ROS Implementation For Mapping and Localization using TurtleBot

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Project In Nutshell

- Problem Statement
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Problem Statement

We were assigned three tasks:

1. Robot should automatically navigate itself from another room to the center of the main room by avoiding obstacles.

2. Localize where are the two robotic arms in the room and go to the starting one autonomously.

3. As soon as the First robotic arm finishes its job, it should navigate itself to the second robotic autonomously.

Framework

- Ubuntu-14.04
- ROS-Indigo
- Language: Python (Not French)
- TurtleBot-2
- Kinect-1
- HP-Z420 Workstation
- ASUS-Notebook
- Friendly Environment

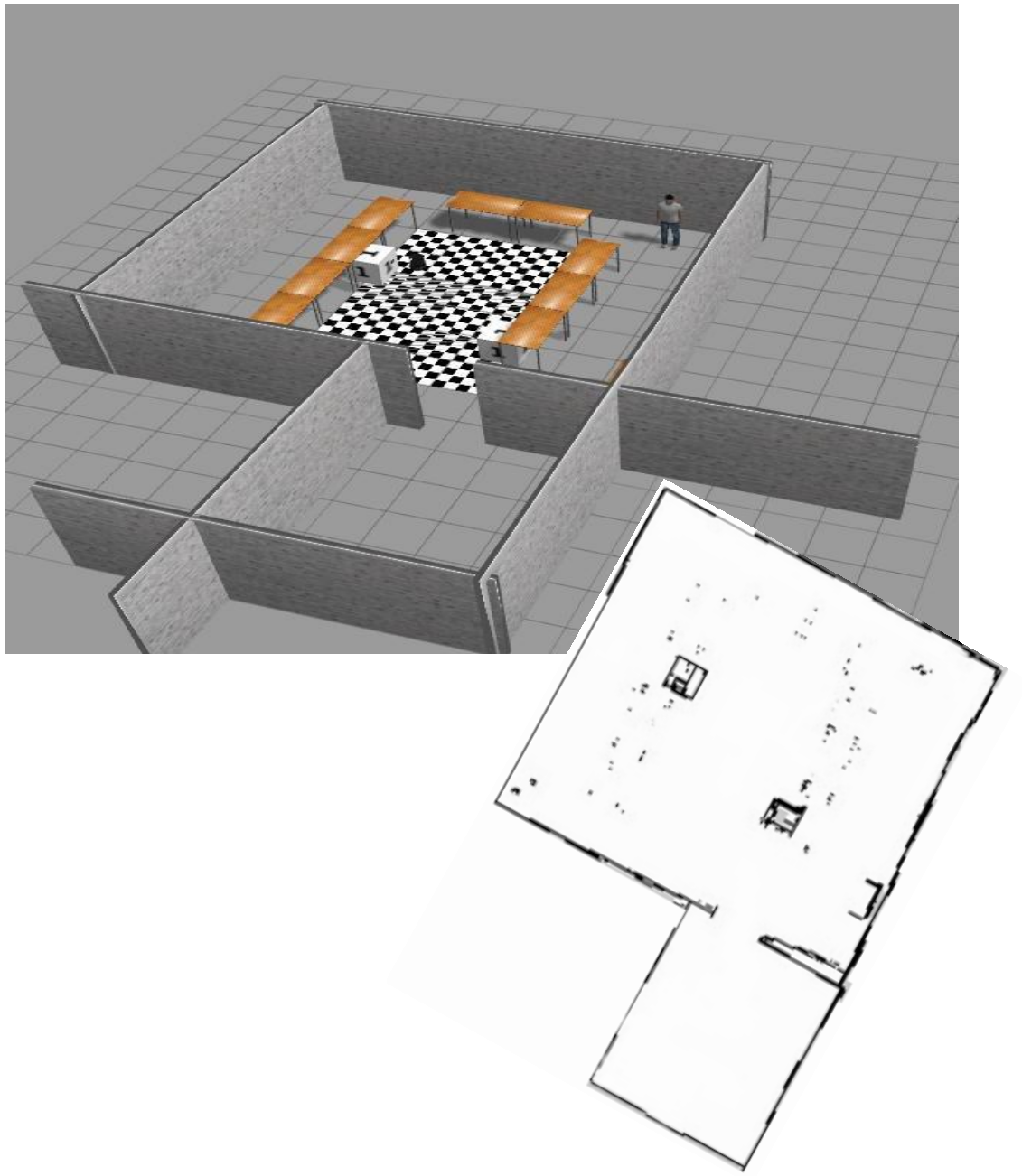
Packages Used[1]

