

# iTHESEUS

## Robust Indoor Navigation and Localization of Bipeds

The localization, navigation and even more guidance of a walking or running person or a swarm of persons inside a building, i.e. in a GNSS denied environment and without any other aiding means (e.g. WLAN), has been a strong challenge in the past. Now, with **iTHESEUS**, iMAR provides an extreme robust solution for this task.



The system consists of a foot sensor unit, called **iTHESEUS-FSU**, which can be easily attached to the foot with a clip, and a lightweight local communication and processor device, attached to the calf, **iTHESEUS-LCPU**. In the mobile control station only a notebook / tablet (MS Windows 10) and the also supplied radio modem in combination with the **iTHESEUS-ARGUS** software are required. Position and direction reference points (**iTHESEUS-PDRP**), as far as available, which can be applied stationary or temporarily by the action forces themselves during operation, enable the display of the position of a larger number of emergency staff (in operation) on the control center in the same relative coordinate system or on a floor plan or even on a georeferenced map.

iTHESEUS allows



a completely autonomous localization of people in the lower meter accuracy range for tasks in which, in the event of an operation, possibly no infrastructure is (any more) existing. The action radius is not subject to any restrictions, the accuracy is typically better than 1% of the distance covered.

iTHESEUS is designed to be used by, e.g.

- civil protection and disaster control; sovereign tasks
- worldwide, without any infrastructure requirements (no WLAN, no Bluetooth or similar, no camera, no ultrasonic, ... just **nothing!**)
- fire brigades, police
- security and rescue personnel
- special and para-military forces
- service and maintenance staff
- inspection personnel (e.g. Intl. Atomic Energy Agency IAEA)
- occupational safety
- ...

For that purpose the emergency personnel which needs to operate in the same coordinate system



has to remain on the **iTHESEUS-PDRP** marking for just 4 seconds - the detection process and direction transfer are completely automatic. In the case of stationary installation, it is also possible to

record the arrival and departure of persons and, in addition, to extend the deployment radius to almost any extent without loss of accuracy. The system works completely independently, no interaction with the user is required and therefore the user training effort is minimal.

The design of the **iTHESEUS** system is based on iMAR's long time experience with low-cost MEMS based inertial sensors as well as high performance INS/GNSS algorithms, typically used for high end navigation solutions.

**iTHESEUS** is also available as a cableless version, where the light-weight **iTHESEUS-LCPU** is located e.g. in the backpack of the operator.

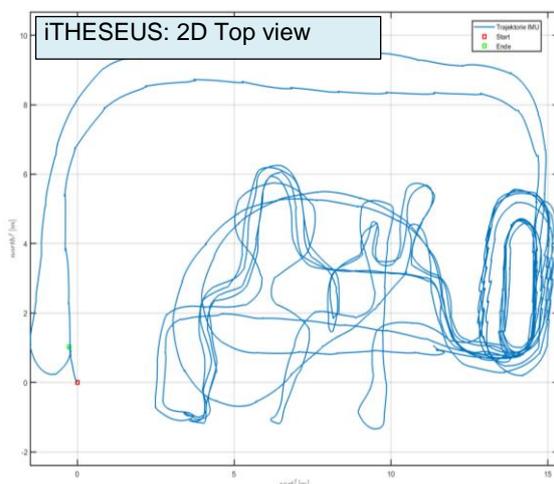
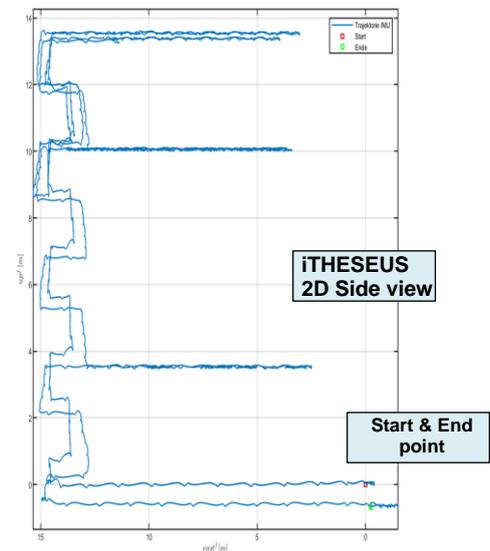
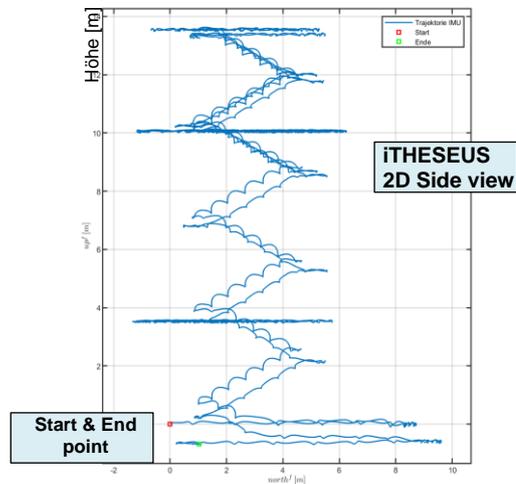


The huge advantage of the iTHESEUS solution, compared to most available systems on the market, is obvious due to the following facts:

- easy to use, light weight, simple to mount on or in the shoe, no training required, economic cost
- provides 3D localization of walking person with up to 50 measurements per second in-door and out-door
- **operates as fully autonomous (self-sufficient) system**, i.e. without any GNSS, without any WiFi or similar localization techniques, without any vision based or magnetometer based systems
- hence, no map or other infrastructural information is required
- accuracy in full autonomous mode typically < 1 % of distance travelled (in-door)
- suitable for all human beings walking on two feet, i.e. forward, backward, sideward, step or ramp up/down fully supported
- iTHESEUS also contains an integrated GNSS engine to provide a seamless out-door / in-door operation; accuracy out-door < 2 m CEP with sufficient GNSS availability
- works also within elevators and on escalators
- high reliable but low-cost solution due to the usage of robust but “consumer-like” electronics

For the online visualization and storage of the actual position a standard tablet PC with Bluetooth interface is sufficient (other communication interfaces on request possible).

The following figures exemplify the measured trajectory, walked by a person over 11 minutes within a building with 7 floors, as 3D plot as well as top projection.



#### Characteristics of application:

- Normal walk through staircase, search on each floor (4 levels of an industrial complex) incl. 6 m crawling, return to starting point at the end of mission
- distance: 271 m, mission duration 22 min
- horizontal error: 1.15 m (0.4 %)
- vertical error: 0.63 m (0.2 %)

