Intelligent Position Aware Mobile Services for Seamless and Non-Intrusive Clocking-in

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***Abstract* – This paper analyzes the viability of the use of employees smartphones as a valid tool for companies in order to conduct presence control. A Mobile Location Aware Information System is also proposed for a non intrusive Presence Control using exclusively terminal-based reactive location technologies, meeting cost minimization, and universal access criteria. The focus is providing trust to the employees, so that they feel safe and in control of when the location data is gathered while satisfying the control needs of the employer. LAMS platform is a state-of-the-art framework for synchronous mobile location-aware content personalization, using A-GPS terminal-based/network assisted mobile positioning techniques and UAProf data processing at the origin server.**

***Keywords* - Clocking in, Presence Control, Terminal Based Positioning, Network Assisted Positioning, A-GPS**

I. Introduction

There is enough evidence suggesting that use of Information Technology can play a quite important role on the growth of small and medium size businesses. In this line of thought, IT can be employed to bring about increased competitiveness if it enables businesses to create new jobs, increase productivity and sales achieving new levels of administrative efficiencies. It goes without saying that these outcomes can be achieved through measurable improvements of key performance indicators [1].

Tardiness, or –worst case- absenteeism, are two of the most persistent obstacles to productivity, profitability and competitiveness. They cause overtime, late deliveries, dissatisfied customers and a decline in employee morale amongst workers who are expected to cover for an absent or late coming employee. Early recognition and rapid intervention are key when it comes to managing absence in the workplace and can prevent absenteeism from becoming a long-term problem. [2] [18].

As for performance measurement, companies should collect and systematize all the information available so that they signal or allow the execution of their strategy to be successful in their business and remain in business. Once a company acknowledges tardiness and absenteeism as key problems, it should try to collect information detecting such behaviors.

Workplace surveillance and business organizations go hand in hand, and that employee monitoring is nothing new. The implication is that surveillance at work is, first, a necessity, and second, a normal, taken-for-granted element of working life. Employees expect to have their performance reviewed, objectives set, and information gathered on their activities and whereabouts – indeed, this is seen as good management practice. [18].

Controversies generally arise when employee monitoring goes beyond what is reasonable or necessary (i.e. when employers use what employees perceive as intrusive monitoring, gathering precise information as to how employees use their time) or when the application of monitoring negatively affects existing levels of autonomy and trust. [18][19]

So, when employers intend to control tardiness of absenteeism, they generally make use of clock-in systems. But they prove to be ineffective when applied to remote workers (ie. Sales force, field force…etc). [20]

Here we will be presenting LAMS platform, a Location Aware Mobile System for non intrusive clocking in. Field force employees make use of their own (or company supplied) smartphone to clock-in, and they are in full control of the positioning process and can trust that the system only gathers location data when they allow it to do so.

II. Location Technologies and LAMS Overview

One of today's key technologies related to advanced mobile services development is the physical positioning of mobile terminals requesting services. Moreover, the use of terminal based and network assisted solutions in order to achieve higher precision and lower acquisition times is the current direction of the state of the art research being conducted on this field.

In this paper, at first we will be presenting the fundamentals of Location Services and current location technologies, and we will go on with a description of the proposed platform designed to assist the employee clocking in process, with full HTML5/xHTMLMP-compliant contents personalization, together with integration services for spatial analysis, in terminal based and network assisted mobile services.

This implementation currently uses W3C Location API code within the terminal, in order to obtain the local position measurement from the embedded positioning device and the A-GPS data from a SUPL-enabled network. [14]. This information is then feeded to the JavaEE core of the platform, which build XML-based spatial queries and forwards them to the available GNSS servers, processes their XML responses (GML, PoIX) through XSL transformations to the final HTML5/JQueryMobile contents delivered to the requesting client terminal.[1],[2]

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III. POSITIONING TECHNOLOGIES

Currently available technologies for physical determination of the position of a mobile terminal fall into two broad areas: terminal based technologies and network based ones.

In the former case, the positioning intelligence resides in the mobile terminal or in its SIM/USIM card. Within these technologies we have those based/dependant on GNSS systems (Galileo, GPS, Glonass), those which use the mobile network operators (MNOs) infrastructure (i.e E-OTD, Enhanced Observed Time Difference) and finally, those hybrid solutions which constitute the main focus in this paper: terminal based and network assisted positioning, currently represented by A-GPS.[9],[11]

In the latter case, network bases solutions don't require the integration of the positioning intelligence within the mobile handset. So, this kind of positioning services can be provided to all existing handsets with no distinction, as there are no change sin hardware required. The tradeoff is the relative lack of precision, comparing to the aforementioned terminal based solutions. Representative technologies in this area are CGI+TA (Celle Global Identity + Time Advance) and UL-TDoA (Uplink Time Difference of Arrival) [5][7]

A. A-GPS and Enhanced A-GPS

The Assisted GPS technology appeared recently and represents a key turning point. The technology enables a powerful hybridization between a worldwide location means – GPS– and a mass-market communications means – GSM/UMTS.

