're planning to track something portable like a pet, cruiser or watercraft which can move long separations in a short measure of time. Having Bluetooth continually exchanged on channels some cell phone batteries in a couple of hours, especially Android gadgets. In long run, specialists fear that utilizing Bluetooth gadgets may represent a security hazard of confidential information on your telephone("Bluetooth wireless technology basics," 2004; Padgette & Padgette, 2017)

3.0 Global Positioning System

Global Positioning System (GPS) trackers are in a general sense not quite the same as Bluetooth. Rather than an individual gadget hunting down adjacent labels, the tag speaks with satellites, asking for its own area on the globe. A few satellites cooperate to find the tag, and after that send the label arranges itemizing its position(Gavalas & Economou, 2011)

3.1 Concepts of Global Positioning System

It may seem three satellites are sufficient to determine for position the utilization of triangulation math, anyway an absolutely little planning blunder expanded by the substantial speed of gentle outcomes in a vast positional mistake. The collector makes utilization of a fourth satellite to settle for x, y, z, and t which is utilized to exact the beneficiary's clock. Despite the fact that four satellites are required for ordinary task, less practice in particular case. If one variable is already regarded (as an example, a ship or aircraft may additionally have regarded elevation), a receiver can determine its position using simplest three satellites. Some GPS receivers may additionally use additional clues or assumptions (along with reusing the ultimate known altitude or which include information from an automobile computer) to present a degraded function while fewer than four satellites are seen(Dimitrova et al., 2011). Fundamentally based at the ordinarily announced insights that GPS has a positional blunder of among 5m & 10m globally. Considering the satellite tv for pc sign is travelling 20,000km to its vacation spot, having a 10m mistakes works out to be a % errors of best zero.0000005%. Being the fastidious species that people are, this mistake edge remains seen to be excessively flawed for the elements of situating of a man or ladies on, as a case; an asphalt (I bet 10m could see this character strolling inside the focal point of the street in

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the event that they had been following the site information mindfully!) Or on a conveying discipline(Gavalas & Economou, 2011).

With similarly tendencies in GPS era itself we will see fantastic upgrades in absolute positioning accuracy over the next 10 years (see my subsequent article – GPS system Accuracy). From a carrying (bodily overall performance) perspective, it's miles the relative positioning accuracy this is of actual hobby to the wearing coach and player[1] . By using relative positioning, I mean how far the character has travelled, their velocity and time over a hard and fast path. While the actual start role might range due to the 10m absolute blunders, the actual distance travelled measured by using sports activities particular GPS gadgets have this mistake right down to <1% (so in a 100m race, a GPS will as it should be measure ninety-nine.0m+). Due to the massive benefit of now being capable of measure these variables real time in a real sport or training environment, this utility has been extensively prevalent in elite sport packages international.

3.2 Pros and Cons of GPS

PROS- GPS is self-calibrating and can use in any environment and any place. This technology no larger than a small smart phone and it can bring anywhere. It sizes just like a microchip. Nowadays, it service can supplies information about location that can be used to mapping, search location, performance analysis and GIS using in Google Earth. GPS also use in army technology to detect the enemy, planning the strategy, and in communication. • Several new GPS systems are being installed globally over the next 5 years giving greater accuracy and usability(Padgette & Padgette, 2017)

CONS-The technology is very power hungry, most systems will only last 8-12 hours before needing a battery replacement or recharge. The GPS signal is unable to pass through solid structures so is unable to work indoors, underground, under the water, or under a dense canopy of trees. Can be affected by large buildings and is typically unreliable in CBD areas. GPS accuracy is related to the quality of signal reception, the larger the antenna the better the signal – so absolute miniaturization is not possible whilst maintaining good positioning accuracy(Padgette & Padgette, 2017)

4.0 Discussion

4.1 Analysis of Bluetooth

The Bluetooth particular spreads both exemplary Bluetooth (the notable remote standard that has been typical in numerous customer gadgets for quite a long while now) and Bluetooth Low Energy (the new, very streamlined remote standard presented in 4.0) Those two remote correspondence models are not straightforwardly perfect and Bluetooth gadgets qualified on any determination form before 4.0 can't impart in any capacity with a BLE gadget. The on-air convention, the upper convention layers, and the applications are unique and inconsistent between the two advancements.