- Turtlebot_Bringup
- Turtlebot_Gazebo
- Turtlebot_Rviz_Launchers
- Gmapping
- Turtlebot_teleop
- Turtlebot_Navigation
- AMCL
- Ar_track_alvar

- Robo_Project-OurNodes
- Robo_Project_Simulation

Simulation

- Gazebo
- Rviz
- Ar_tags
- Gmapping
- Teleop
- Amcl_demo
- Our Nodes



Simulation contd…

Steps to be followed in simulation:

- Create the world in gazebo
- AR Markers in gazebo world
- Save the world with .sdf file
- Launch the newly created gazebo environment
- Use gmapping to map the gazebo world by using teleop operation
- rviz to see the mapping environment
- Save the map
- Launch amcl_demo
- Developed code with Ar_tags

Real-Time

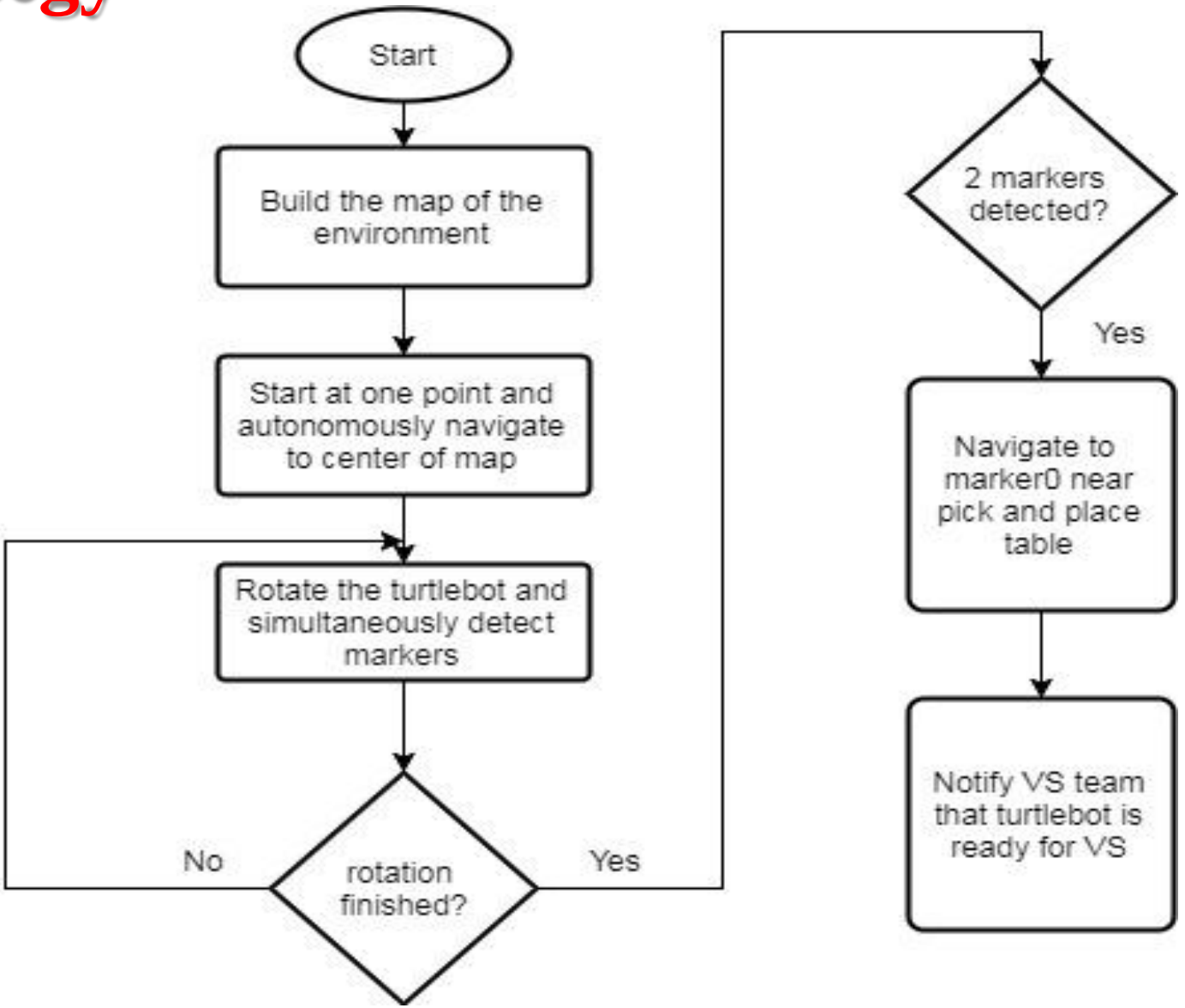
- Bringup minimal
- Rviz
- Gmapping
- Teleop
- Amcl_demo
- Our Nodes

