



Project Proposal for Digital Engineering Projects

Project Topic:	Privacy-Preserving Localization and Privileged Sensor Fusion in a Camera Network
Project abbreviation:	<i>ppLoc</i>
Institute/ Chair/ Research Group:	Autonomous Multisensor Systems
Advisor(s):	Marko Ristic, Benjamin Noack
Preferred group size:	3-4
Desired project period:	SoSe 2021
Required/Desired knowledge:	Required: <ul style="list-style-type: none">• Programming in C/C++ or Python. Desired: <ul style="list-style-type: none">• Experience of working with embedded hardware.• Knowledge of any of the following is a plus:<ul style="list-style-type: none">○ Kalman filtering,○ image processing,○ cryptography.
Is any external affiliation involved (e.g., industrial partner, affiliated institute)? yes <input type="checkbox"/> no <input checked="" type="checkbox"/> Which one(s)?	
Project Description: General description: Distributed state estimation and localization methods have become increasingly prevalent in modern networked tracking systems. Traditional distributed sensor localization methods involve the leakage of sensor or state information during estimation, and thus do not preserve participants' data privacy. For example, a vehicle may be tracked by multiple external sensors that different parties operate. The sensor data and parameters are typically gathered centrally, implying that the participants have to trust each other. Not only sensor data, but sensing modalities, sensor positions, and hardware details might be leaked to the aggregator. To preserve the privacy of the participants, this project focuses on the implementation of cryptographically secure localization schemes. This project involves designing a small-scale camera network using Raspberry Pi nodes to track a moving object. Each node will process the camera data to detect and track the object. The aggregation of the nodes' data will rely on two cryptographically secure methods to ensure the privacy of some or all of the input data. The first algorithm relies on a privacy-	

preserving aggregation scheme, while the second distinguishes between privileged and unprivileged participants, allowing quantifiable partial leakage of sensor information.

Project goals:

- *Design and implementation of a camera network*
- *Image processing for the tracking of a moving object*
- *Implementation and evaluation of privacy-preserving aggregation*
- *Implementation and evaluation of cryptographically privileged sensor fusion*

Subtasks:

- Design and construction of hardware setup
- Implementation of algorithms for tracking and sensor data fusion
- Implementation of cryptographic localization and aggregation protocols
- Evaluation of performance and accuracy
- Documentation of project