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General Solution To Find Objects

D2: Revised Initial Presentation

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Contents

Problem Statement

The problem being addressed is described as follows:-

- Navigate through multiple coordinates in knowledge base based on ontology to find specified object
- Perceive the required object
- Fetch the user specified object and navigate back to user

Project Goals

- Implement a general strategy to find object
  - Navigate through “storage locations”
  - Perceive scenes to look for specified object(s)
  - Move to next location if object not found
- Fetch object and bring back to original location

User Stories

Priority: High	**[US01]: Detecting objects**	**Estimation: 3 weeks**
Requirements: As a user of robot, We want to detect objects, So that the robot can pick up the user-specified object and bring it back to the user.		**Acceptance Criteria:** Given a location with multiple objects, the robot has to detect different objects present in the location using the embedding calculation.
Risk: High		**Real Effort:**

User Stories

Priority: High	**[US02]: Find objects**	**Estimation: 2 weeks**
Requirements: As a user of robot, We want the robot to find a particular object from the set of detected objects, so that the robot can fetch the object to the user.		**Acceptance Criteria:** Given a set of detected objects the robot has to find the user-specified object by comparing the detected objects with the input data.
Risk: High		**Real Effort:**

User Stories

Priority: High	**[US03]: Navigation**	**Estimation: 2 weeks**
Requirements: As a user of robot, We want the robot to navigate through different given locations, So that the robot can perceive for different objects.	**Acceptance Criteria:** Given a set of locations in the knowledge base the robot has to navigate through all the locations to find the user specified object.	
Risk: Medium	**Real Effort:**	

User Stories

Priority: High	**[US04]:Move to next location**	**Estimation: 2 week**
Requirements: As a user of robot, we want the robot to move to the next unvisited locations in the knowledge base, if the user specified object is not detected.	**Acceptance Criteria:** Given a set of detected objects, if the user specified object is not found, then the robot shall move to the next unvisited location in the knowledge base.	
Risk: Medium	**Real Effort:**	

User Stories

Priority: Low	**[US05]: Fetch object (Optional)**	**Estimation:3 weeks**
Requirements: As a user of robot, we want the robot to pick the user-specified object so that the item can be brought back to the user.		**Acceptance Criteria:** The robot shall be able to estimate the pose of the detected user-specified object.
Risk: High		**Real Effort:**

User Stories

Priority: Low	**[US06]: Bring object back to user (Optional)**	**Estimation:2 weeks**
Requirements: As a user of robot, we want the robot to bring the picked item to the user so that the request of the user can be fulfilled.		**Acceptance Criteria:** The robot must know the location of the user.
Risk: High		**Real Effort:**

Minimum Viable Prototype

- Given a user specified choice(string), the software shall return all the default locations (strings) relative to the specified item based on the ontology structure.
- We have to interpret the default location in the knowledge base to the natural location in the ontology.
- After obtaining the co-ordinates of the respective locations the robot shall navigate through all of the respective returned locations.

