



Autoware Mapping WG Proposal

September 15, 2022 TSC Meeting



Autoware Mapping WG Description

Autoware Mapping WG is responsible for all activities related to creating and sharing details of mapping hardware systems, mapping software packages, creating point cloud maps and HD-Maps for the selected ODDs, sensor calibration techniques for Lidar, GNSS/INS, Camera and aligning with members who have experience in the field and encouraging sharing of knowledge in the related technologies.

The group's main goal is to improve the current mapping pipeline and support companies who are new to this domain for them to deploy autonomous vehicles using Autoware Software faster.

The WG is open to anyone who wants to contribute and learn AV mapping technologies.



WG Leaders



MAP IV



Tomtom



Leo Drive



WG Participants & Developers



TierIV: Xinyu Wang, Ryohsuke Mitsudome

MAP IV: Yuki Kitsukawa, Patiphon Narksri, Abraham Monroy, Kazuki Tanaka

Tomtom: TBA

Leo Drive: Armağan Arslan, Melike Tanrıku, Ata Parlar, Irem Sena Golcuk, Göktuğ Yıldırım

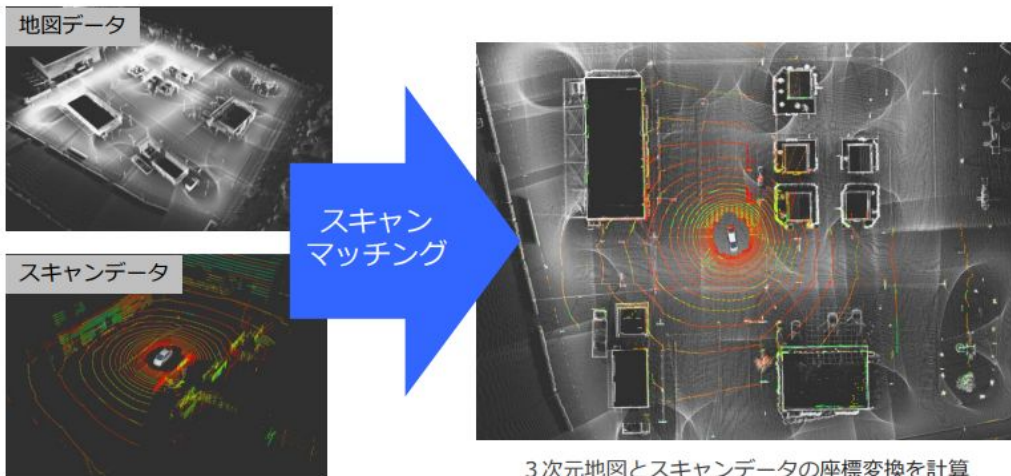
Adastec: Mert Yavuz, Enes Cingöz

David W



WG Goals (Short Term)

