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HUMAN ROBOT INTERACTION ON NAVIGATION PLATFORM USING ROBOT OPERATING SYSTEM

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Abstract :-

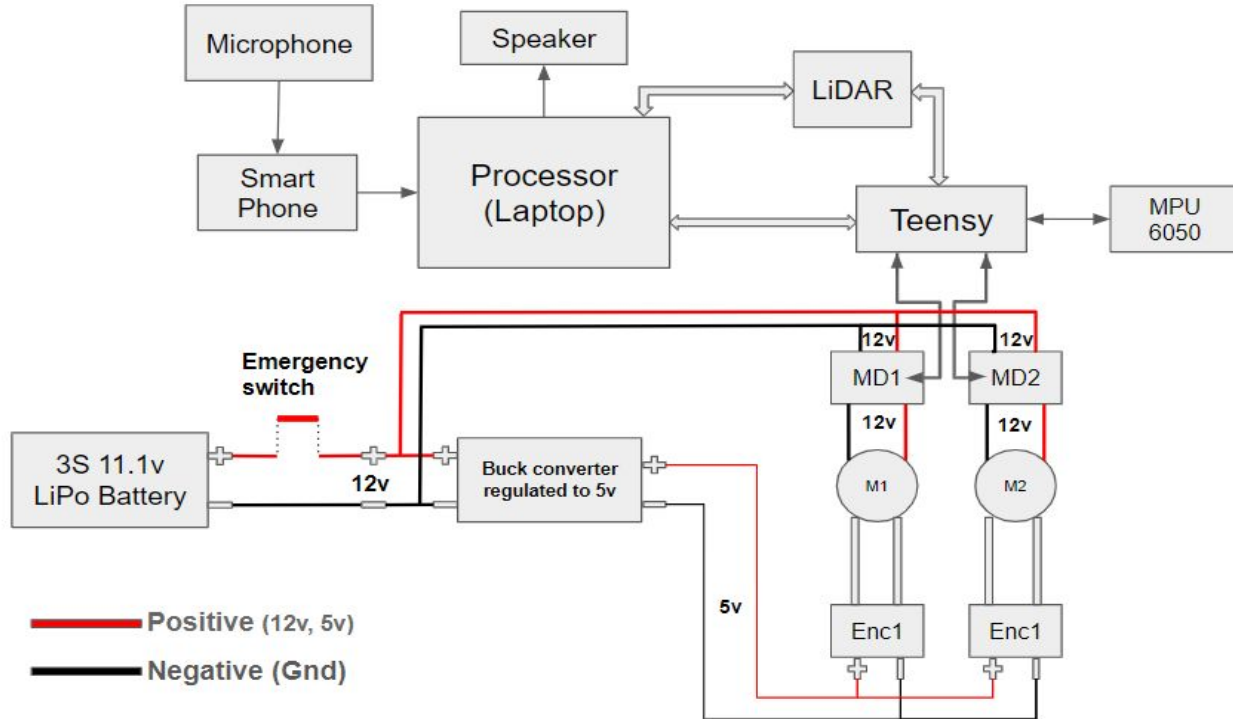
- Automation has been one of the leading and emerging technologies to develop sophisticated and robust robotic solutions.
- In these robots, the interaction between humans and robots is done through Human Robot Interaction(HRI).
- This research proposes the implementation and integration of Speech recognition on an autonomous navigation system using Robot Operating System(ROS) as a software platform.

Introduction:-

- There are many physical disabilities being experienced by people all around the world and Symbrachydactyly is one of those. By 2050, the world's population aged 60 years and older is expected to total 2 billion.
- Many joystick or app driven robots have been developed to solve this problem. But a person who is completely paralysed could not use them.
- So we have implemented and integrated a Human Robot Interaction(HRI) on an autonomous navigation system using Robot Operating System (ROS).

