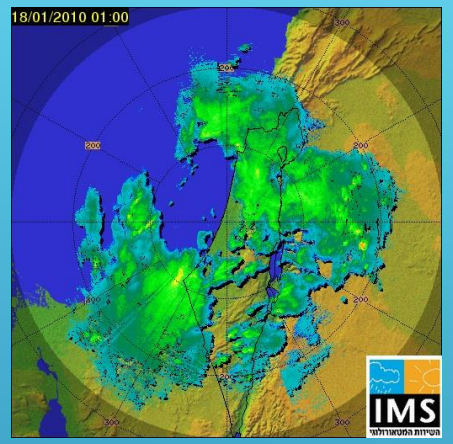


Faculty of natural sciences

the department of computer science

Elbit Systems™
Sigmabit

Geo-Sensorial Data Fusion Visualization

Mali Yakobov, Maayan Kaduri, Stas Rodov, Alex Shimanovich

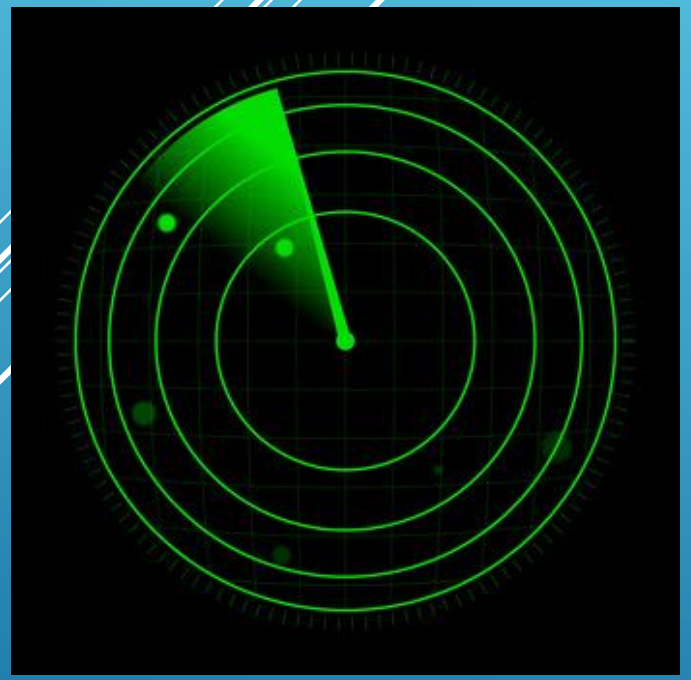
Advisors: Prof. Aryeh Kontorovich, Mr. Guy Yafe

Introduction

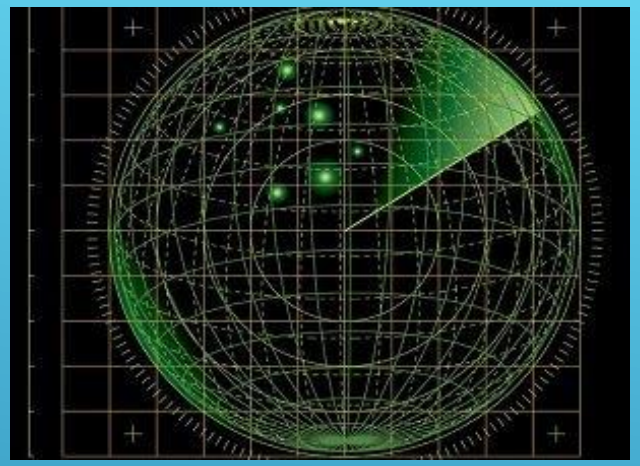
- During the project we designed and developed an interactive visualization system, and implemented some machine learning algorithms

- The algorithms deal with geo-sensorial data fusion and tracking of spatial entities over time (using Kalman filter).

- The visualization system plays a temporal scenario resulted from above algorithms and shows information about the scenario and the learning process.



