

Power Efficient Location Based Services on Smart Phones

Pradip Suresh Mane¹, Prof. Vaishali Khairnar²

¹PG Scholar, ²Asst.Professor, Dept. of Information Technology, Terna Engineering College, Mumbai, India

Abstract— The modern mobile phones have the special features such that they can position themselves. It is a necessary feature required not only for the device but need for the remote applications that need the tracking of the system. The battery life of the mobile should not have any major impacts while using the tracing applications i.e. it should be energy-efficient. Furthermore, while changing conditions such as positioning delays, communication delays and changing positioning accuracy the tracking has to strongly update the positions.

This work proposes EnTracked - based on the estimation and prediction of system conditions, mobility, and position updates a system will minimize consumption of energy and strongly optimize. The realized system equipped with GPS-enabled devices that tracks target of pedestrian. The system is configurable to be familiar with different tradeoffs between energy consumption and robustness.

We carried out experiments by outlining consume power of the devices, emulation on collected data and justification in several real-world deployments. This shows the consumption of power of the device while tracking its position. Results of the experiments on emulation on data collected shows that the system can calculate approximately and forecast system environment and mobility. It also provides proof that the mobile device's energy consumption is considerably lower and remains robust while changes in system environments. By justification in real-world deployments it provides proof that the system works as predicted by the emulation.

Keywords— EnTracked, GPS, LBS, Power consumption, Mobile devices.

I. INTRODUCTION

If the mobile device has Successful location-based service (LBS) running on it, it shouldn't consume device's battery. Currently the new developments of power requirement features are increasing but the mobile phone's battery capacity is not increasing. The users might stop using such kind of Location based services since this kind of services reduces the battery's lifetime.

However, development of less-power consuming LBSs isn't quite easy since such applications heavily use many features of mobile phones that need more power—for example, they display maps hence the use of maps, to receive and send data the use of radio, or for positioning the use of a built-in GPS receiver.

Hence such applications must be developed to reduce the power consumption while using features, especially when such service runs continuously and regularly. Research on minimizing power consumption has been held very less so far. Here, importance of minimizing LBS power consumption, power conservation methods and design considerations that should help LBS developers are being discussed

II. EXISTING SYSTEM

Some LBSs are using different types of battery-powered devices, such as position able tags, here minimal power consumption is an important issue. Improving the positioning accuracy and coverage of LBSs has been mainly focused.

A. LBS Power Consumption

Usage pattern, battery charging options and features are the implications of power saving LBS. Apart from the usage pattern it is an important factor that the amount of time the service will be running on the mobile. It is important to have power conservation when the LBS are running for hours or weeks. The recharge options should also be considered by the designers, a lot of power has been consumed by these services if the user can recharge the phone after using the service. The issue is situation dependent. The power consumption is depending on the individual features'. The power consumption of different types of LBSs are classified in Figure 1 and a factor that indicates the impact on the battery lifetime is presented and compared to a stand-by battery consumption of 0.05 watt. (Paolo Bellavista, Axel Küpper, and Sumi Helal.1 introduced the service types and that inspires the classified types)

Consider two service types that only run for seconds. Geo tagging services attach information on Location to other digital services like pictures, and upon request reactive location-based search services are searching for user's location related information like nearest hospital and restaurant. These kinds of services consume the power medium to high because this use screen along with features like communication and positioning. However, lifetime of battery isn't important; hence these services are being used short time and infrequently rerun.

Consider the three type of services run for minutes. People need their current location on a map or satellite image and directions to a specific location, Maps and navigation services are being used. Location-based games are using location as a game element— for example, players need physical caches using GPS (known as geo caching). Again, such services requires medium to high consumption of power but, because they run for minutes, power consumption impact is higher.