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Table 2 Comparisons Specification Configuration

Device	BR/EDR (classic Bluetooth support)	BLE(Bluetooth Low Energy) support
Pre - 4.0 Bluetooth	Yes	No
4.x Single-Mode(Bluetooth Smart)	No	Yes
4.x Dual-Mode (Bluetooth Smart Ready)	Yes	Yes

More BR/EDR gadgets entering the market incorporate BLE also, and the pattern is relied upon to proceed as single-mode BLE sensors turn out to be more universal. Those double mode gadgets can forward the information got from a solitary mode BLE gadget to the web utilizing their GSM or WiFi radios, an element that is ending up increasingly regular as more BLE sensors enter the market.(Dimitrova et al., 2011; Hasan, Rahman, & Haque, 2009)

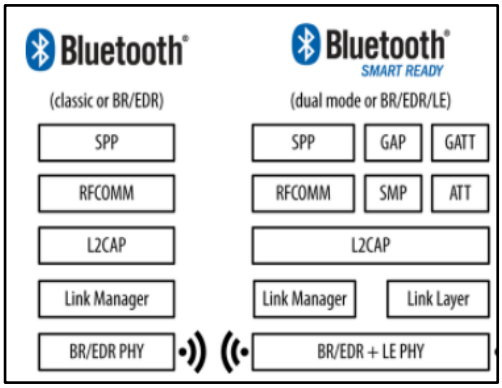

Figure 6 Bluetooth service

4.2 Analysis of GPS

There are many types of GPS for tracking in the market. For example

i. Smart Anti-Lost GPS Tracker for Kids Keys and Pets - it could trace your vehicle on car parking zone and retrieve your misplaced gadgets appropriate for: pockets, automobile, child, Pets, luggage, Suitcase or other belongings. Works as a faraway shutter for self-portrait, capture the happiest moment effortlessly compatible smartphone: iOS and Android gadget with Bluetooth 4.0 telephone (Android 4.3 version and up-grade version)(Mohamed Doheir, Basari, Elzamly, Yaacob, & Al-shami, 2019; Mingkhwan, 2006)

ii. TrackR Bravo- TrackR is the best method to find lost or lost things. Request a TrackR today and not the slightest bit, lose something again. On the off chance

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that your question is going without, the TrackR application data its definitive perceived region on a guide. While another TrackR application customer comes quite close to your lost question, its place will be mechanically state-of-the-art on your application. This tracker is IOS and android Platform compatible(Feldmann et al., 2003; Yaacob, Basari, Salahuddin, Abd Ghani, & Shibghatullah, 2017)

iii. Mini SPY Vehicle GSM GPRS GPS Tracker- Backings particular area and constant following. Helps area caused by means of tracker. Backings region encouraged by utilizing legitimate cell phone. Helps test region with the guide of SMS and web. Find the locator holder through the mobile phone through SMS. SOS button sends out actual area for fast rescue/movement. Geo-fencing to restrict tracker motion to a defined radius(Padgette & Padgette, 2017; Yaacob et al., 2019)

Table below show the comparisons all the device.

Table 3 Comparisons Device

Features	**Smart Anti-Lost GPS Tracker**	**TrackR Bravo**	**Mini SPY Vehicle GSM GPRS GPS Tracker**	**SMART TRACKER**
Programmable	Yes	Yes	No	Yes
Support Android	Yes	Yes	No	Yes
Support IOS(APPLE)	No	Yes	No	No
Accuracy Data	10 – 20 meters	5 – 10 meters	5 -10 meters	1 – 2 meters
Support SMS	No	No	Yes	Yes
Support Bluetooth	No	No	No	Yes

4.3 Development Platform of Mobile Application

Smartphones are a handled device integrated with a running gadget capable of appearing a number particular functions in conjunction with common cell smartphone capabilities, video virtual digicam, multimedia player, internet surfing, advanced computing functionality and multi-contact display display screen. the ones abilities useful resource the proliferation of cell programs regularly called “apps”.