Real-Time contd…

Steps to be followed in simulation:

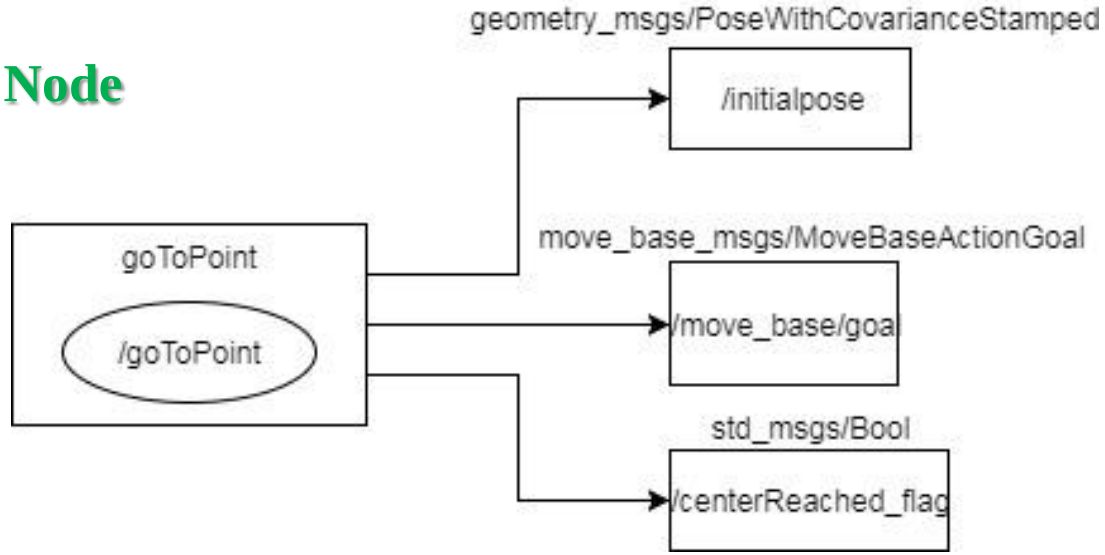
- Connect to turtlebot by ssh
- Launch bringup minimal gmapping on turtlebot
- Rviz and teleop on workstation
- Move around the turtlebot in real time to map the world and save it in .yaml file
- Change the amcl_demo launch file in turtlebot_navigation package on turtlebot, make the boolean values of registration, processing set to True
- turtlebot_navigation amcl_demo.launch on turtlebot
- Developed nodes should be launched on workstation with AR_Tags

