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#### Deployment of mobile robots in collaborative work cell for assembly of product variants

### UWB based indoor localization module



## UWB based indoor localization module

- Purpose and goal
- -Technical specifications
- Requirements
- Components
- Tools
- Use case in industrial applications
- Conclusions





## Purpose and goal

#### Purpose

- Facilitate deployment of mobile robots in a shared collaborative work cell

#### Goal

- Provide localization of a mobile robot within indoor environments, by means of poses which consist of both position and orientation







#### Technical specifications

- According to IEEE80.15.4-2011 Ultra Wide Band standard
  - Proprietary firmware, supporting 8 anchors and 8 tags\*
- Accuracy achieved <10 cm for position provided in 2D space, thus x and y
  - Estimates for height (z) are less accurate
- 12.5 Hz per tag, thus 25 Hz update rate for position and orientation
- Coverage area: up to 30m x 30m per localization cell
- Technology Readiness Level is TRL 4

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### Module Components

NDFR:

- Requires Qorvo TREK1000<sup>1</sup> UWB hardware units
  - Proprietary firmware, supporting 8 anchors and 8 tags<sup>2</sup>
  - Minimum of six units; 4 anchors and 2 tags

- Localization processing unit for tags
  - USB interfaced with UWB hardware units
  - Tested with Linux 16.04, ROS and Python2.7 (e.g., can run on RPi3)

1- Future plan is to support Qorvo DWM1001 modules

2- Default configuration part of the UWB module's package





### Module's Environment Requirements

- Ensure basic RF principles
  - shielding of open RF PCB traces
  - Avoid placing antennas to close to other objects
  - Ensure line-of-sight (LOS) conditions as much as possible
- Anchors' antennas placement within environment
  - Accurately measure anchors antennas coordinates against a ground floor plane
  - Ensure spread of anchors placement but avoid also obstacles that may block RF signal
- Tags' antennas placement on mobile robot
  - Accurately measure tags antennas coordinate against mobile robot's reference point







#### Module's Supporting Tools

- Anchors placement tool (open space)
  - Performs a Horizontal Dilution of Precision (HDOP) analysis to determine geometric effect on precision in the used space
- Tool for system wide firmware update

- Antenna delay calibration tool

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### Use in industrial applications/production line

- Example use case: navigation and tracking
  of mobile robots or Automated Guide
  Vehicles (AGVs) in production line
- The system provide location service



- Place anchors on the area to be covered
- Place tags on the mobile robots/AGVs
- Connect anchors & mobile robots to the local network
- User interaction to the system via ROS





#### Conclusions

This module provides an accurate, tested localization solution
 for applications operating in 2D space requiring position and orientation

- A set of tools is provided to kickstart applications requiring localization

 If you got interested and would like to find out more, feel free to contact <u>trinity@flandersmake.be</u>







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