Moreover, Assisted GPS comes in handy mixing the best of the two worlds, since it compensates for the major faults of GPS and GSM/UMTS: a purely network- based technology does not provide sufficient accuracy (80 meters at best), and pure GPS solutions suffer from long delays before position delivery (typically several minutes). The principle of Assisted GPS consists of coupling satellite positioning and communication networks, sending assistance data to the receiver integrated in the handset to improve its performance [7][10]

Compared with standard GPS, Assisted GPS offers (1) very short latency to get a position, by sending satellite data much more rapidly, than GPS itself; (2) Hence, very low power consumption; and (3). Increased sensitivity, therefore increased availability of the location service, particularly in dense urban area and indoor environments.

Enhanced A-GPS is an improvement of the classic A-GPS positioning with new satellite technologies: EGNOS (European Geostationary Navigation Overlay Service), and Galileo. The Enhanced A-GPS provides EGNOS-based assistance data to GPS-enabled mobile phones, via GSM/GPRS or UMTS networks. This is obtained by incorporating an EGNOS/GPS reference receiver in the Enhanced A-GPS server, which receives the EGNOS correction messages.[11]

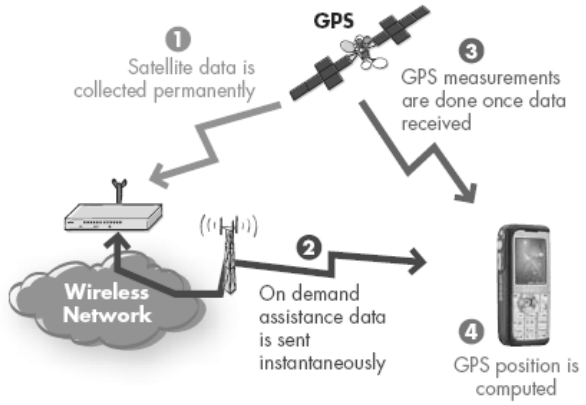

Fig 1. A-GPS Operation Flow

EGNOS is a system consisting of three geo-stationary satellites and 34 ground stations in Europe, the Americas and Asia. EGNOS improves GPS & GLONASS position accuracy and availability by 'adding' measurements from its three geo-stationary satellites locally visible in Europe to the Galileo, GPS & GLONASS, and by providing ionosphere, orbitography and clock corrections.

IV. LOCATION AWARE MOBILE SERVICES (LAMS) PLATFORM

The LAMS Platform has been developed as a proof-of-concept of the proposed service architecture, acting as an universal LCS (LoCation Services) client.(See Fig.3)

Once the platform gets the positioning info obtained using local AGPS data through W3C Location API, sends it to the server , which in turn, trans codifies this information to XML, using an specific XML application (LAMSX). With this information, the platform sends a spatial query to a GIS server in order to obtain reverse geocoding data which carries the desired Points of Interest (POIs) also in native XML format. [4],[5],[6]

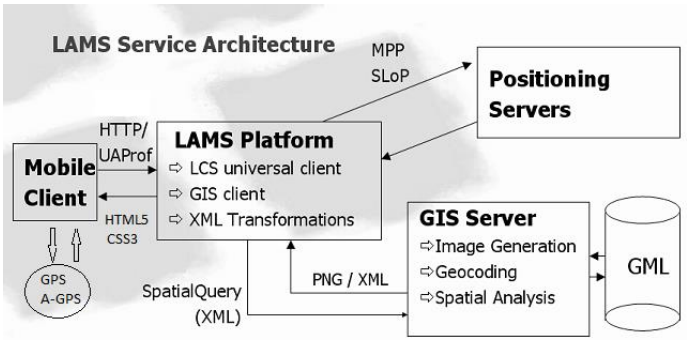

Fig 2. LAMS Platform Service Architecture

At this point, the platforms enters a dynamic content generation phase, personalizing the overall response to the make, model and capabilities of the requesting handset, so that the employee gets the best experience in the clocking in process, no matter which phone he or her has been using to complete the task [3]

Finally, the outcome of this content generation phase is the end HTML5 / JQuery Mobile or xHTML/MP page targeted to the handset.

V. CONCLUSIONS

In this paper has been presented the practical use of Location Services, applied to non intrusive field force clocking in, allowing the employee for the control of their position data gathering times.

This knowledge can be used along with the also described UAProf framework to achieve full personalization of the contents delivered to the end client. In this case, we are able to dynamically generate location-dependent, device-dependent and user preferences-aware contents.

Also, this paper demonstrates the feasibility of a time-constraint service provision when using terminal based technologies with the most up to date enablers, such as W3C Location API, OMA SUPL and A-GPS at application level.

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