Details about the implemented algorithms



The raw geographic data obtained from sensors. This data is probabilistic and assumed to have a Gaussian distribution

The data processed by the following pipeline of algorithms, and becomes a scenario of tracked spatial entities in time

The output of the pipeline in more detail:

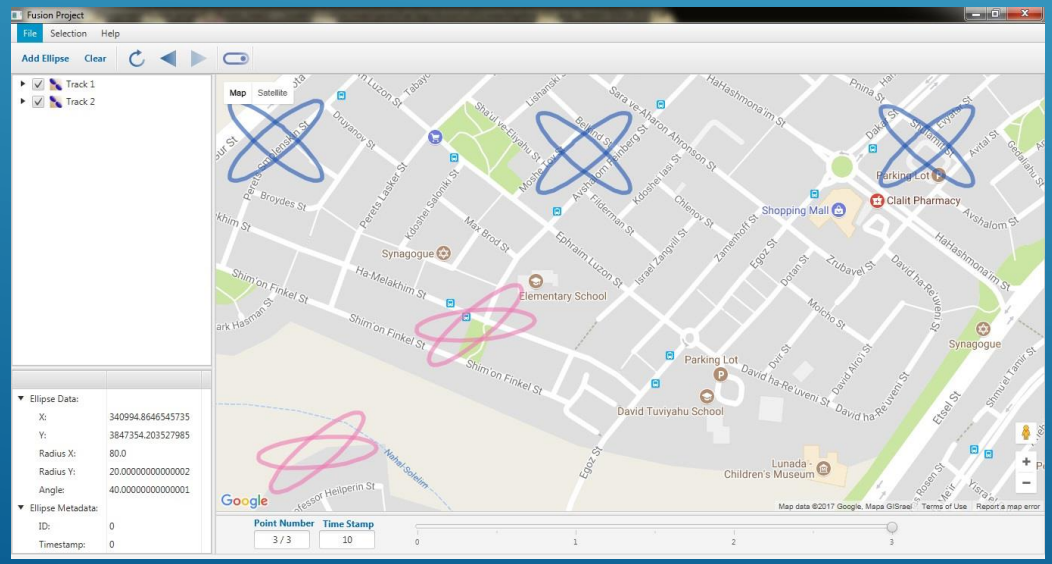
- A scenario that consists of points in time.
- Each point contains tracks – a single track for each tracked entity
- Each track contains probabilistic positions of the entity over time and the raw data those positions fused from.

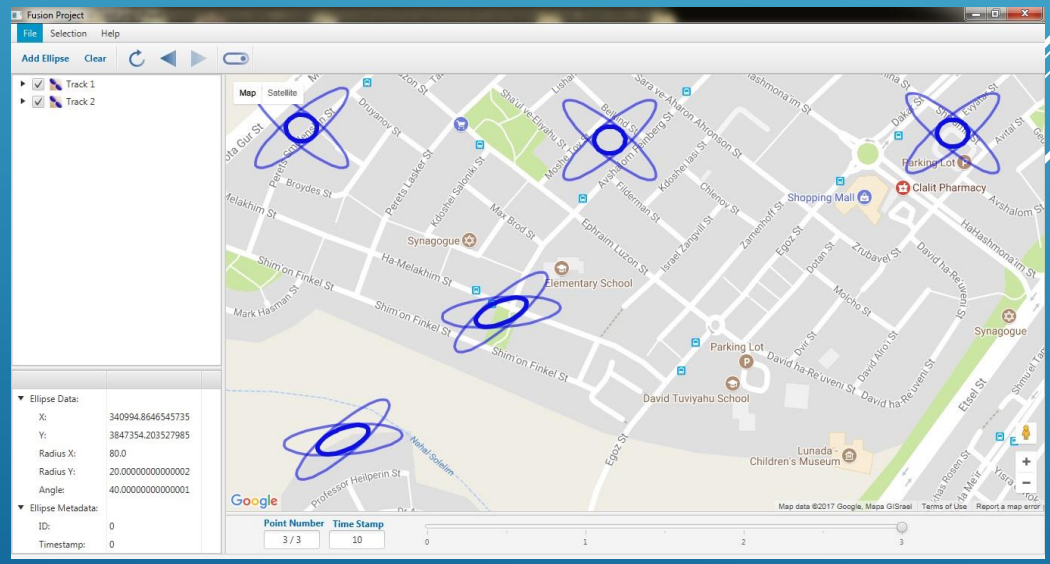
The Pipeline:

1. Initial clustering algorithm

The raw data obtained from different sensors, then fused into clusters, each cluster represents a position of single entity in time

Example of initial clustering from the GUI:





2·Distance matrix

Calculating the statistical distances of new clusters from all existing tracks, with respect to two movement models (static and linear)

3·M2M (Many to Many)