Mobile application development can be separate into three categories(Chan, Connell, Madrid, Park, & Kamoua, 2009);

i. Native Mobile Application development - Local mobile software are executable binary documents designed for precise cell OS and its devices. These apps are established into cellular OS directly and users can launch the apps with none box or middleman tool. Native apps can freely access all the APIs and built-in device functionality such as dialer, camera, SMS, thumbprint scanner and location services. Even as native cell application development calls for deep knowledge of the unique platform, this method grants a higher high-quality person experienced that other cell software development strategies. Local apps are written in java,

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objective-c and different programming languages(Chan et al., 2009; Mohamed Doheir, Kadhim, et al., 2014)

ii. Hybrid Mobile Application Development - Hybrid cell app improvement combines each neighborhood development and net generation; however hybrid apps look and behave a super deal more like net apps than mobile apps. The usage of this approach, developers code their non-public framework, taking advantage of geared up-made improvement gear which incorporates "phone gap," an open supply library that offers a JavaScript programming interface giving access underlying working system abilities(Mingkhwan, 2006)

iii. Web Mobile Application Development - The internet mobile application can be both a web web page this is living on a server or a fixed of HTML, CSS, JavaScript and other related files stored on the devices. The net pages are formatted for smartphones and capsules, and are accessed thru the cellular devices' net browser. this kind of machine is designed to host the application deliver code on a web server for flexibility, however cache them locally at the mobile device for basic overall performance(Hasan et al., 2009)

4.4 Open Technology of Mobile Application

There are many open source technology that provide functionality for developers to develop a mobile application. The most common technology used are as follow:

i. Android Studio - Android Studio is the authority Integrated Development Environment (IDE) for android application advancement. Over IntelliJ's effective code editorial manager and designer apparatuses, Android Studio offers more highlights that upgrade the efficiency for building Android application, for example, an adaptable Gradle-based form framework, quick and highlight rich emulator, and bound together condition to produce for all Android gadgets, broad testing instruments and structure, build up devices to get execution, ease of use, adaptation similarity and other issue, NDK support and to wrap things up worked in help for Google Cloud Platform(Chowdhury, Chatterjee, Sardar, Agarwal, & Nath, 2013; Javed, 2003)

ii. Sencha Touch - Sencha contact is an open convey skip-platform cell application advancement instrument written in JavaScript. It underpins the change on all stages like android, iOS, Blackberry, Kindle, home windows cellphone and Tizen. it's miles a shopper interface JavaScript library or structure developed particularly for the cell web. it is utilized to extend GUIs for portable web programming program, making the applications seem, by all accounts, to be neighborhood programming on cell gadget. Sencha contact is a produced using Sencha, which wound up unique after renowned JavaScript library mission Ext, JS, JQTouch and Raphael were mixed. It offers a MVC design shape, an extensible API, an amazing measured UI factor library and various UI inconveniences that might be utilized with the Sencha nearby packager and also PhoneGap(Javed, 2003)

iii. Apache Cordova / PhoneGap - Apache Cordova (formerly called PhoneGap)

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is an open source cell utility advancement system on the begin made with the asset of Nitobi. After Nitobi changed into purchased out by utilizing Adobe structures, the association upgraded PhoneGap and propelled the product program as Apache Cordova, which enables developers to utilize web advances like HTML5, CSS3 and JavaScript for course stage change. Cordova permits wrapping up of CSS, HTML and JavaScript code, depending at the stage of the instrument. The center of Apache Cordova programs utilizes CSS3 and HTML5 for rendering, and uses JavaScript for rationale. To get admission to equipment like the accelerometer, computerized camera and the GPS, HTML5 is getting utilized. Cordova also can be delayed with local modules, which transfer more prominent functionalities through JavaScript, influencing the verbal trade to coordinate among the local layer and the HTML five page. Apache Cordova helps the improvement of different portable application frameworks like iOS, Bada, BlackBerry, Firefox, residential home windows cell phone, Android, WebOS, Symbian, and Tizen(Mohamed Doheir, Hussin, & Basari, 2014; Javed, 2003; Wind, Jensen, & Thomsen, 2009)

4.5 Comparisons of App

Table 4 Comparisons of App

Features	Native Application	Hybrid Application	Web Application
Development Language	Native Only	Native and Web or Web Only	Web Only
Device Access	Full	Full	Partial
Speed	Very Fast	Native Speed	Fast
Development Cost	Expensive	Reasonable	Reasonable
App Store	Yes	Yes	No
Advanced Graphic	High	Moderate	Moderate
Upgrade Flexibility	Low	Moderate	High
Example Applications	Instagram	PayPal	m.facebook.com

4.0 Conclusion

Bluetooth and GPS is the tracking service that have their own strength and weeknesses. To choose the best service it depends on what we want to do and what we focus it. It can be concluded Bluetooth more suitable to track for the short distance environment and the GPS more focus to the long-distance tracking environment.

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