Sometimes the user may not have turned off a service, in which case power consumption minimization would be useful. Three services shown in Figure 1 are running for hours or days. Location and activity recognition services can register a user’s position and activities to, for example, construct a daily report. If the user request a query a Proactive location-based search services can push information—for example, reply to a user’s search for nearby restaurants. Location-based social networking services let the user can able to link location to social networking—for example, if user has nearby friends or an event user will be notified. Again, the power consumption of such services will be medium to high but, due to the services are running for hours or days, it’s important that they must consume a minimal amount of power. Such services could eat the battery 20 times faster than normal stand-by consumption. For long time-running services, the power consumption minimization is crucial.

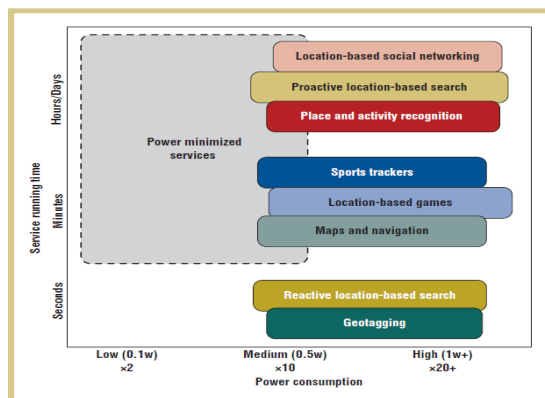


Fig.1. Service types grouped by service running time and power consumption, with multiplicity factors for power consumption

B. Power Profiling a Mobile Phone

To understand the way of consumption power of existing LBSs, we arrange five commercial LBSs on a 8GB Nokia GPS ENABLED MOBILE PHONES.

For each individual LBS, We then allow the user to carry out some standard tasks, while we got the phone’s power consumption. Figure 3 shows profiles of the power for eight minutes of data for every service. We presented the Table 1 using the power consumption of the individual features, and interpreted the graphs and correlated those data with certain tasks. The Geo cache Navigator service (Figure 3a) helped to find nearby caches, view their images, using a radar or map locate them view, and log them online. We Interpret the collected profile and it shows a high consumption while beginning, but when the LBS is using GPS decisive about the user’s position; received assisted GPS data; and fetched application data about caches, maps, and descriptions. During use, power consumption of this LBS’s never goes below 0.5 watt, which is indicating that the service is keeping the GPS powered on.

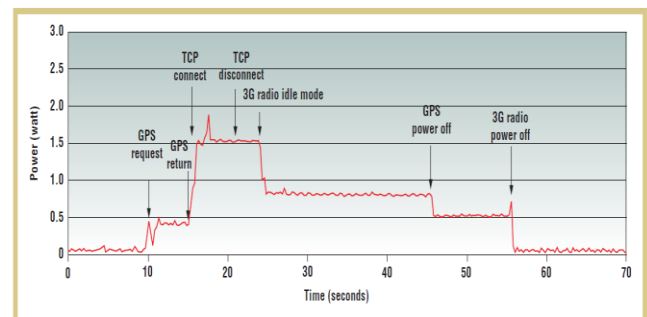


Fig.2: Power consumption for position updating measured on a Nokia N95.

III. PROPOSED SYSTEM

As stated earlier, existing research have proposed updation of position information about a target by dynamic tracking. By lowering the number of position updates previous study of dynamic tracking minimize communication and minimize the load on server nodes. Time-based and distance based tracking that is taking a constant positioning accuracy and speed of target into account.

It is studied by simulation that the number of updates for each tracking technique produces and the average and maximum ambiguity of the server-known position. The works later extended this work for tracking the position based on dead-reckoning. Systems such as GeoPages have also been proposed that try to minimize the number of position for a specific service. Both energy efficiency and GPS positioning are also focussed.

The proposed methods take into account a constant positioning delay, speed of target, and the stress that it is not energy free to use GPS constantly.

We evaluate the proposed methods by simulation, where it can be saved around 50% of energy in the evaluated situations assuming a direct power model. The later work can be extended for area-based tracking while it can also take constant position accuracy and heading. It is assumed that the positioning vagueness is negligible. It is evaluated that the methods by simulation for proximity-based sensor network positioning.