Strategy

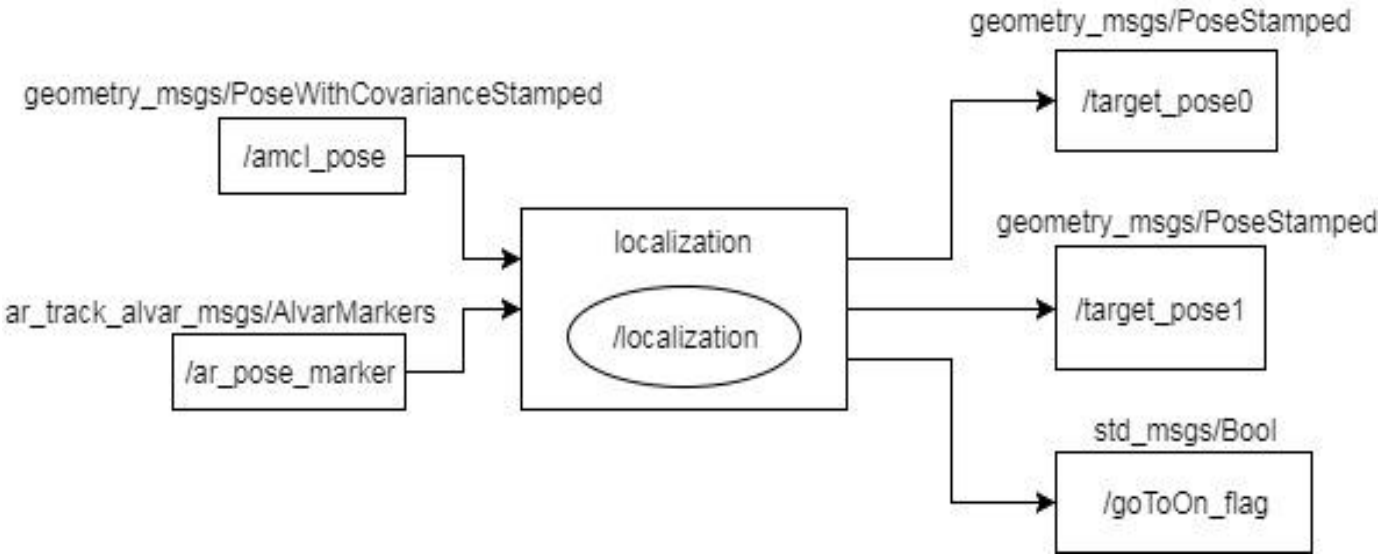

Start
Build the map of the environment
Start at one point and autonomously navigate to center of map
Rotate the turtlebot and simultaneously detect markers
rotation finished?
No
Yes
2 markers detected?
Yes
Navigate to marker0 near pick and place table
Notify VS team that turtlebot is ready for VS