Classifying the clusters to the most suitable tracks and movement models

4·Update

Updating the tracks,

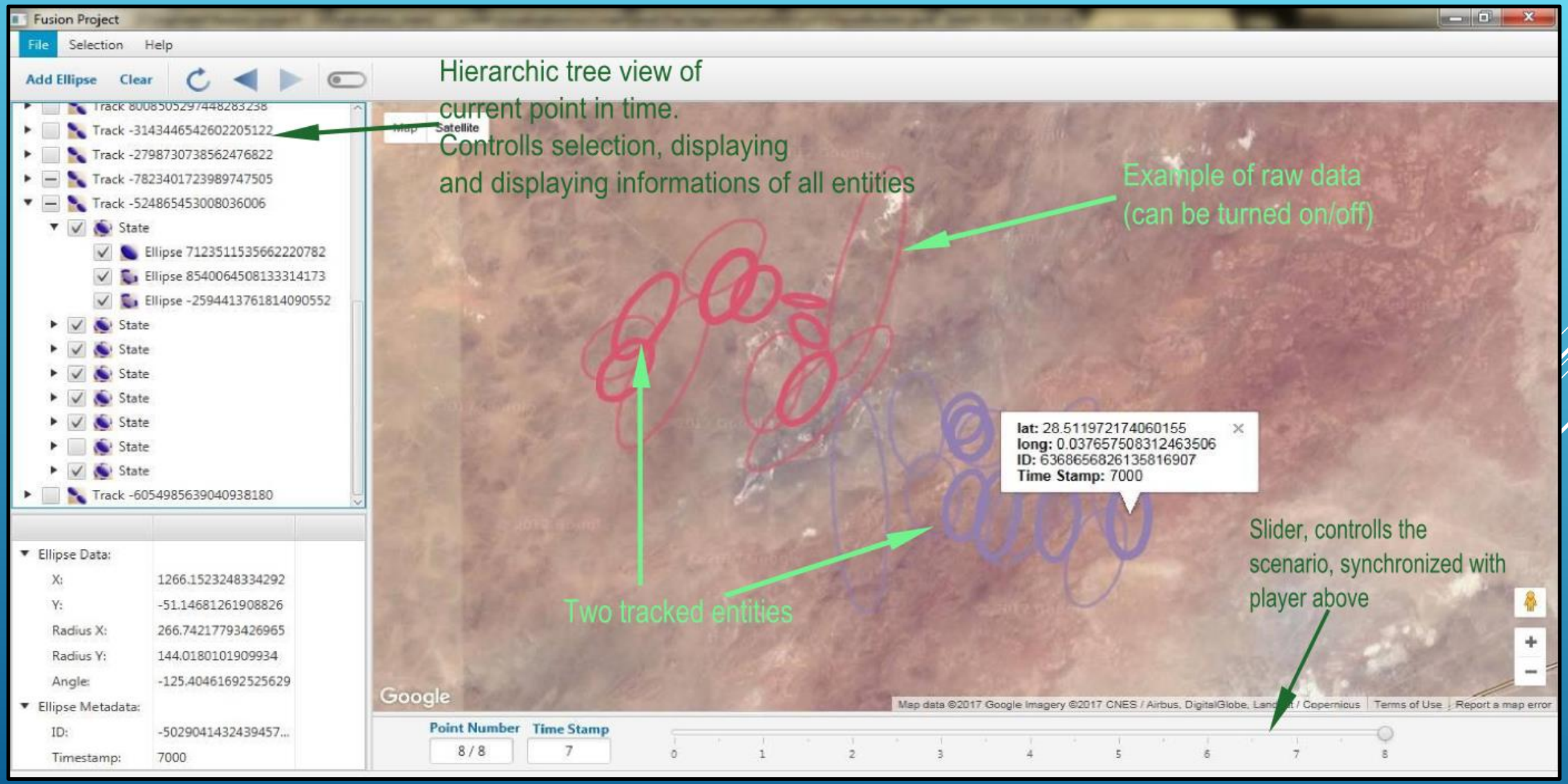
or creating new tracks if there is no suitability.