Minimum Viable Prototype

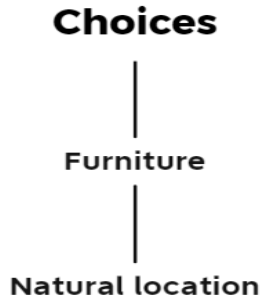


Figure 1: General structure

Minimum Viable Prototype

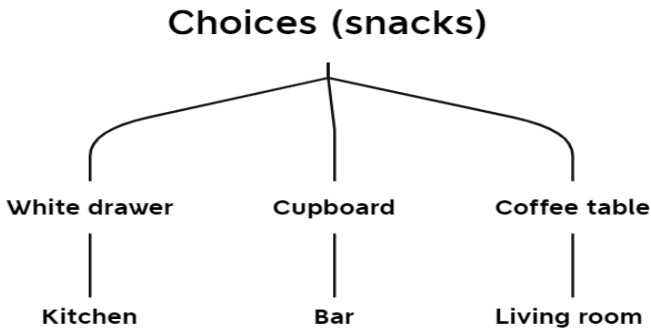


Figure 2: Example structure

Minimum Viable Prototype

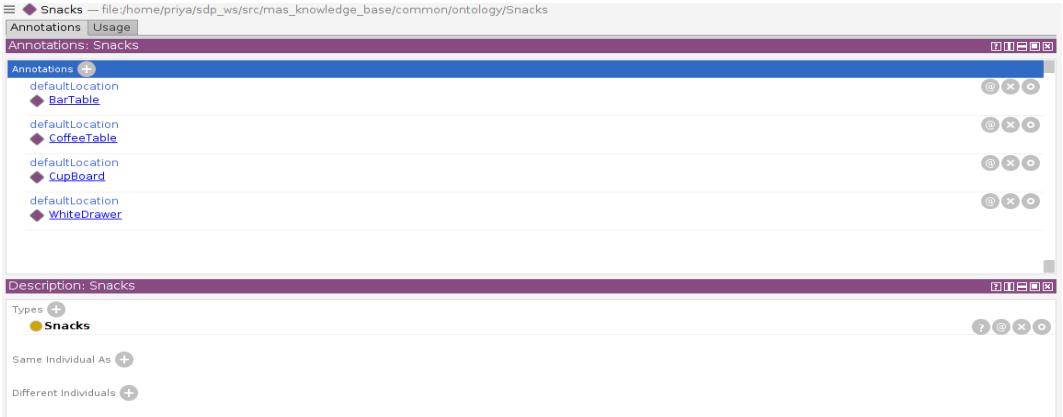


Figure 3: Item default locations

Minimum Viable Prototype

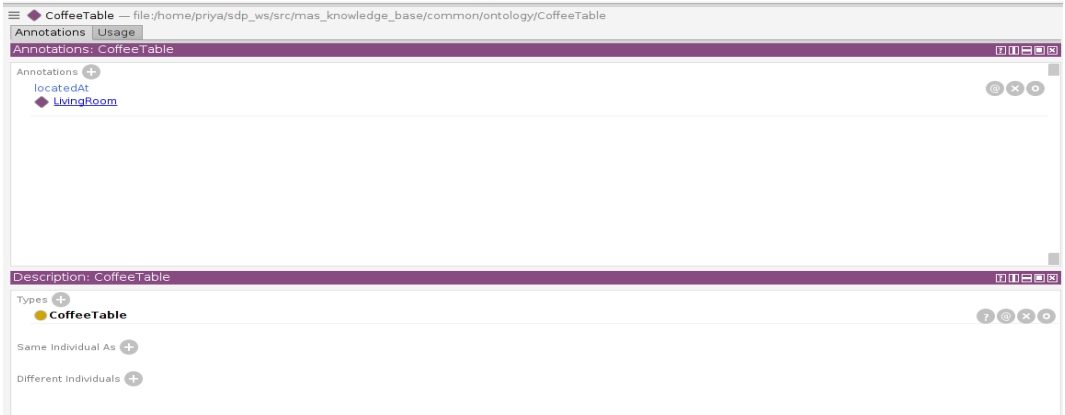
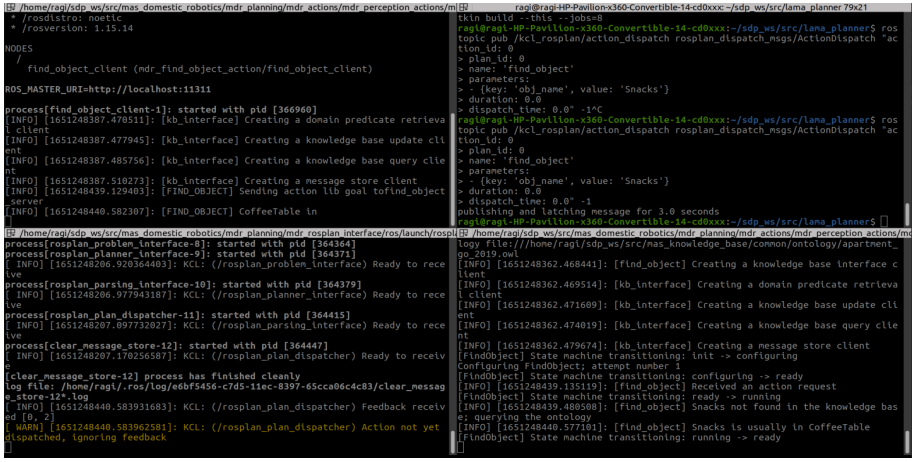
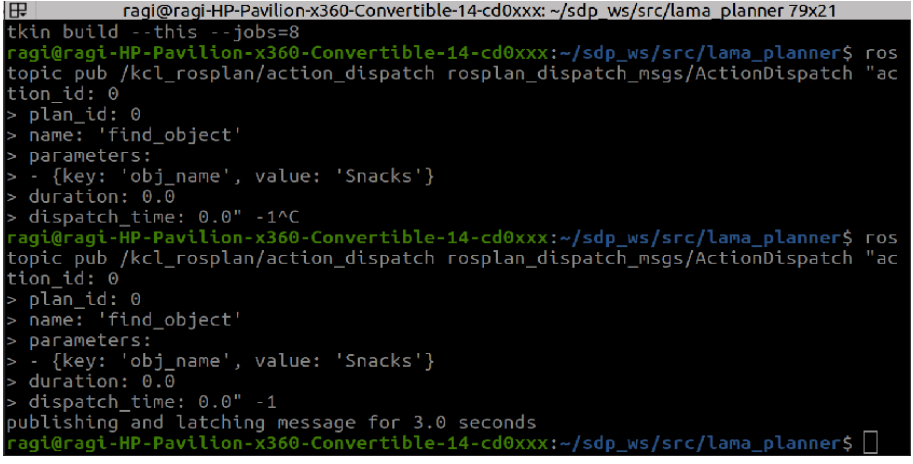