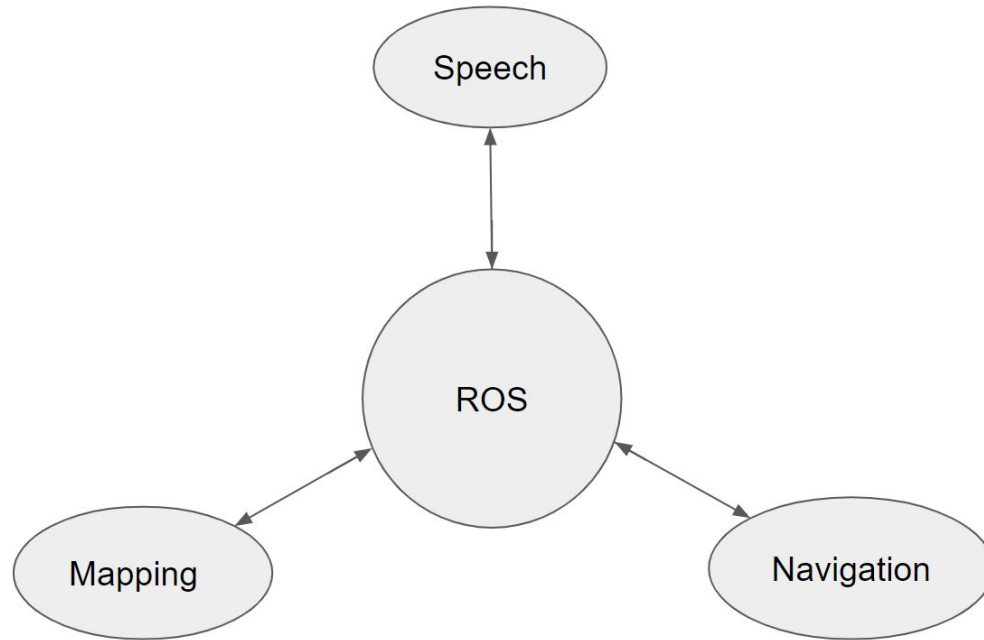
System Architecture

Hardware Architecture:-

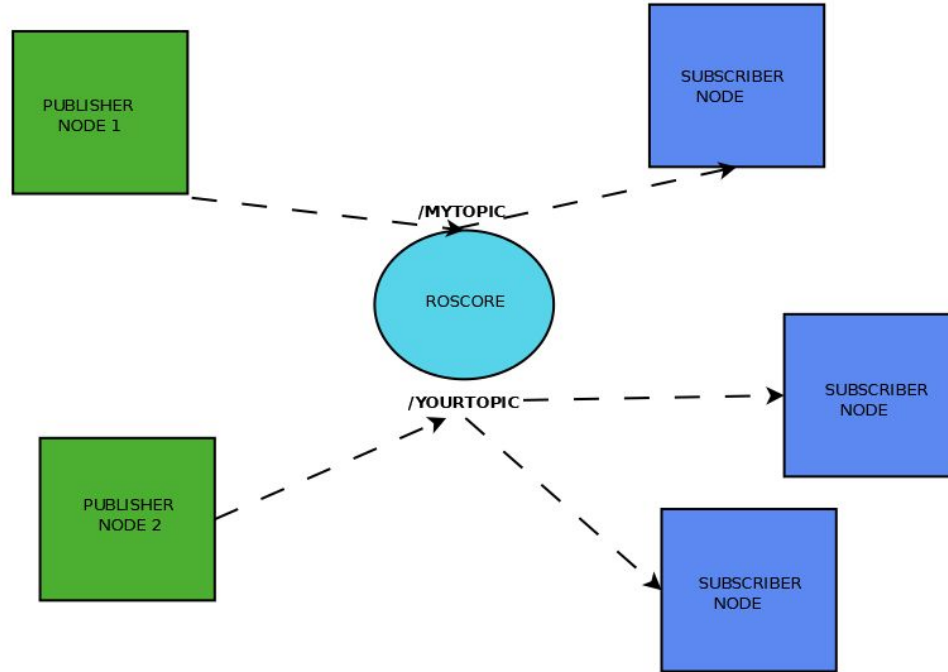


System Architecture

Software Architecture:-



Robot Operating System (ROS):-



Speech Recognition:-

- As Smart phones are becoming part of our day to day lives, they become the best interface for the user to communicate with robot.
- Speech synthesis is done through,

Android speech application : Speech recognition of the system is developed using “Android Speech Recognition”, an android application implemented in Java. Works on the principle that sequential recognition models such as Hidden Markov Model (HMM) which is supported by Viterbi Algorithm to choose the most probable output.