Details about the visualization system

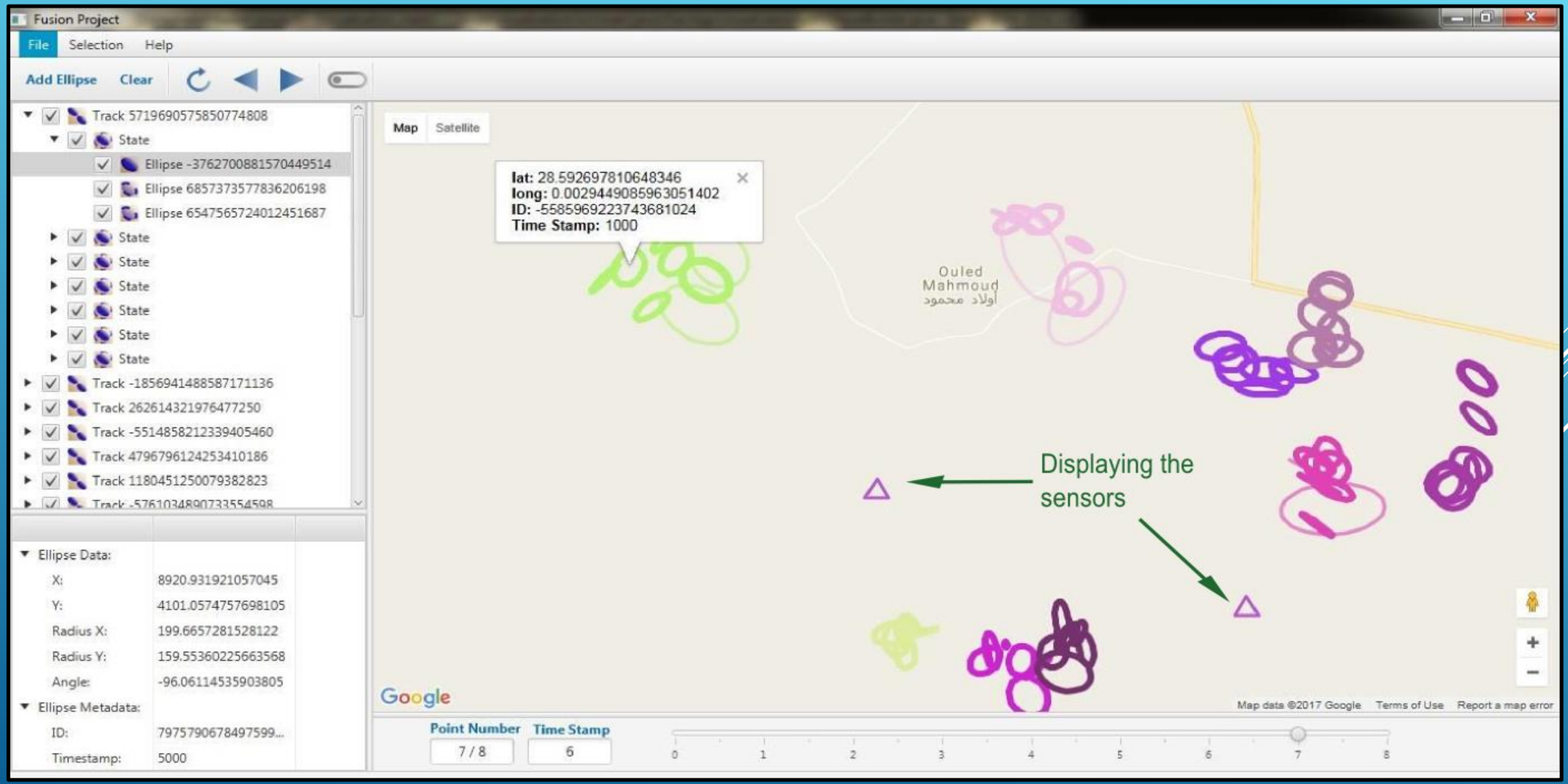
The visualization tool plays a scenario of tracked entities over time

- The scenario is loaded in JSON format
- The results are displayed with GoogleMaps API, but can be wired to any map service