Figure 4: Object-location relation

Project Progress



Project Progress



Project Progress

```
/home/ragi/sdp_ws/src/mas_domestic_robotics/mdr_planning/mdr_actions/mdr_perception_actions/r
 * /rosdistro: noetic
 * /rosversion: 1.15.14

NODES
  /
    find_object_client (mdr_find_object_action/find_object_client)

ROS_MASTER_URI=http://localhost:11311

process[find_object_client-1]: started with pid [366960]
[INFO] [1651248387.470511]: [kb_interface] Creating a domain predicate retrieva
l client
[INFO] [1651248387.477945]: [kb_interface] Creating a knowledge base update cli
ent
[INFO] [1651248387.485756]: [kb_interface] Creating a knowledge base query clie
nt
[INFO] [1651248387.510273]: [kb_interface] Creating a message store client
[INFO] [1651248439.129403]: [FIND_OBJECT] Sending action lib goal tofind_object
_server
[INFO] [1651248440.582307]: [FIND_OBJECT] CoffeeTable in
```

Project Progress

```
/home/ragi/sdp_ws/src/mas_domestic_robotics/mdr_planning/mdr_actions/mdr_perception_actions/m
logy file:///home/ragi/sdp_ws/src/mas_knowledge_base/common/ontology/apartment_
go_2019.owl
[INFO] [1651248362.468441]: [find_object] Creating a knowledge base interface c
lient
[INFO] [1651248362.469514]: [kb_interface] Creating a domain predicate retrieva
l client
[INFO] [1651248362.471609]: [kb_interface] Creating a knowledge base update cli
ent
[INFO] [1651248362.474019]: [kb_interface] Creating a knowledge base query clie
nt
[INFO] [1651248362.479674]: [kb_interface] Creating a message store client
[FindObject] State machine transitioning: init -> configuring
Configuring FindObject; attempt number 1
[FindObject] State machine transitioning: configuring -> ready
[INFO] [1651248439.135119]: [find_object] Received an action request
[FindObject] State machine transitioning: ready -> running
[INFO] [1651248439.480508]: [find_object] Snacks not found in the knowledge bas
e; querying the ontology
[INFO] [1651248440.577101]: [find_object] Snacks is usually in CoffeeTable
[FindObject] State machine transitioning: running -> ready
```

