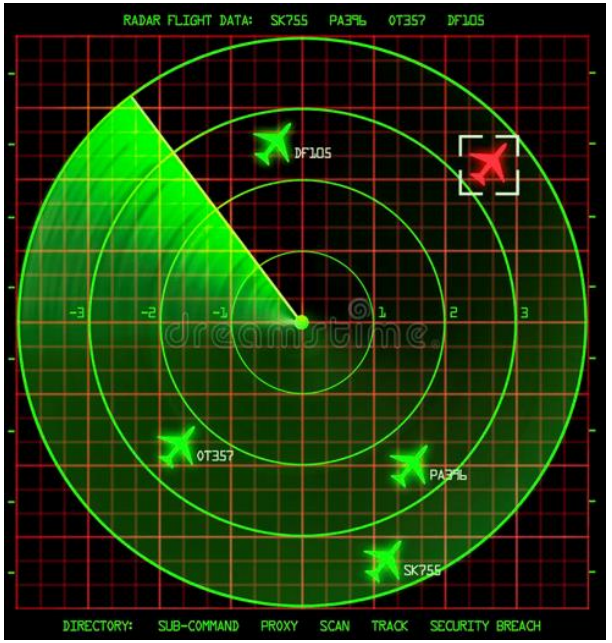
Passive optoelectronic tracking system (POTS)



Conceptual overview of the surveillance system for detection, identification and localisation of moving objects

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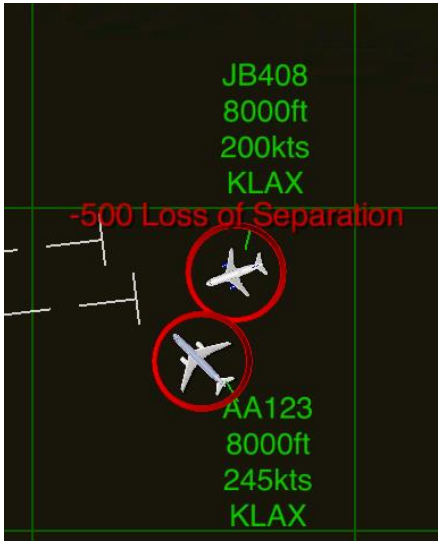
1. Conceptual information



Basic principles of Passive optoelectronic tracking system:

- System is based on the Computer vision principle followed by the Image processing
- Deep learning in connection to neural network is used for object recognition
- Stereo vision and Triangulation principle is used for localisation
- Visual and Thermal cameras are used

Basic steps of target tracking :

- Moving object detection – the moving object within the monitored range is detected (**detection**)
- Detected object is identified and its level of danger is estimated (**recognition**)
- Moving object is localised and tracked, expected route is predicted (**localisation**)
- All the information are continuously send to central dispatching (**integration**)

Value proposition of the Passive optoelectronic tracking system:

1. Detects all the objects in the monitored space (even if they do not respond e.g. transponder)
2. Estimates position and predicts the route of dangerous flying objects
3. Detects unidentified objects (e.g. drones, UAVs) not detectable by standard radars to precede air traffic incidents
4. Integrates the collected information into the main system for the air traffic controller (all in one)