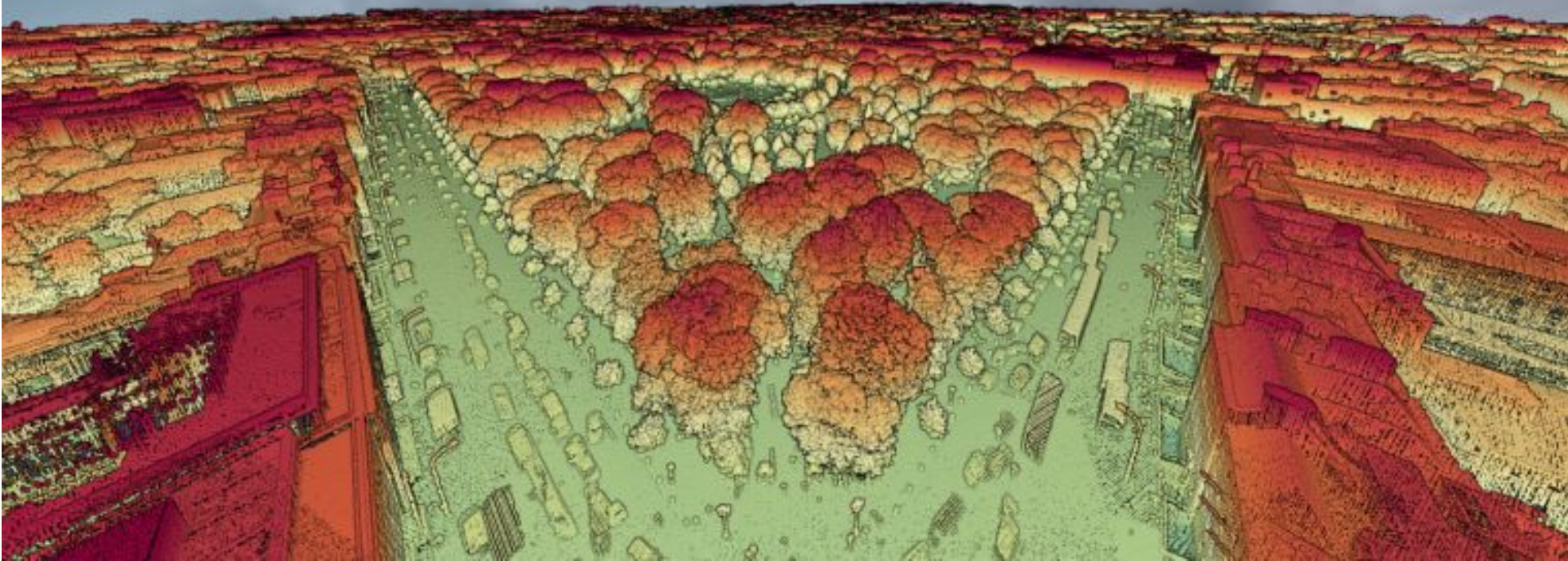
- Comparison for the ready open source tools and choosing or preferring a tool and giving support for one tool and creating tutorial
- Creating documentation for hardware tested/used by members as a reference
 - <https://autowarefoundation.github.io/autoware-documentation/main/how-to-guides/creating-maps-for-autoware/#creating-a-point-cloud-map>
 - <https://autowarefoundation.github.io/autoware-documentation/main/design/autoware-architecture/main/>



3次元地図とスキャンデータの座標変換を計算
車両の位置・向き

WG Goals (Short Term)

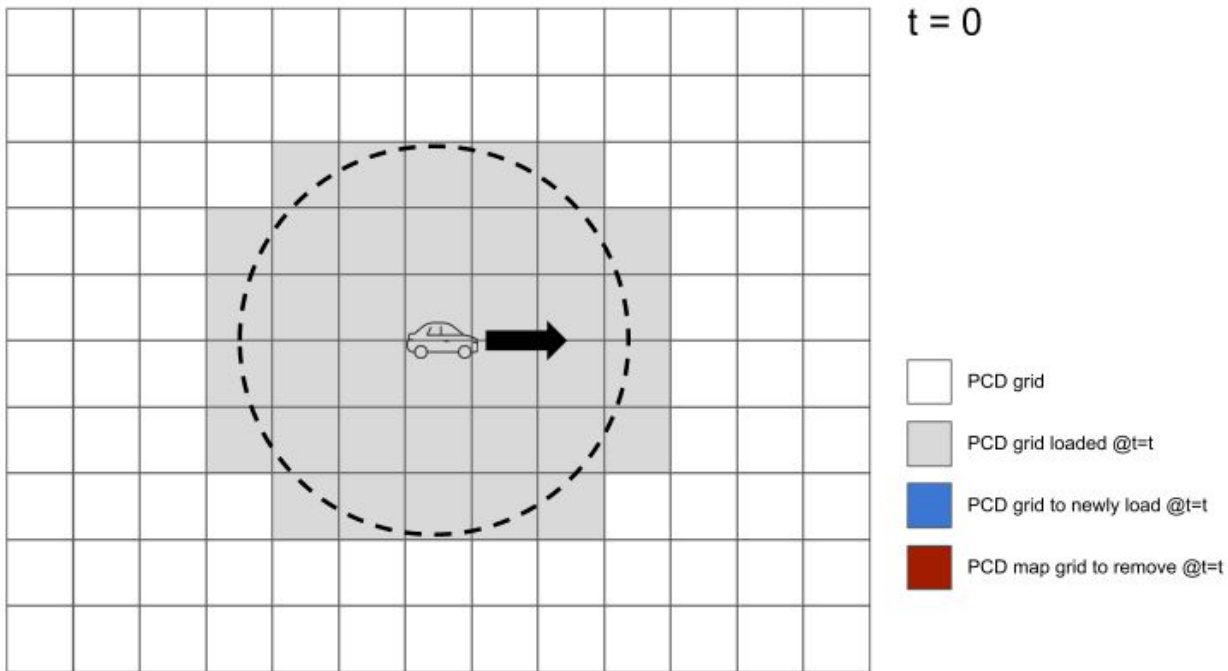
- Add geo-referencing to NDT Mapping (any other open source tool) so that separate maps could be added to each other to create large area point cloud maps