IBM_Watson : It was developed by IBM’s DeepQA project team, in which this system is capable of answering predefined questions. There are certain parameters like intents and entities which helps to establish the required dialog.

Text-to-speech Conversion : This conversion of text to speech takes place in 2 steps.

front end - Tokenization and phonetic transcription

back end - Output of the front end to sound.

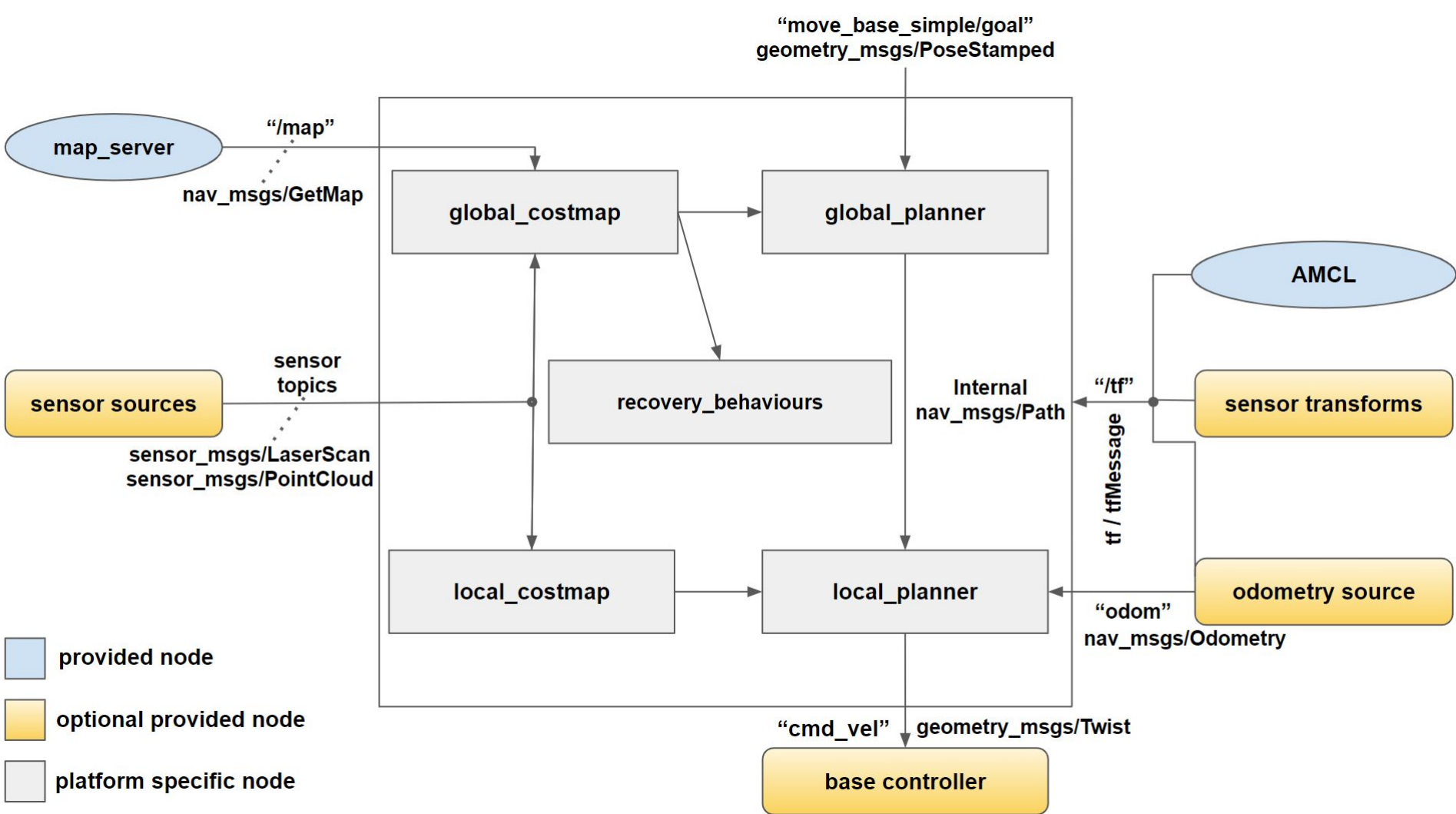
Navigation

Simultaneous Localisation and mapping:-

- SLAM (Simultaneous Localisation and mapping) means generating and updating a map of the real unknown environment.
- There are many algorithms such as Gmapping, Hector_slam, google_cartographer, core_slam, RGB-D slam for mapping wherein we preferred Gmapping algorithm to others.

Localization:-

- To obtain the current pose of the robot Adaptive Monte Carlo Localisation (AMCL) algorithm is used.
- AMCL uses a particle filter to track the position of the robot by matching the points on the map to the laserscan_data.



Navigation

The shortest path to reach the desired goal is done through Dijkstra's algorithm.

The main tasks that are used for navigation are

1. Global Planner
2. Local Planner
3. Recovery Behaviour

Integrated module

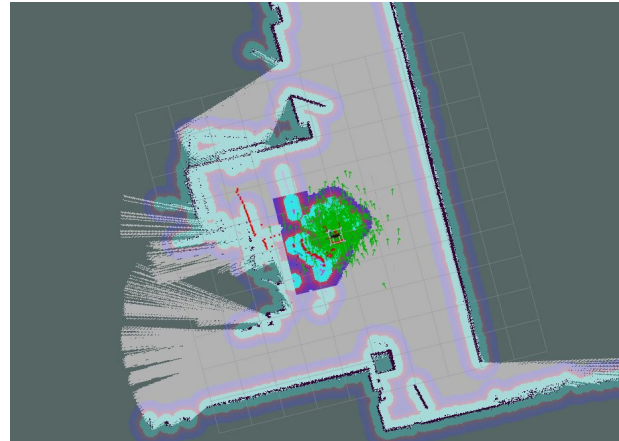
