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Geosecurity System – Geotags from Multiple Sources and Noisy Location Data

A team of Stanford engineers have developed an accurate, robust location-based security method using signals from distinct classes of communication systems. This system includes fuzzy extractor algorithms to generate unique, reproducible, error-tolerant location signatures (“geotags”). These algorithms allow the geotags to be calibrated and verified even when there is noisy location data – such as when Loran stations are offline or when Wi-Fi access points relocate. The system can be applied to time and location-based parameters extracted from a range of signal sources to provide an additional layer of assurance to traditional security systems.

Stage of Research
The inventors implemented algorithms in MATLAB and the performance has been tested using real RF signals from Loran and Wi-Fi.

Applications

- **Geo-security/Location-based security** - position and/or time parameters to implement features such as:
  - Data access control – to prevent access to location-aware disk drives outside of designated data center
  - Digital Manners Policies (DMP)
- **Indoor positioning**

Advantages

- **Robust, reproducible tags:**

    - four-dimensional discriminating tags (3-D spatial and 1-D temporal) from multiple signal sources lower both false rejection and false acceptance rates
    - Loran and WiFi signals can reach dense urban or indoor environments where line-of-sight signals such as GPS are not available
    - a combination of different fuzzy extractor algorithms are used to compensate for different sources of noise in location signals
- **Efficient:**
    - the fuzzy extractor algorithms can be easily implemented in either hardware and software and require low computational time and storage space
    - no time synchronization or blending algorithms are need to integrate signal information from different sources
- **One-way** - fuzzy extractors do not reveal information of the original inputs and the system does not need to convert location-dependent parameters into a physical location estimate
- **Secure, unpredictable tags** - attackers would not be able to predict location parameters for tags because buildings, walls, moving objects, and environments introduce sufficient randomness to the parameters
- **Range of signal types** - the system can be applied to a variety of RF signals (such as Loran, Wi-Fi, TV, and cellular) as well as non-RF signals (such as infrared and ultrasound)

Publications

- Qiu, Di, Lo, Sherman, De Lorenzo, David S., and Enge, Per, "Fuzzy Geotag Extraction for Geo-Security: Implementation and Performance." Presented September 2009 at the ION Institute of Navigation Global Navigation Satellite Systems Conference, Savannah, GA

Patents

- Published Application: 20110181470

Innovators

- Di Qiu
- Per Enge
- Dan Boneh
- Sherman Lo
- David De Lorenzo

Licensing Contact

Imelda Oropeza

Senior Licensing Manager, Physical Sciences

Email