WG Goals (Short Term)

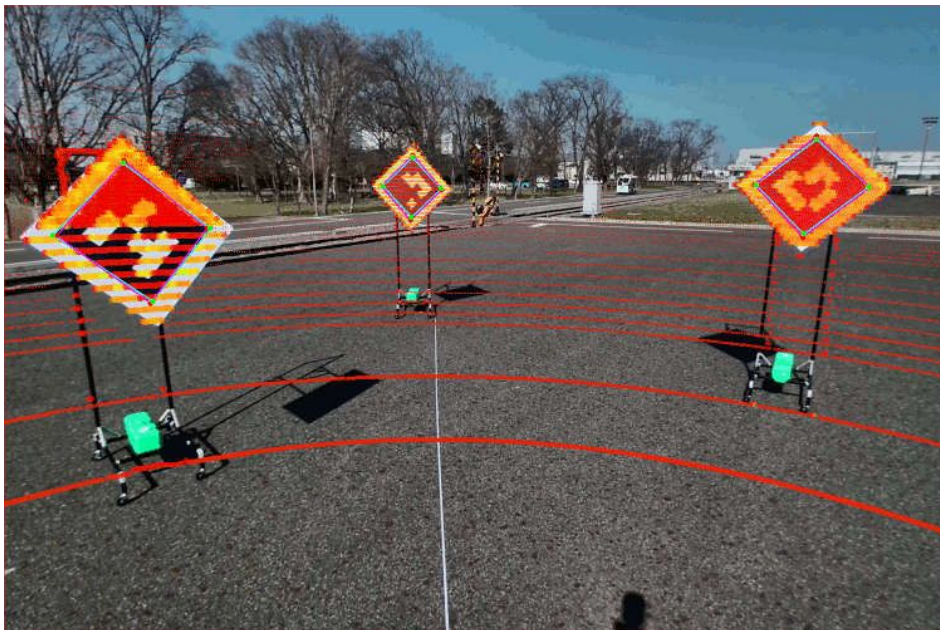
- Dynamic map loading: <https://github.com/autwarefoundation/autware/discussions/2812>





WG Goals (Mid Term)

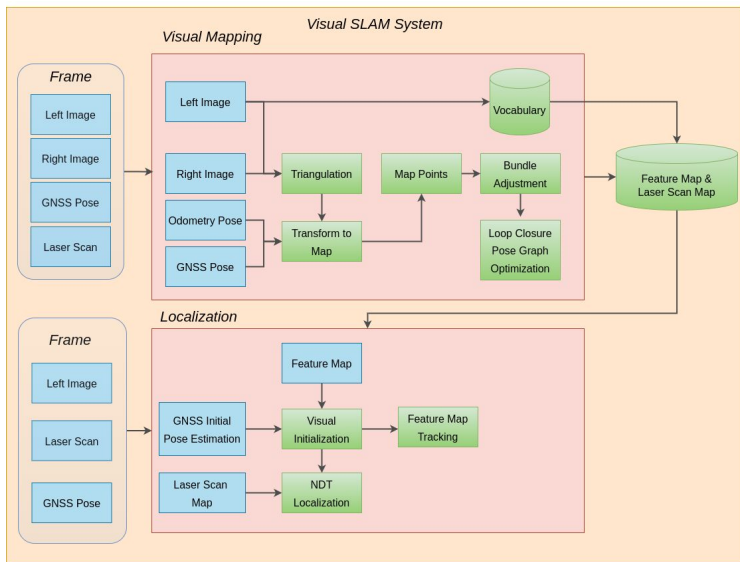
- Test the calibration techniques of IMU-Camera-Lidar, further develop or use the techniques for mapping
 - <https://github.com/orgs/autowarefoundation/discussions/2727>