Developed Nodes

- **goToPoint Node**

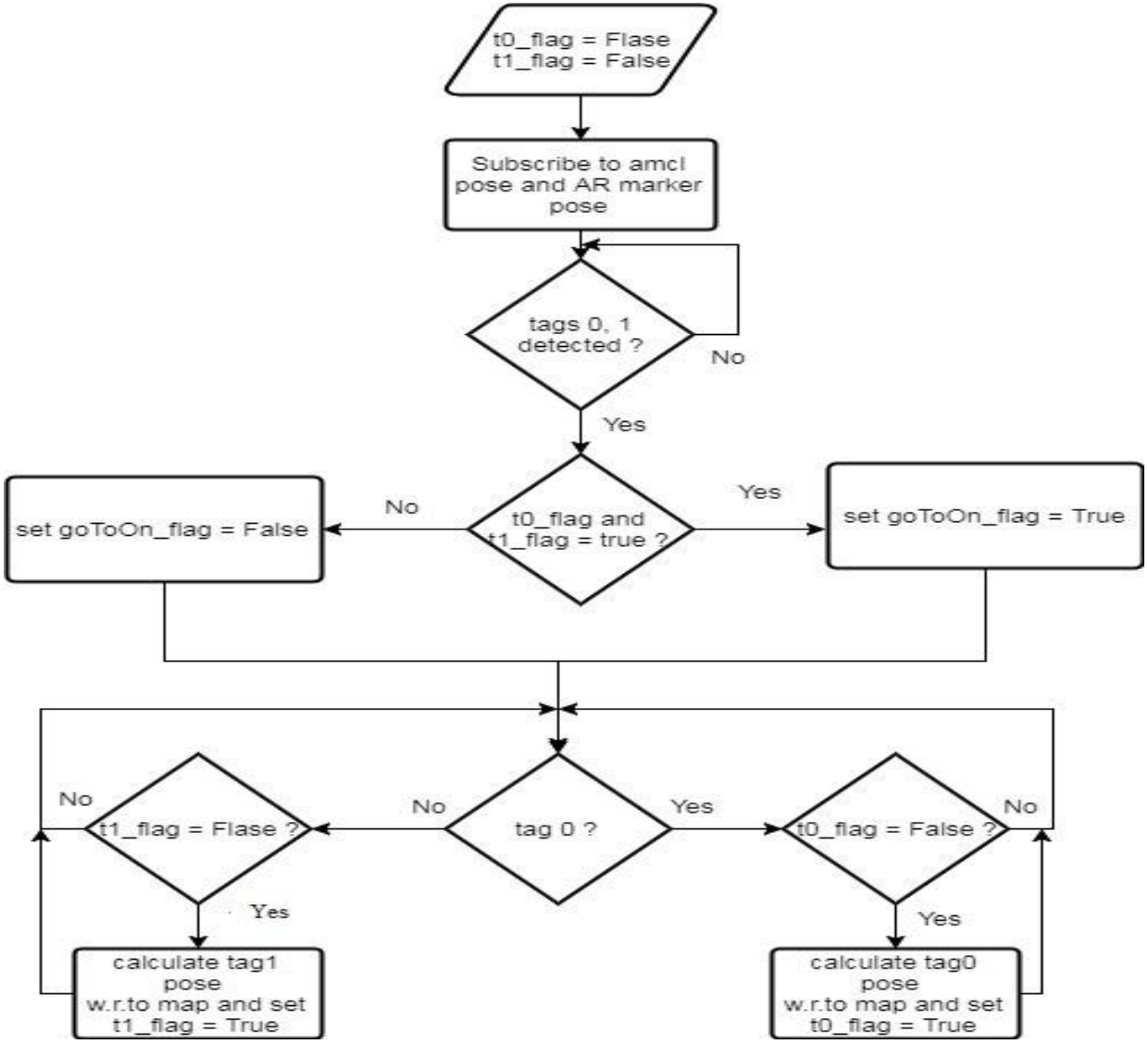


- **localization Node**



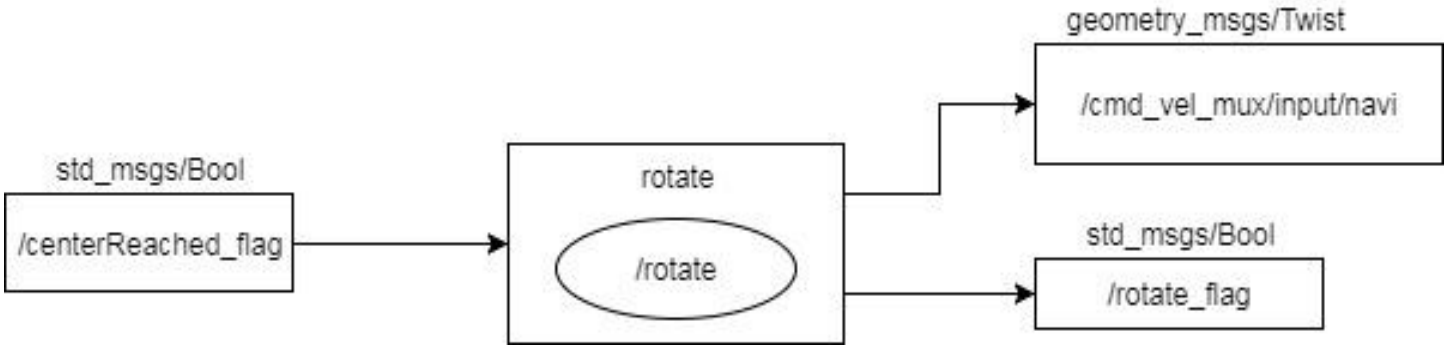
Developed Nodes contd…

- **localization Node Flowchart**

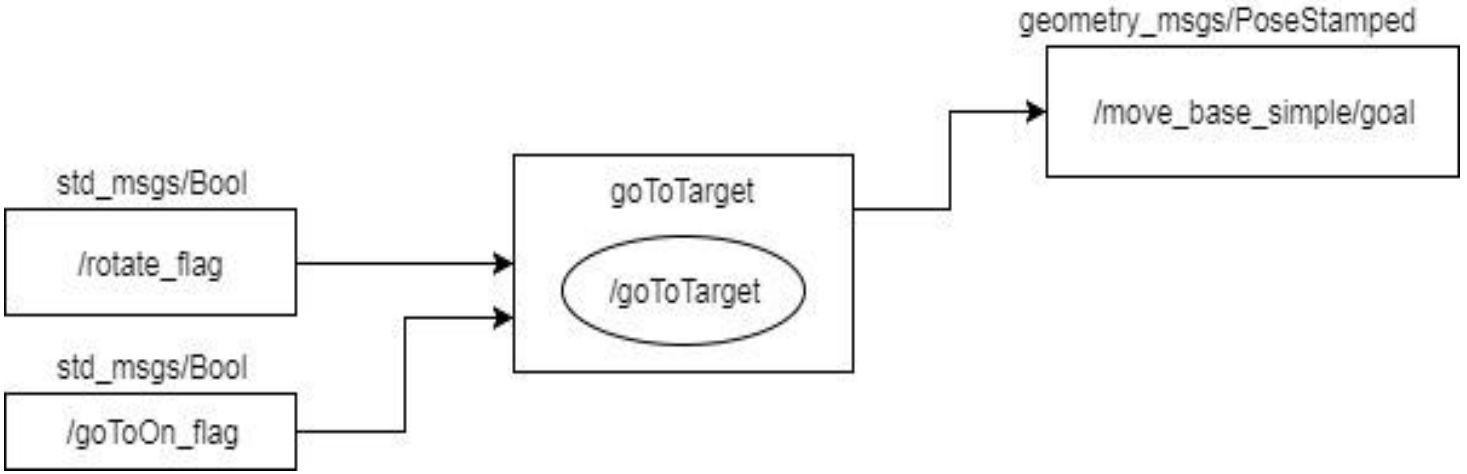


Developed Nodes contd…