1. Conceptual information

Limitations

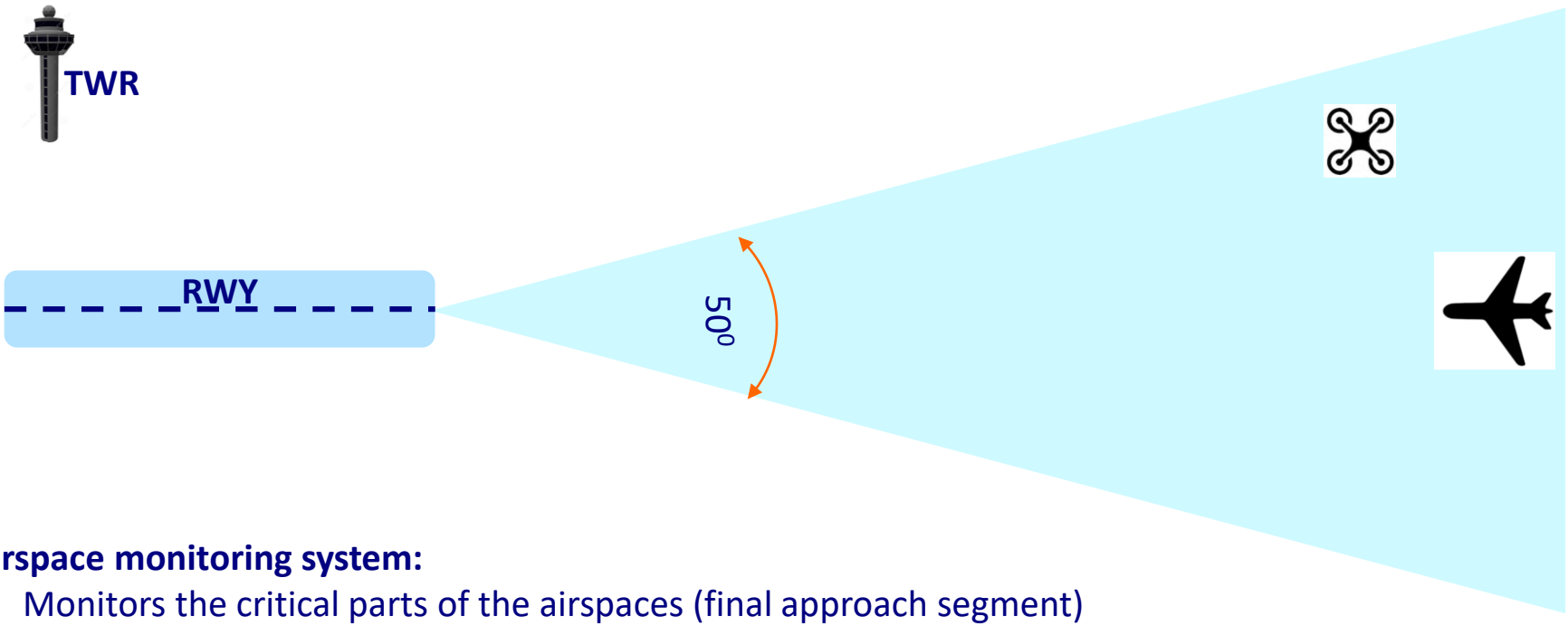
Visibility	Object recognition distance
Day – good visibility	• Reliable recognition of drones to oblique distance of 1,500 meters * • This corresponds to the specific lead-time of 100 sec for drone detection flying at 50 km/h
Day – poor visibility	• Reliable recognition of drones to oblique distance of 1,000 meters * • This corresponds to the specific lead-time of 70 sec for drone detection flying at 50 km/h
Night	• Reliable recognition of drones to oblique distance of 1,000 meters * • This corresponds to the specific lead-time of 70 sec for drone detection flying at 50 km/h

* If one station is used. In case of more than one stations are used the distance can be multiplied by the number of stations
* CD_T of 0,5 m is assumed

Comments:

1. Visibility ranges of thermal vision cameras are shortened by increasing night ambient temperature.
2. Poor visibility shortens non-lineary distances. The biggest shortening is for the detection range, the smallest for the identification range.

Airspace monitoring system - unknown flying object detection



Airspace monitoring system:

- Monitors the critical parts of the airspaces (final approach segment)
- Identifies objects (airplanes, drones, etc.)
- Localises objects and predicts their track
- Provides information to ATC (integrated into air management system)