WG Goals (Mid Term)

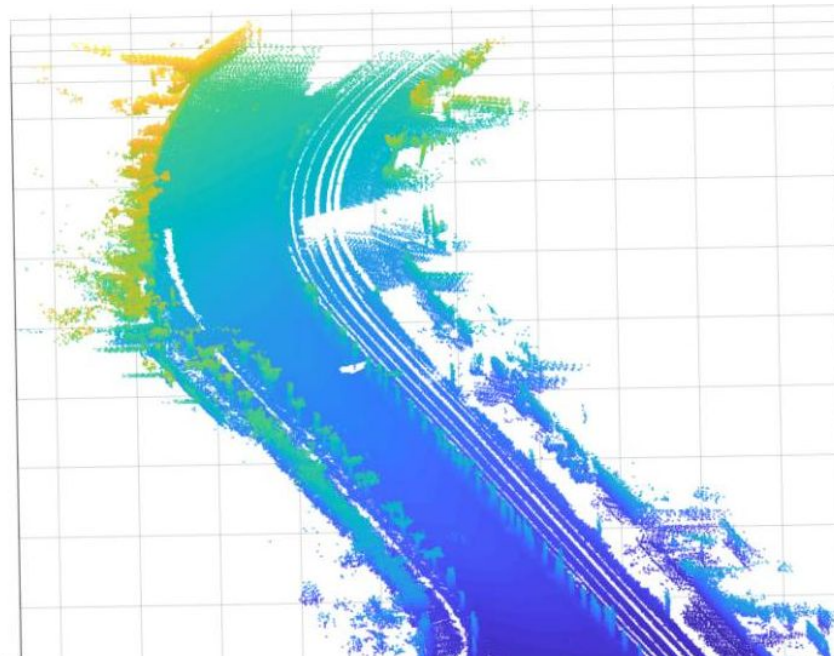
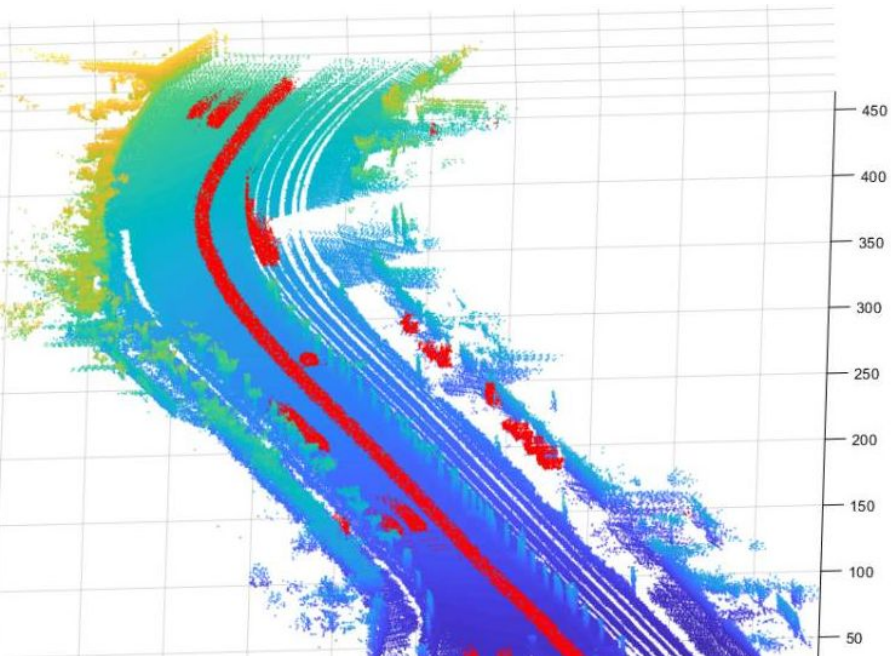
- Add camera feature based mapping & localization techniques





WG Goals (Mid Term)