Planned Steps

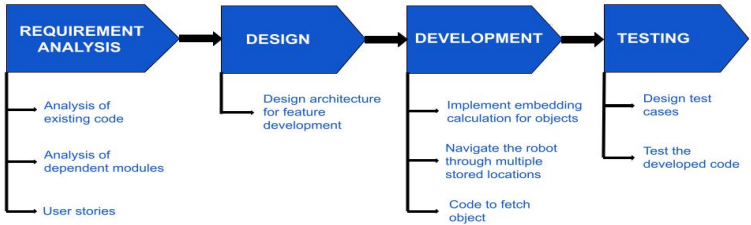


Figure 5: Workflow

Means of Collaboration

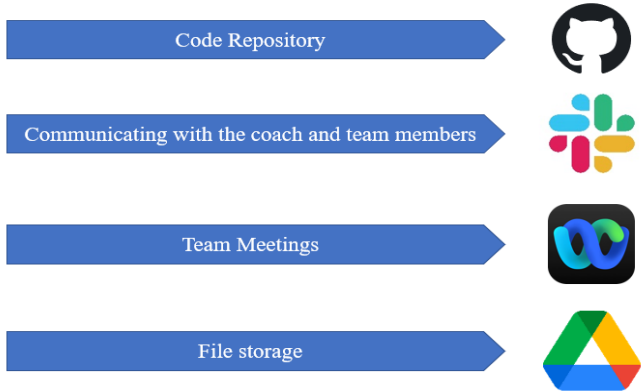


Figure 6: Means of collaboration

Technologies Used

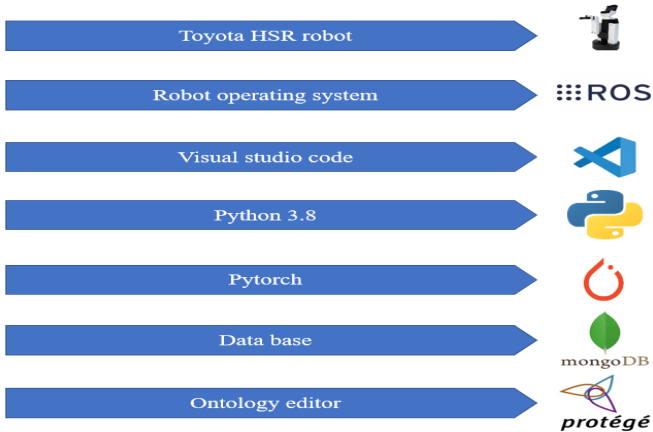


Figure 7: Technologies used

Timeline and Release Plan

TASK	ASSIGNED TO	PROGRESS	START	END
Requirement Analysis				
Task 1	Analyse the existing code	70%	4-19-22	5-7-22
Task 2	Analyse the dependent module	60%	4-22-22	4-24-22
Task 3	Prepared Deliverables	75%	4-19-22	4-25-22
Task 4	Understanding ontology structure	30%	5-6-22	5-16-22
Design				
Task 1	Design structural architecture for dependant module	0%	5-7-22	5-20-22
Development				
Task 1	Ontology Structure	0%	5-2-22	5-17-22
Task 2	Run object detection pipeline	0%	6-10-22	7-20-22
Task 3	Add navigation to mdr_find_object	0%	5-10-22	6-13-22
Task 4	Run knowledge base to get locations	0%	5-15-22	6-10-22
Task 5	Implement embedding calculations for object detection	0%	6-1-22	8-15-22
Task 6	Fetch the object	0%	6-1-22	7-15-22
Task 7	Navigate back to user	0%	7-15-22	8-15-22
Testing				
Task 1	Test for ontological structure	0%	5-15-22	6-16-22
Task 2	Test to check natural location	0%	6-1-22	6-20-22
Task 3	Testing Navigation	0%	5-9-22	6-16-22
Task 4	Testing Fetching	0%	7-15-22	9-12-22
Task 5	Run the code on lucy	0%	7-15-22	9-12-22

Figure 8: Decided Dates and Tasks

Timeline and Release Plan

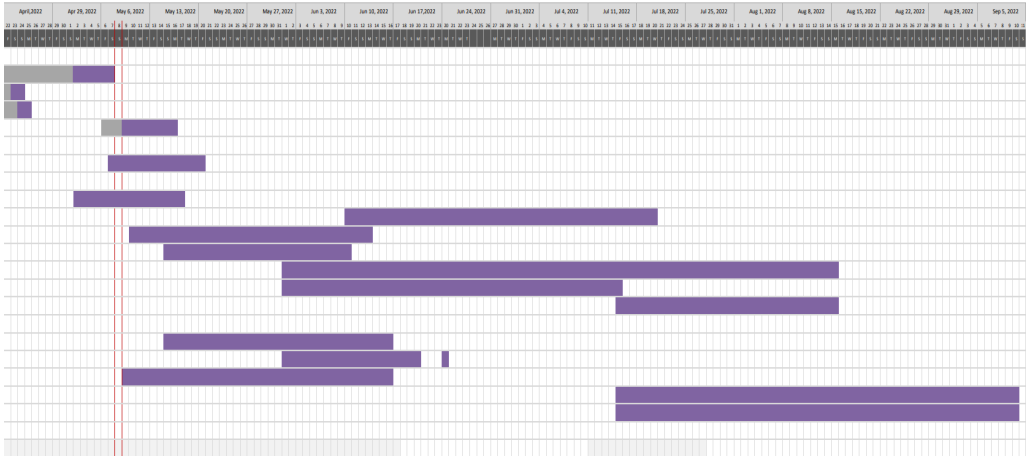


Figure 9: Gantt Chart

Thank You!