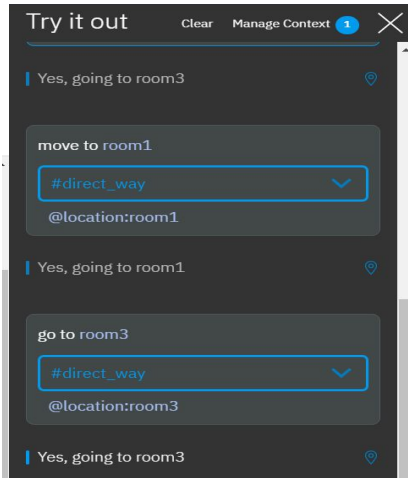
Android app will be containing IP address of the WiFi network and port number of the user's smartphone. The recognised speech is converted to text and sent to IBM_Watson. From there predefined coordinates are published to move_base.

Example:-

If the command is “Can you go to the kitchen?”, the keywords ‘go’ and ‘kitchen’ is recognized by the system and processing takes place. By doing the process, the robot navigates to the specified location.

Conclusion:-

- The integration of speech recognition and autonomous navigation platform will be an ideal system to serve for the disabled and physically handicapped people.
- The implementation of the whole system in dynamic environments procured efficient and accurate results.



Future works

- The accuracy of navigation to the desired location is tested in different environments and conditions where it was observed that accuracy varies with the change in IMU model.
- By using some sophisticated algorithms and machine learning techniques, the robot can be trained and tested simultaneously.
- Combining the visual data with the odometry data to achieve high accuracy navigation.
- Filters can be added to the microphone for much efficient speech recognition.

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Thank you