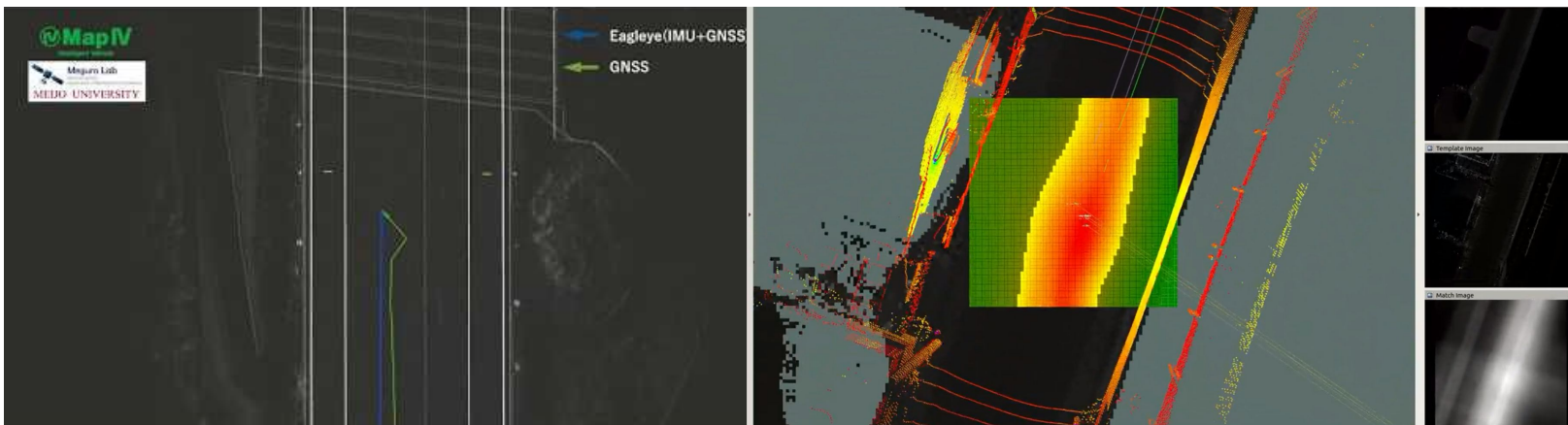
- Remove all the vehicles & pedestrians from the point cloud map using perception
 - <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7435716/>
 - <https://github.com/irapkaist/removert> (Dynamic point remover)
 - <https://github.com/PRBonn/4DMOS>





WG Goals (Mid Term)

- Integrate [Eagleeye](#) into Autoware
 - Improve the ndt based localization
 - Achieve GNSS/INS based localization
- Implement ortho-image map loader into Autoware to integrate [Hawkeye](#)