For proposed dynamic tracking techniques, an indoor sensor network setting that take into account a positioning accuracy and delay, target speed and speeding up to detect if the target is moving or not. It is evaluated the techniques by emulation for IEEE 802.15.4 signal-strength based indoor positioning and one of the results is that accelerometer to find whether the target is at a standstill or not. In comparison, the system proposes techniques that take into account position accuracy that estimated dynamically and delays, communication delays, power constraints, target speed and acceleration. Also we can evaluate our techniques both by simulation and in real-world applications.

A. Minimization of Power consumption:

Relaxing the required positioning accuracy from “the highest possible” is the general concept behind many power saving methods. We can apply this concept to both the phone devices and servers which we need for the current position of the target. Phone devices we can consider for different positioning options and servers can be considered for levels of accuracy. LBS can be used to relax the required accuracy of the positioning in many locations. First, mapping of services that explain the position of a mobile phone device can use the level of zoom to establish relevant accuracy limits (for a street-level view such as 25 meters, for a suburb 100 meters, and for a city-wide view 200 meters).

Second, accuracy requirements depending on targets' positions can be relaxed by location-based social networking or proactive location-based search services. For example, closeness can be competently observed using methods such as the system proposed by Axel Küpper and Georg Treu. In this method, the distances between targets are used to calculate the required accuracy limit for each target. This produced the accuracy limits by this calculation range from 10 meters when targets are close and several kilometres when they are far apart.

Third, services adjust the service quality based on how much power of battery is left. For instance, a runner who is using a sports-tracker service will have a less fine-grained record of the whole trip and can call for help while he or she falls than have a fine-grained record of only the first part and afterward no voice service.

Finally, privacy limitations might require LBS to work with locations with limited accuracy. Minimizing Needed Position Fixes In principle, we can save power by avoiding position fix. The error of the last known position need to be modelled to establish which position fixes can be avoided. Till the error doesn't exceed the accuracy limit, no positioning is necessary.

B. Using Positioning Features

Different amounts of power are consumed by different positioning options. Consider a situation in which we calculate approximately our position every 30 seconds, the average consumption of power would be 0.32 watt with GPS, 0.094 watt with Wi-Fi, and 0.064 watt with GSM. The low utilization of Wi-Fi and GSM is because they can rapidly power on and off to scan for access points and base stations. However, accuracy also be provided at different levels— with GPS around 10 meters, with Wi-Fi 40 meters, and with GSM.5 400 meters. Hence always the least consuming positioning feature are being switched, these positioning feature provides the required accuracy can provide significant savings.

Between GPS and sensing motion using accelerometer readings The EnTracked system are switched. If a mobile phone has not been moved, there is no need to update the position on the server and the GPS can be switched off. But when the motion is sensed, the system should switch on the GPS. This method provides significant power savings as the accelerometer is consuming sixth of the GPS's power consumption and communication is avoided. Power savings of 85.7 percent compared to periodic reporting was evaluated over several hours of running the system.

Only the monitoring LBS that monitors whether a target is within a certain area or not, can be applied switching between GPS and GSM positioning in a different manner. The key idea is that you can switch to only monitor if the target stays within this GSM cell if a target is entering a GSM cell that's fully contained within the monitoring area. As long as the target stays within the GSM cell, the GPS will be switched off. This method is evaluated and reported savings of power up to 80 percent, depending on the setting.

Power can also be saved using On-Phone Data Caching and Processing Minimizing the frequency and size of data transfers. Consider the power consumption between Nokia Maps using cached maps versus Google Maps using downloaded maps is noted and considered. Both GSM and Wi-Fi positioning need access to a database that maps GSM cells and Wi-Fi addresses to coordinates. The strength of signals at various locations are required by more advanced GSM and Wi-Fi positioning that requires a database with information. The phone must contact a server that hosts the database hence this type of positioning is normally implemented.

