Sudan University of Science & Technology
College of Graduated Studies

Wi-Fi positioning techniques for location based services

A Research Submitted in Partial Fulfillment for The Requirements Degree of MSC in Communication Engineering

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باليٍّ الله من الشيطان الرجيم
وَقُل اعْمَلُوا قَسَيْرًا لِللهِ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ وَسَتَرَدُّونَ إِلَى عَالِمِ الْعَيْبِ وَالْشَهَادَةِ قَبْلَ إِنّكُمْ تَعْمَلُوْنَ {التوبة 105}

صدق الله العظيم

Dedication
This work is devotedly dedicated to

ALMIGHTY GOD

TO GREATEST FATHERS
AND KIND MOTHERS.
Acknowledgement

First and Foremost we give thanks to Allah then, I would like to express my sincere gratitude to my advisor Dr. Mohammed Hussien Mohmmed for the continuous support of my Msc research, for his patience, motivation, enthusiasm, and immense knowledge. His guidance helped me in all the time of research and writing of this thesis. I could not have imagined having a better advisor and mentor for my Msc study. I thank my colleagues for stimulating discussions, for the sleepless nights we were working together before deadlines. Last but not the least I would like to thank my family my mother Nawal and my father Hamid my brothers Mazin, Moiz, Mosab and my little sister Mai at first place and supporting me spiritually throughout my life.
Abstract

Location-aware computing becomes an exciting research as recent advancements in RF circuits and wireless communication stacks. In this thesis, we present a fingerprinting based location assessment. The proposed method uses WLAN signal Strength to estimate the global position of mobile users in an indoor environments. The system uses the signal strength from several base stations rather than angle for determining the location of mobile station. The project deal with two algorithms to calibrate signals received from access points and stored it in the radio map (fingerprinting) is called calibration phase. In localization phase the stored values are compared with calibrate one to predict the user locations. Therefore a fingerprinting algorithm that was introduced is used to improvement of the presented work and with multi sensors which enhance the accuracy of fingerprinting algorithms and tracking of the users.
المستخلص:

التطور الهائلف تقنية تحديد المواقع وما اشتملت عليه من تطبيقات ساهمت في تحديث البنية التحتية لسوق العمل. ومع وجود بعض القصور في في بعض التقنيات تم الاستعاضة بآخرين لم تكن تستخدم في نفس النطاق. في هذا المشروع تم استخدام تقنية أخز البصمة باستخدام خوارزميتين لتحديد مكان المستخدم وتعدم التقنية على أخز قراءة الإشارات من أجهزة الإرسال (نقاط الوصول) في المنطقة المخصصة للمسح في المرحلة الأولى لبناء الخريطة الراديوية. في المرحلة الثانية يتم مقارنة القراءة التي خصل عليها المستخدم مع الخريطة الراديوية وتصبح القيم التي يرجعها النظام بعد المقارنة أكثر دقة كلما زادت قيم الخريطة الراديوية.
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List of Abbreviations

MS       Mobile Station
FCC      Federal Communications Commission
4G       Forth Generation
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<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
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<tbody>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>ITS</td>
<td>Intelligent Transportation Systems</td>
</tr>
<tr>
<td>WLAN</td>
<td>Wireless Local Area Network</td>
</tr>
<tr>
<td>WI-FI</td>
<td>Wireless Fidelity</td>
</tr>
<tr>
<td>LBS</td>
<td>Location-Based Services</td>
</tr>
<tr>
<td>SS</td>
<td>Signal Strength</td>
</tr>
<tr>
<td>RTLS</td>
<td>Real-Time Locating System</td>
</tr>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>PDA</td>
<td>Personal Digital Assistance</td>
</tr>
<tr>
<td>VOIP</td>
<td>Voice Over IP</td>
</tr>
<tr>
<td>SSID</td>
<td>Service Set Identifier</td>
</tr>
<tr>
<td>MAC</td>
<td>Media Access Control</td>
</tr>
<tr>
<td>RF</td>
<td>Radio Frequency</td>
</tr>
<tr>
<td>TDOA</td>
<td>Time Distance Of Arrival</td>
</tr>
<tr>
<td>RFID</td>
<td>Radio Frequency Identification</td>
</tr>
<tr>
<td>TOA</td>
<td>Time Of Arrival</td>
</tr>
<tr>
<td>VHF</td>
<td>Very High Frequency</td>
</tr>
<tr>
<td>VOR</td>
<td>VHF Omni Directional Ranging</td>
</tr>
<tr>
<td>AOA</td>
<td>Angle Of Arrival</td>
</tr>
<tr>
<td>RSS</td>
<td>Received Signal Strength</td>
</tr>
<tr>
<td>IPS</td>
<td>Indoor Positioning System</td>
</tr>
<tr>
<td>SVM</td>
<td>Support Vector Machine</td>
</tr>
<tr>
<td>UWB</td>
<td>Ultra Wide Band</td>
</tr>
<tr>
<td>OSL</td>
<td>Opportunistic Seamless Localization</td>
</tr>
<tr>
<td>AP</td>
<td>Access Point</td>
</tr>
<tr>
<td>-----</td>
<td>--------------</td>
</tr>
<tr>
<td>SS</td>
<td>Sum of Square</td>
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</tbody>
</table>