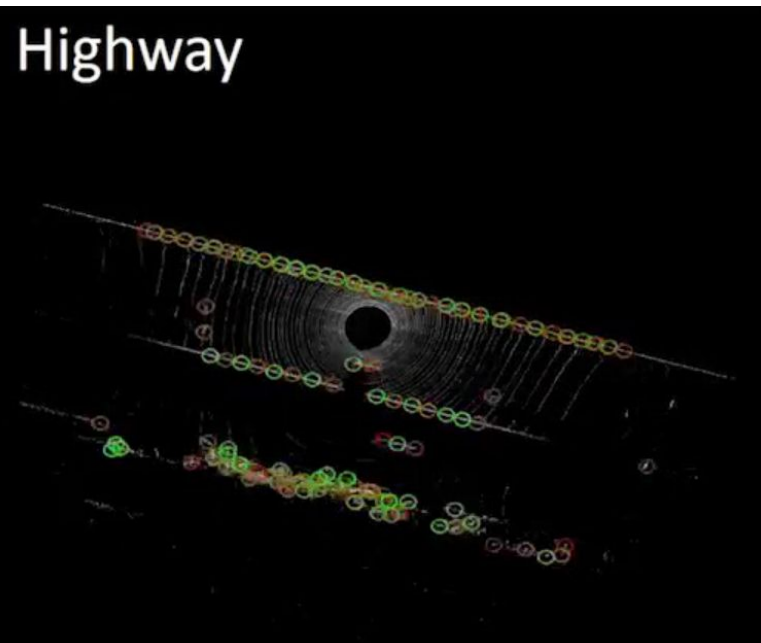




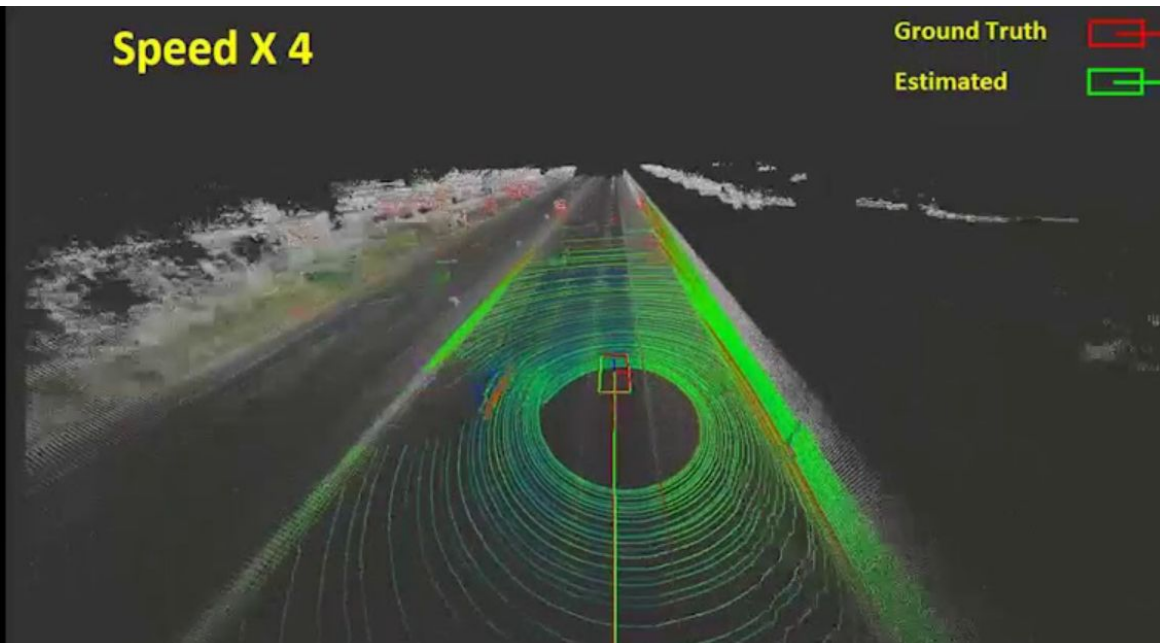
WG Goals (Mid Term)

- Test and develop mapping techniques to be used for localization in highway/high speed
 - <https://www.semanticscholar.org/paper/L3-Net%3A-Towards-Learning-Based-LiDAR-Localization-Lu-Zhou/0df81be86926562d02048755e11ca7a6582aa6c5>

Highway



Speed X 4



Ground Truth



Estimated





WG Goals (Long Term)

- Development & Support for Autoware to use commercial (e.g. Tomtom) or other open source formats like.opendrive
 - <https://gitlab.lrz.de/tum-cps/commonroad-scenario-designer>
 - <https://github.com/hatem-darweesh/assuremappingtools>



WG Goals (Long Term)

