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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

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