- **rotate Node**

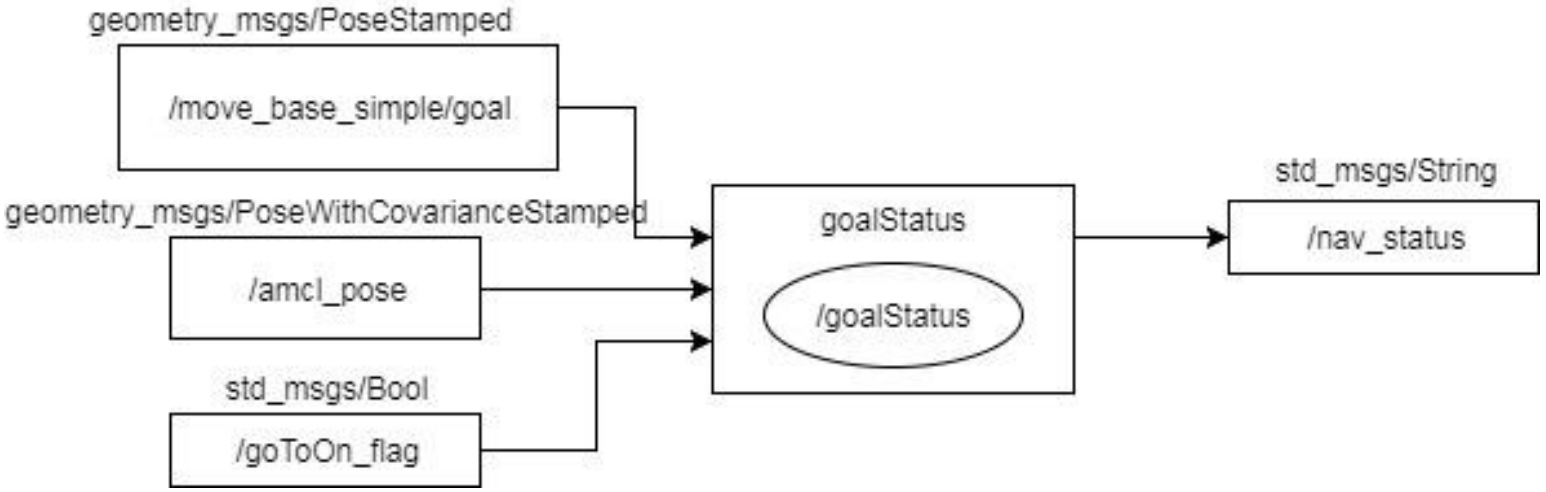


- **goToTarget Node**

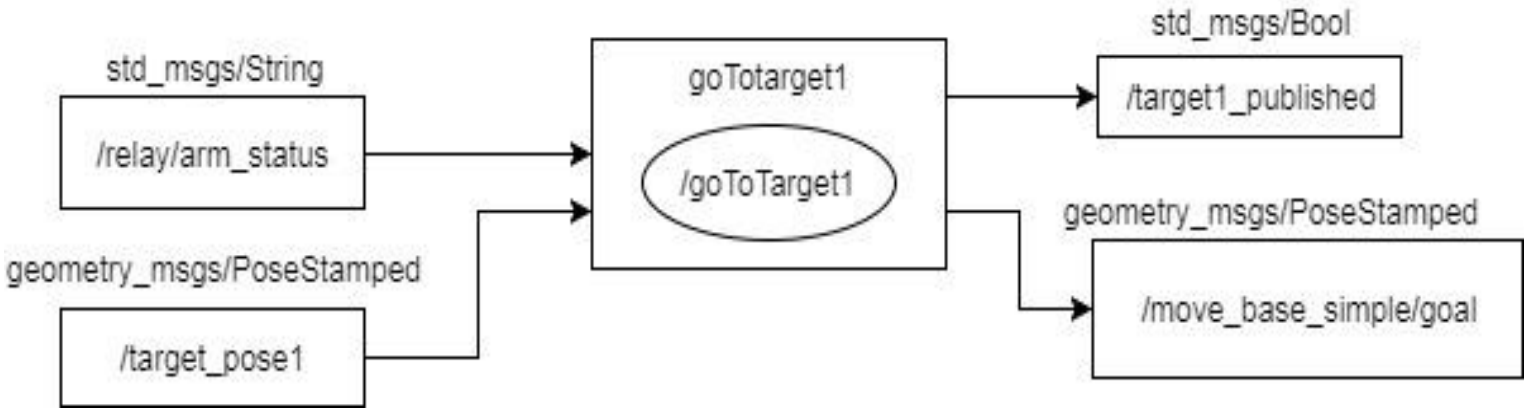


Developed Nodes contd…

- **goalStatus Node**

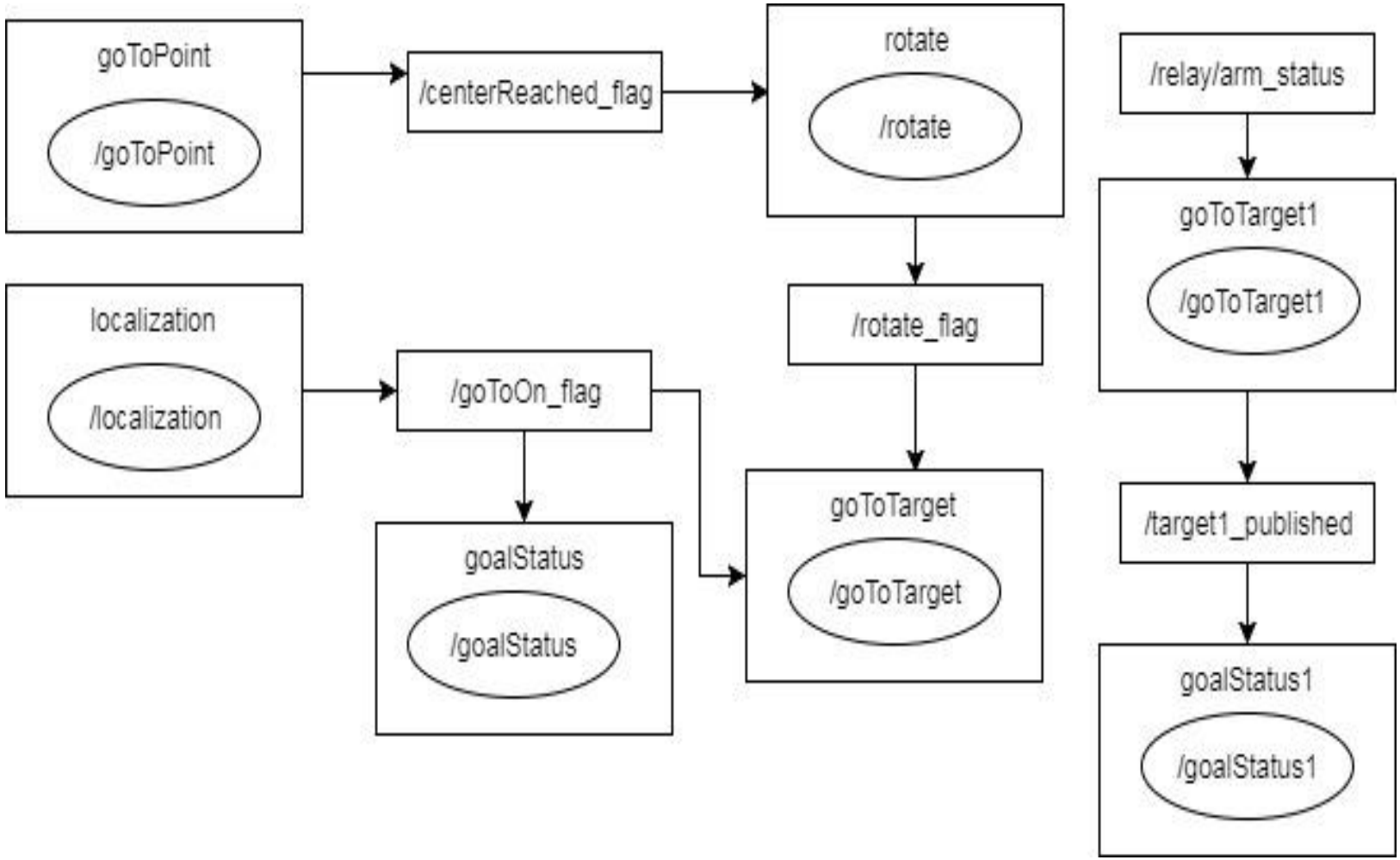


- **goTotarget1 Node**



Developed Nodes contd…

- **Communication between Nodes**



Problems faced

- ~~Running AMCL and AR_track_Alvar simultaneously~~ - Solved
- Pose of Marker – synchronous problem
- Running Multi-Master – Partially Solved

Let’s see how real world will behave with us

Conclusion

- Successfully Finished all of the tasks.
- No Hard Coding in Marker Pose Detection (Everything is Autonomous).
- Successfully merged our project with Visual Servoing Team.
- Successfully merged our project with Robotic Arm Team.

References

1. ROSWiki
2. StackOverFlow
3. Wikipedia

THANK YOU