The visualization tool plays a scenario of tracked entities over time

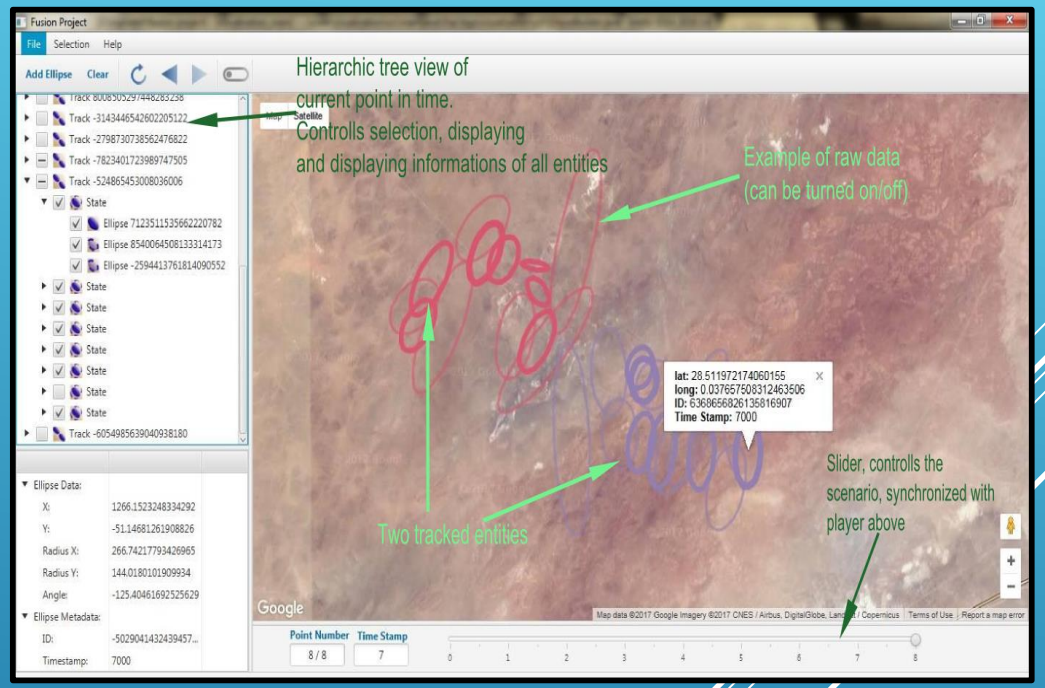


The visualization tool plays a scenario of tracked entities over time



Features:

- Player - advances backward and forward in time
- Slider - controls the scenario, synchronized with the player
- Toggle show/hide raw data
- Show information about every entity, in table and in hover balloon
- Each tracked entity have unique random color

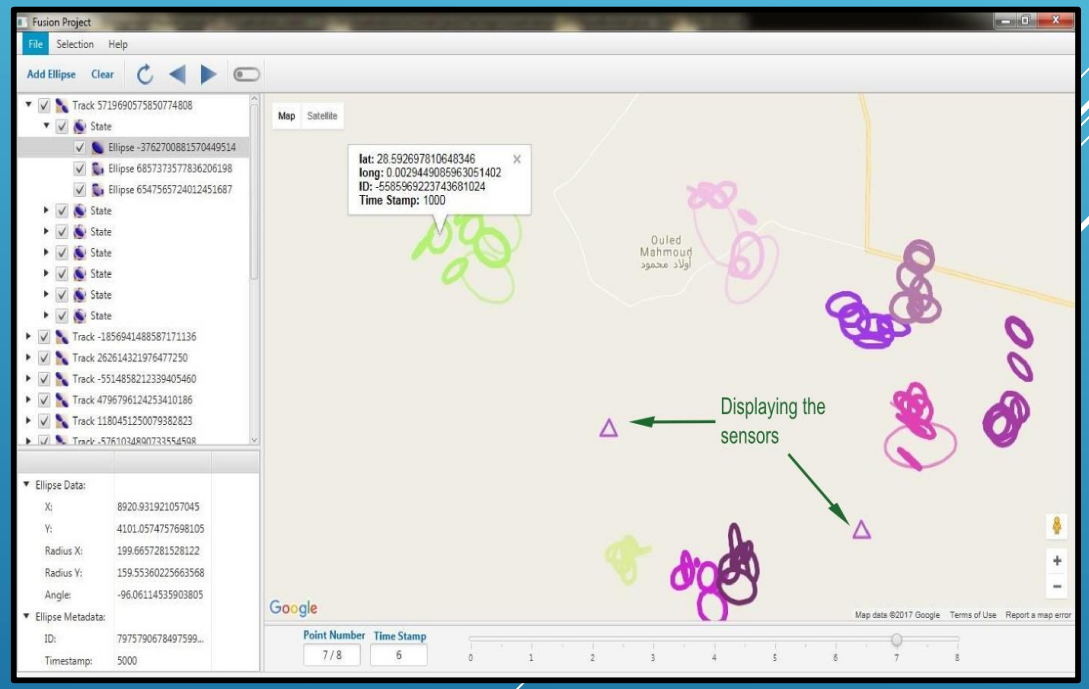


Features:

- Hierarchic tree view of current point in time - allows to display information about all entities, select entities, show/hide entities and tracks

- Ability to apply initial clustering algorithm on selected entities (as shown in example above)

- Ability to add entities to the scenario with mouse click



Technologies we used during the project