2. Possible system applications

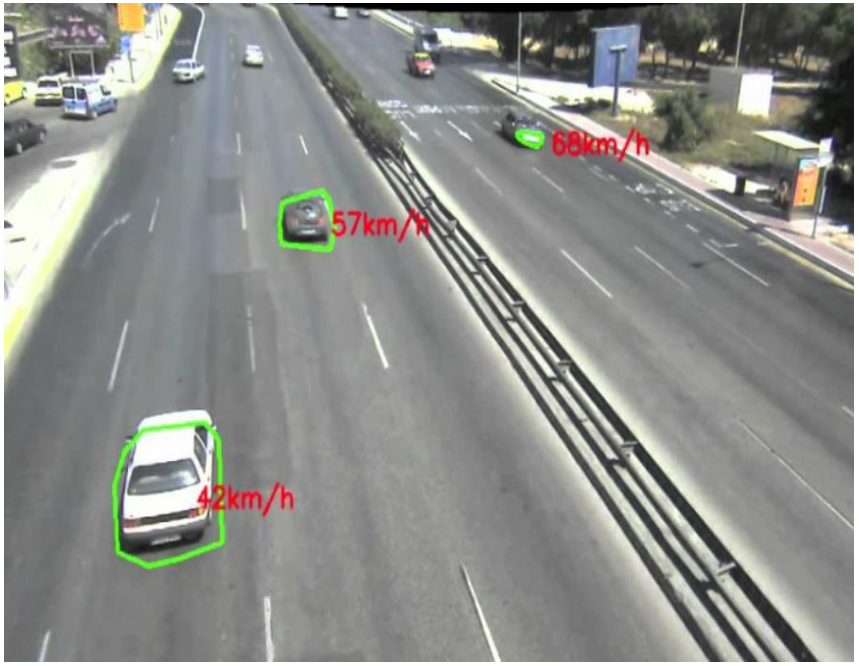
Critical infrastructure monitoring system - unknown moving object detection

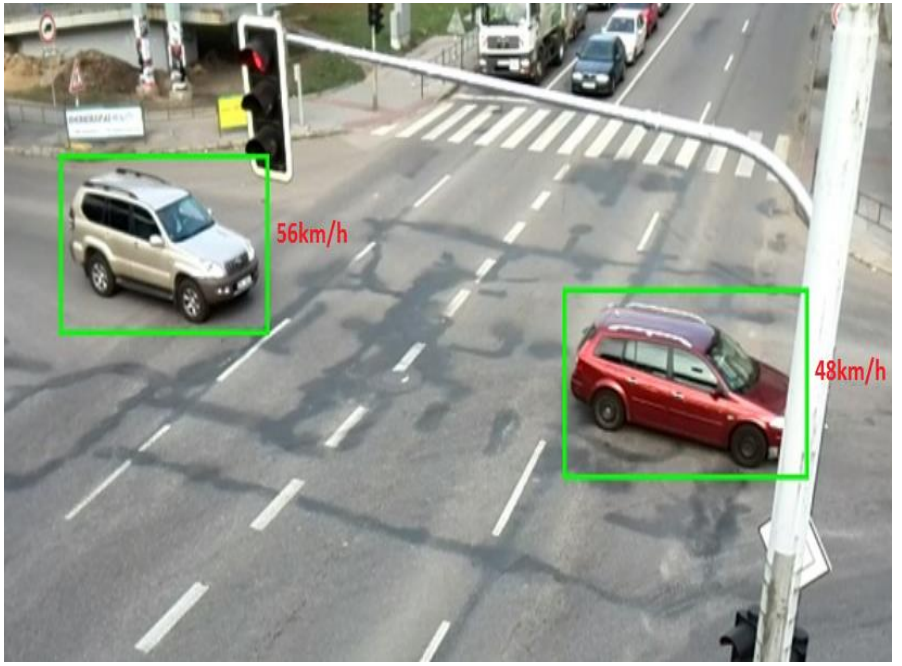
Restricted space/airspace monitoring system:

- Monitors the critical parts of the restricted space/airspaces
- Identifies objects (person, car, drones, etc.)
- Localises objects and predicts their track
- Provides information to central dispatch

2. Possible system applications

Car flow analysis





Dangerous locations (crossings, restricted speed places,..) monitoring system:

- Monitors the critical parts of the highway/route
- Identifies cars (car plate recognition)
- Localises cars and calculates the speed
- Provides information to central dispatch