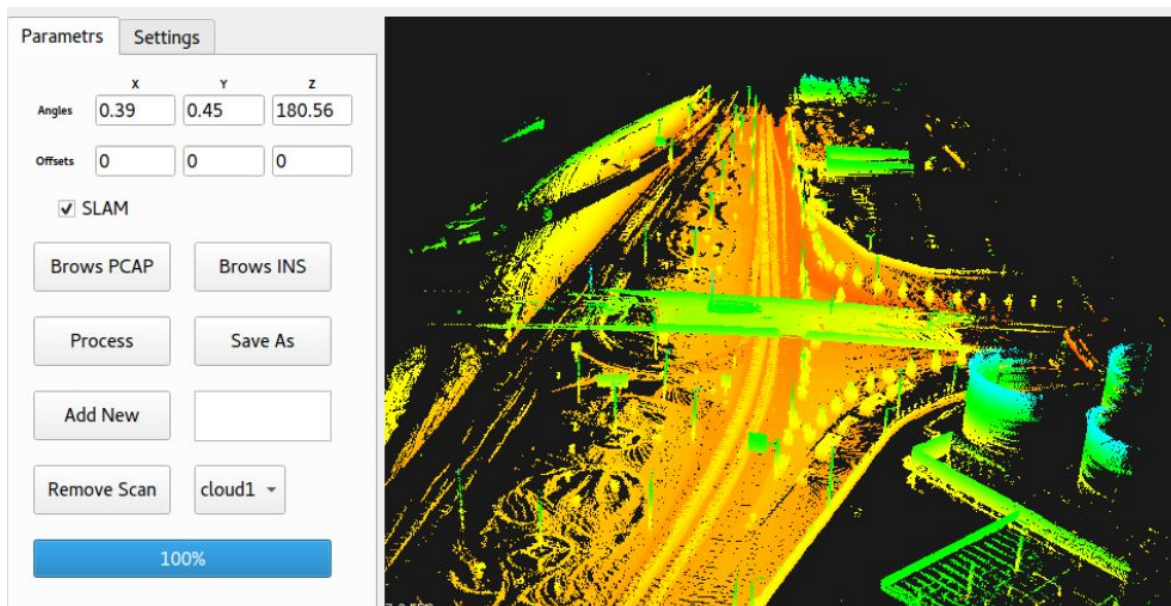
- Create semi-Automatic HD-Mapping





WG Goals (Long Term)

- Developing Eagleeye to be used for post-processing to be used for Mobile Mapping System (MMS)
- Create mapping software which uses RTK GNSS/INS and fuses NDT Mapping for geo-referenced indoor-outdoor point cloud and feature map generation



WG Goals (Long Term)

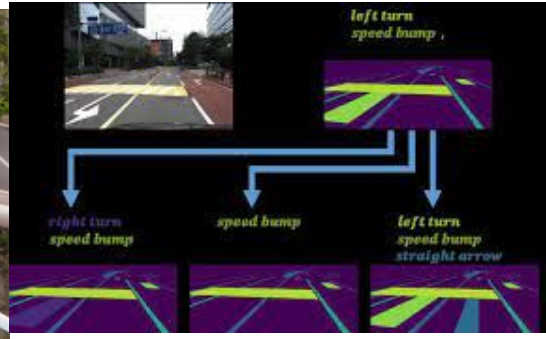
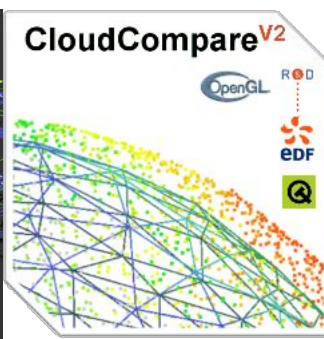
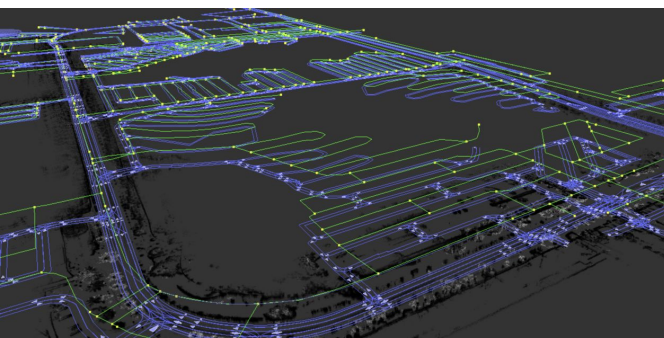
- Create colorized point cloud for simulation & lanelet2 generation
 - <https://www.svl simulator.com/product/digitaltwin/>





WG Stretch Goals

- Create & publish a mapping database where people could reach to the point cloud map and HD-Map of cities
- Create a mapping hardware kit which could be shipped to the selected ODD vehicles location
- Contribute to Cloud-Compare (or similar open source projects) or invite to AWF for better synchronization with a point cloud editor.
- Detect HD-Map changes on the move





How to participate

The Mapping work group meets weekly at 10:00 Am UTC (subject to change) every Wednesday. For meeting information, see the the [Autoware Foundation's events calendar](#) for when the upcoming meetings will be held. If you use Google Calendar, you can subscribe to this calendar directly to have it displayed alongside your own calendar events. To do this, click the "+ Google Calendar" link in the bottom right corner of that site. Note that this will not add the events to your own calendar, meaning you may not receive notifications about meetings starting soon. For those not using Google Calendar, you can add the calendar to your own by downloading it as an ICS file and importing that into your calendar software.