These methods show that the required server connection doubles the power consumption. However, in most cases, it's impracticable to keep the database on the phone because of its size, licensing issues, and the need for updates. To address this problem, we proposed method that only caches a subset of the database on the phone. These systems can efficiently select relevant parts of the database to be kept on the phone with minimal overhead based on the user's current location. Many LBSs need sending position related data to the server. For ex. LBS that transfers a flow of positions to a server to monitor and be familiar with the route a target takes. It is one way to save power by processing the data on the phone before sending—for example, processing positions into routes on the phone.

C. LBS Design Considerations

The design process in several ways can be affected by power-consumption issues. Most of the methods presented earlier add complexity to the LBS implementation. The service might have to deal with several positioning methods instead of only one, if more specialized processing and messages are used. Another issue is that correctly minimizing power consumption requires a right model of how the power consumption takes place on specific phone model. Such a model must be parameterized.

Power profiling phones, adds to the complexity. As d mentioned earlier, an LBS's positioning function is not always consumes more power. It might be better to consider data transfers when trying to minimize power consumption. The data transfers are associated with positioning and that might also be important to consider, as in the case of GSM positioning. In this way, classic client-server architectures might have storage and processing benefits on the phone. But due to the high consumption of the needed data communication, such client server architecture may not be the solution to minimize consumption of the power.

Data communication may also be minimized to save power and this also provides other benefits, such as lowering bandwidth use, reducing the cost of data traffic, and decreasing server demand.

D. ENTRACKED

Dynamically track mobile devices in not only in an energy-efficient but also in robust manner is the goal of EnTracked. Thus, robust, applications must received position updates within application-specified error limits, where distance between the application-known position and the real position of the device is refers as error. We should o provide error limits for use EnTracked, position-based applications they want targets tracked with.

But if it is the case highest possible accuracy that it always want. In practice application providing limits to minimize their applications' power consumption because Users should stop applications if their device's battery get quickly drain. Granularity if users specify lower limits to track them with which an application is allowed provide error limits for Privacy restrictions.

Another option is that by setting the limits themselves users decide how to trade application experience with energy efficiency. A map application, shows the positions of a number of mobile devices, to determine relevant error limits can use the zoom level (such as 25 meters for street-level view, 100 meter for a suburb, and 200 meter for a city-wide view). Another example is most of social networking applications that focus on relationships between the positions of devices.

Kupper et al.. Methods have been proposed to efficiently track devices to reveal relationships. with that depends on the distance between the targets they calculate changing error limits based on that The methods work by dynamically assigning tracking jobs. Depending on the distance between the devices, methods produce tracking error limits ranging from 10 meters to several kilometers.

To use En- Tracked by the position-based application steps illustrated in Figure 4 are carried out. Firstly, It can request to track a device with an error limit (1). Secondly, the client-side part of En-Tracked receives the request propagates by server (2). Thirdly, the client finds a start position and send it to the application through the server (3)+(4). Fourthly, the En-Tracked client logic within the error limit delivers the next position (5). Fifthly, after some point EnTracked identifies that a new position has to be delivered through the server to the client (6)+(7). If many applications wants to track to the same device, En-Tracked configures the device with the smallest requested error limit for tracking to satisfy both of the applications' limits.

When the EnTracked client received a request, it handles the request following the steps illustrated in Figure 5. GPS position is requested to return the initial position to the server (1) and reported to the server (2). Then, it is determined if the device is moving or not by using the accelerometer-based method (3).

