

1.2 Interface development

1.3 Human Robot Interaction

1.4 Manipulation

1.5 Navigation

1.8 Project
Management

1.7 Testing and Integration

1.1 Software Support Systems

1.6 Hardware

1.2 Interface development

1.2.1 Robot Display

1.2.2 Handheld Interface

1.8 Project Management

1.8.1 Work management

1.8.2 Manage schedule

1.8.3 Manage budget

1.8.4 Manage risk

1.3 Human Robot Interaction

1.3.1 Speech Recognition

1.3.2 Template based language interpretation

1.2.4 Text Response Generator

1.7 Testing and Integration

1.7.1 Testing

1.7.2 Integration

1.4 Manipulation

1.4.1 Perception

1.4.2 Multi-joint Motion planning for manipulator

1.4.3 Controller for Manipulator

1.1 Software Support Systems

1.1.1 Setup simulator environment

1.1.2 Develop automated testing systems

1.1.2 Develop software architectures

1.1.4 Data Collection

1.5 Navigation

1.5.1 Perception

1.5.2 Motion planning

1.4.3 Controller

1.6 Hardware

1.6.1 Embedded Computer

1.6.2 Robot display gimbal

1.6.3 Setup test environment

1.6.3 Gripper Camera

1.2 Interface development

1.2.1 Robot Display

1.2.1.1 Design UI/UX

1.2.1.2 Develop UI/UX

1.2.1.3 Implement communication APIs

1.2.2 Handheld Interface

1.2.2.1 Design UI/UX

1.2.2.2 Develop UI/UX

1.2.2.3 Implement communication APIs

1.8 Project Management

1.8.1 Work management

1.8.2 Manage schedule

1.8.3 Manage budget

1.8.4 Manage risk

1.3 Human Robot Interaction

1.3.1 Speech Recognition

1.3.1.1 Develop trigger word algorithm

1.3.1.2 Develop speech to text algorithm

1.3.2 Template based language interpretation

1.2.2.2 Task allocation from interpreted language

1.2.4 Text Response Generator

1.7 Testing and Integration

1.7.1 Testing

1.7.1.1 Teleoperation Testing

1.7.1.2 Simulation tests

1.7.1.3 Unit tests

1.7.1.4 Subsystem tests

1.7.1.5 System Integration tests

1.7.2 Integration

1.7.2.1 Subsystem integration

1.7.2.2 System integration

1.4 Manipulation

1.4.1 Perception

1.4.1.1 Object detection

1.4.1.2 Object pose estimation

1.4.1.3 Grasp Estimation

1.4.2 Multi-joint Motion planning for manipulator

1.4.3 Controller for Manipulator

1.1 Software Support Systems

1.1.1 Setup simulator environment

1.1.2 Develop automated testing systems

1.1.2 Develop software architectures

1.1.4 Data Collection

1.1.4.1 Environment Mapping

1.1.4.2 Object dataset collection

1.1.4.2 Wake word dataset collection

1.5 Navigation

1.5.1 Perception

1.5.1.1 Obstacle Detector

1.5.1.2 Visual and LiDAR localization

1.5.1.3 Sensor fusion: Odometry, LiDAR, Camera

1.5.2 Motion planning

1.5.2.1 High level path planning

1.5.2.2 Low level path planning (obstacle avoidance)

1.4.3 Controller

1.6 Hardware

1.6.1 Embedded Computer

1.6.1.1 Processor mount design

1.6.1.2 Communication pipeline design

1.6.2 Robot display gimbal

1.6.3 Setup test environment

1.6.3 Gripper Camera

1.6.3.1 Design camera mount

1.6.3.2 Software for gripper camera