The meetings and other announcements will be made every week at Autoware Discord. To join Autoware Discord server please use the link: <https://autoware.herokuapp.com/>

Please contact with WG Leaders for further information and issues.



WG Goals (Short Term)

- Autoware Universe doesn't have any mapping functions (Improve NDT Mapping using loop closure)
- <https://autowarefoundation.github.io/autoware-documentation/main/how-to-guides/creating-maps-for-autoware/#creating-a-point-cloud-map>
- Mapping tutorial with one of the open source tools should be added!
- Comparison for the ready open source tools and choosing or preferring a tool and giving support for them?
 - MapIV Engine (Loop Closure Support - Geo-Referencing with GNSS)
 - Cloud Service Implementation by MapIV - Alpha Version Release
- Add geo-referencing to NDT Mapping (any other open source tool) so that separate maps could be added to each other - Static RTK Position (Short-Mid Term Goal it could be depends on the other goals)
- Dynamic map loading: <https://github.com/autowarefoundation/autoware/discussions/2812>
 - Keep it in the short term
 - There was already an implementation at autoware.ai but its never used or needed. Abraham will share the link under the discussion and discord channel



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 - https://github.com/autowarefoundation/autoware_ai_common/tree/master/map_file



WG Goals (Mid Term)

- Test the calibration techniques of IMU-Camera-Lidar, further develop or use the techniques for mapping
 - Should also be added in tutorials (Armağan will check if all or some part is already added)
 - <https://github.com/orgs/autowarefoundation/discussions/2727>
- Add camera feature based mapping techniques for better localization
 - Civilmaps said in the past they might join but they haven't shared the application form.
 - Göktuğ will share his results in the next meeting.
 - https://www.youtube.com/watch?v=JOLzVoYq7cE&feature=emb_logo
- Remove all the vehicles & pedestrians from the point cloud map using camera perception
 - <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7435716/>
 - MAPIV will have a close source version and could be available in cloud service
 - <https://github.com/irapkaist/removert> (Dynamic point remover)



WG Goals (Mid Term)

- Create a converter for HD-Map formats or make autoware software capable of using commercial or other open source formats like opendrive
 - Tomtom map - Lanelet2 converter is already in place - Could be open source or service
 - Hatem Assure Map tools is released to convert different map formats, it supports old vector map formats
 - <https://gitlab.lrz.de/tum-cps/commonroad-scenario-designer>
 - <https://github.com/hatem-darweesh/assuremappingtools>
- Test and develop mapping techniques to be used for localization in highway/high speed
 - Localization team in TierIV is developing similar localization methods. We aim to localize in highway ODD we could open some information soon.
 - Highway use case as future release possible.
 - Adastec might be interested in this as well.



WG Goals (Long Term)

- Create semi-Automatic HD-Mapping
 - MapIV is also working on this and this could be a service as well for Autoware users
- Create mapping software which uses RTK GNSS/INS and fuses NDT Mapping and camera feature based mapping for geo-referenced indoor-outdoor point cloud and feature map generation
 - There are some services or companies are doing this.
 - Open Source GNSS/INS software is developed by MapIV: <https://github.com/MapIV/eagleeye>
 - Integrating Eagle Eye (Open-Source) with Autoware for better localization but maybe this could be used for mapping as well.
- Create colored point cloud for simulation
 - Ata: we can use drone mapping for colored point clouds. Maybe we can integrate it with the mobile mapping systems.
 - <https://www.youtube.com/watch?v=yXCkyuo8bcs>
 - MapIV has it and could release as a service (<https://www.youtube.com/watch?v=jC1vrkgwC-A>)



MAP IV Proposal

Short term goal

- Create design documentation regarding map
<https://autowarefoundation.github.io/autoware-documentation/main/design/autoware-architecture/map/>
-

Mid term goal

- Integrate [EagleEye](#) into Autoware
 - Improve the ndt based localization
 - Achieve GNSS/INS based localization
- Implement ortho-image map loader into Autoware to integrate [Hawkeye](#)

Long term goal

- Improve accuracy of EagleEye to be used for GNSS/INS based mapping (like MMS(Mobile Mapping System))