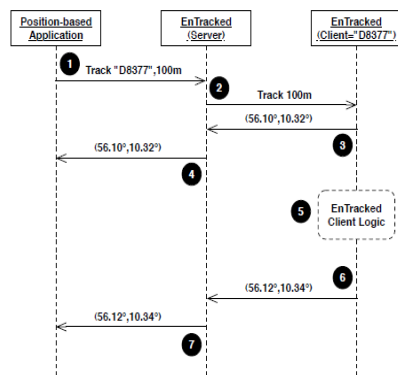


Fig.4: Step of En-Tracked When used by a position based application

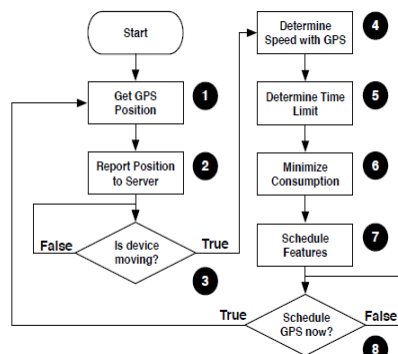


Fig.5: Flowchart of En-Tracked client logic

When moved, the speed of the device is determined using GPS measurements, if not, the logic waits for movement. (4). Then a time for the next GPS position reading is calculated (5). This time limit is then given to a dynamic programming algorithm that — based on the current power state of device features — for this time limit for minimizing the power consumption it finds the optimal strategy and schedule features to satisfy the limit considering both possible radio delays and GPS (6). Then, the scheduling plan calculated by the dynamic algorithm is follows by logic (7), process restarts when appropriate (8), and the next GPS position is return to the server.

IV. CONCLUSION

We profiled how devices consume power for tracking and proposed a device model that can account for the real power consumption of a concrete device family. Furthermore, we propose methods for position tracking that take the changing system conditions into account, specifically radio delays, positioning delays and position accuracy. We also proposed a method that can minimize power consumption and satisfy robustness by calculating the optimal plan for when to power on and off features of the mobile devices such as the GPS module. The result of our emulation was that the proposed methods can lower the energy consumption considerably and remain robust when faced with changing system conditions.

This emulation result was validated by our real-world deployment where a mobile device was successfully energy efficiently tracked in an urban environment. The results also provide insights into the limitations of our system and led to discussions on how to address these, e.g., by changing the trade-off between robustness and energy efficiency. In our ongoing work we are trying to address several issues. These are: First, a further exploration of how to tune parameters of our system to realize the best trade-offs between robustness and energy efficiency. Second, propose methods for automatically determine the parameters of our device model for new devices. Third, apply the proposed methods and findings to other positioning technologies such as location fingerprinting.

REFERENCES

- [1] M.B. Kjærsgaard et al., “Location-Based Services on Mobile Phones: Minimizing Power Consumption.” IEEE Pervasive computing, IEEE press 2012,pp. 67-73.
- [2] Yohan Chon, Hojung Cha, “LifeMap: A Smartphone-Based Context Provider for Location-Based Services.”, IEEE Pervasive computing, IEEE press ,2011,pp. 58-67.
- [3] M.B. Kjærsgaard et al., “EnTracked:Energy-Efficient Robust Position Tracking for Mobile Devices,” Proc. 7th Int’l Conf.Mobile Systems, Applications, and Services(MobiSys 09), ACM Press, 2009,pp. 221–234
- [4] Ionut Constandache (Duke), Shravan Gaonkar (UIUC), Matt Saylor (Duke),Romit Roy Choudhury (Duke), Landon Cox (Duke)“EnLoc: Energy-Efficient Localization for Mobile Phones”Conf.IEEE-INFOCOM, 2009 ,pp. 2716-2720.
- [5] M. Anand, E. B. Nightingale, and J. Flinn. Ghosts in the machine: Interfaces for better power management.In Proceedings of the Second International Conference on Mobile Systems, Applications, and Services, 2008.
- [6] L. Brown, K. A. Karasyov, V. P. Levedev, A. Y. Starikovskiy, and R. P. Stanley. Linux Laptop Battery Life. In Proc. of the Linux Symposium, 2006.
- [7] A. Civilis, C. S. Jensen, and S. Pakalnis. Techniques for efficient road-network-based tracking of moving objects. IEEE Trans. Knowl. Data Eng., 17(5):698–712, 2005