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Advanced Location Tracking and Privacy Preserving with Secure Positioning and Location Proof Udating

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Abstract: Tracking the locations of a particular person or devices plays a crucial role in many real time applications. Current mobile devices use either Bluetooth or Wi-Fi for connectivity and makes tracking as possible with minimum cost of computation and consumption of power. Location proof verification and privacy preserving are the two important criteria in the location sensitive/based applications. This work proposes an location proof updating method by using 'APPLAUS' – A Privacy Preserving LocAtion proof Updating System combined with 'SPINE' -Secure Positioning In sensor Networks Algorithm for location proving, to avoid colluding attacks and preserve the privacy of the source. Experiments were done with few witness nodes and both the witness nodes pseudonym and location are encrypted by public key encryption. The performance of APPLAUS and SPINE are evaluated by Trust level and proof delivery ratio.

Key words: Location proof updating system · APPLAUS · Privacy Preservation · SPINE Algorithm

INTRODUCTION

Location based services (LBS) were emerged in 1990's and initially proposed for emergency related services. Practically it was implemented by Federal Communication Commission in 1996 in US [1]. LBS use real time environment from mobile phones to provide the details such as nearby restaurants, coffee shops, etc [2]. LBS have 5 components. They are: service provider's software application, mobile network for transmitting data and requests for service, a content provider to supply the user by means of geo-specific information, a positioning component like GPS and the end user's mobile device. It is a software application for an IP-capable mobile device that knows where the mobile device is located. It may be a query-based and provide the end users with useful information such as "Where is the nearest ATM?.

Privacy of the location information is connected with controlling the access to individual's current location and past locations. For this purpose pseudonyms are changed frequently [3]. By using mobile device "location proof" tells about accessing the LBS. Individual user can decide whether to accept location proof for a particular time or afterwards. Also user can calculate the location privacy levels [5]. In the Location Proof Updating System adversaries can eavesdrop the location information. Eavesdropping can be prevented by using Public Key Cryptography. For identity privacy, by using pseudonyms the identity of the node is hidden. Multilateration can be used to find the position of nodes from a set of reference points whose positions are already known/identified. This can be based on the distances measured between the reference points and the device. Verifiable Multilateration is used for secure positioning in a variety of systems in the presence of adversaries [4]. Mobility management defines the mobile user's movement and its location in the network.

Bluetooth technology is similar to a client-server architecture. In this context, connection initiator is a client and one who receives the connection is termed as server. If Bluetooth is used by single device at a particular time, then it is called as point-to-point communication. It uses radio frequency for the communication [4]. Bluetooth devices within the range mutually generate location proofs. And that proofs are uploaded to a untrusted location proof server. Server can verify the trust level of each location proof. The prover broadcasts a location proof request to its neighboring nodes via Bluetooth [5].

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