California State University
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Computer Science

Nao Sorter Design Specification

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Contents

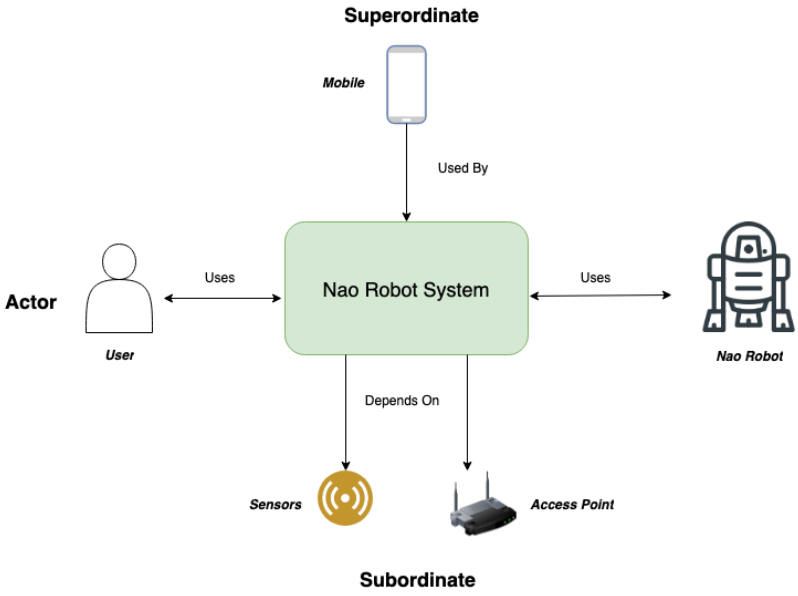
1 Abstract

This is the Design Specification for the NAO robot. The Design Specification for the NAO robot describes the system elements, data storage, functions, and configuration required by the NAO robot through the use of various diagrams. These diagrams will be used to adhere to the functionality described in the functional requirements. The Design Specification was created from a top down approach as well as from the usage models(5-5.1) described in the Requirement Specification.

2 Architecture Overview Diagram

2.1 Description

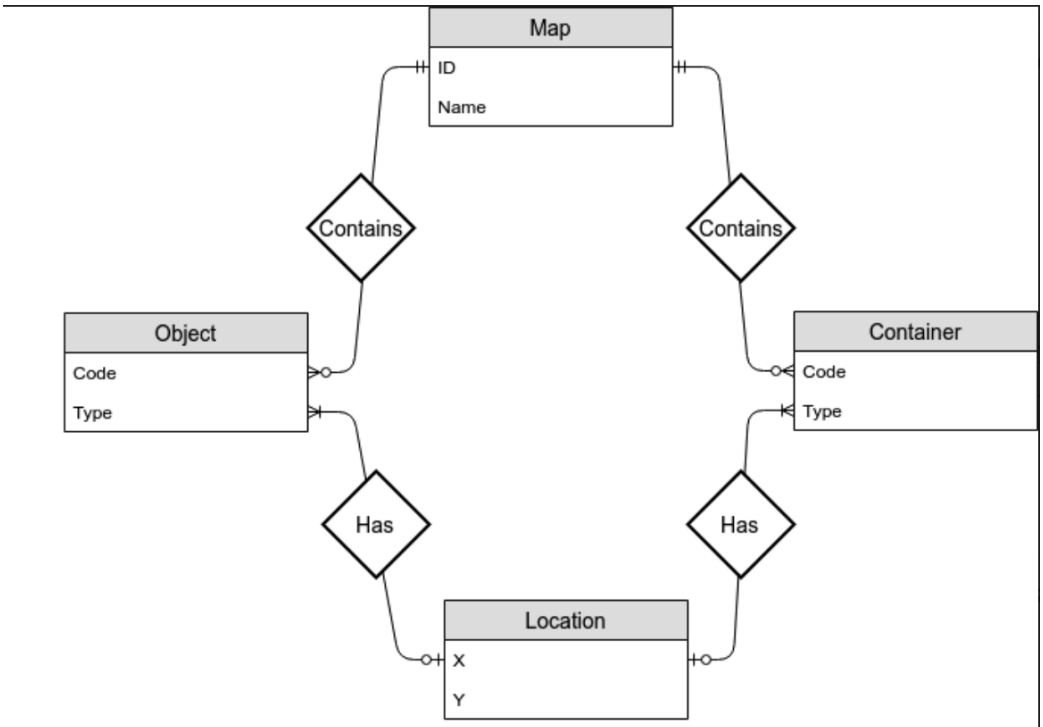
The Architecture Diagram is composed of the Actor, super-ordinate device, and the subordinate devices interacting with the NAO Robot System to control the NAO Robot. The actor is the user who interacts with the system via his/her mobile phone (super-ordinate), and the subordinate devices consists of sensors available to the NAO Robot and Access Point in which the system is connected to. All of these together allow the user to control the NAO Robot.



3 ER diagram

3.1 Description

This is a graphical representation of the entities used in NAO Robot and their relationships to each other, as well as the assumptions made.



Assumptions:

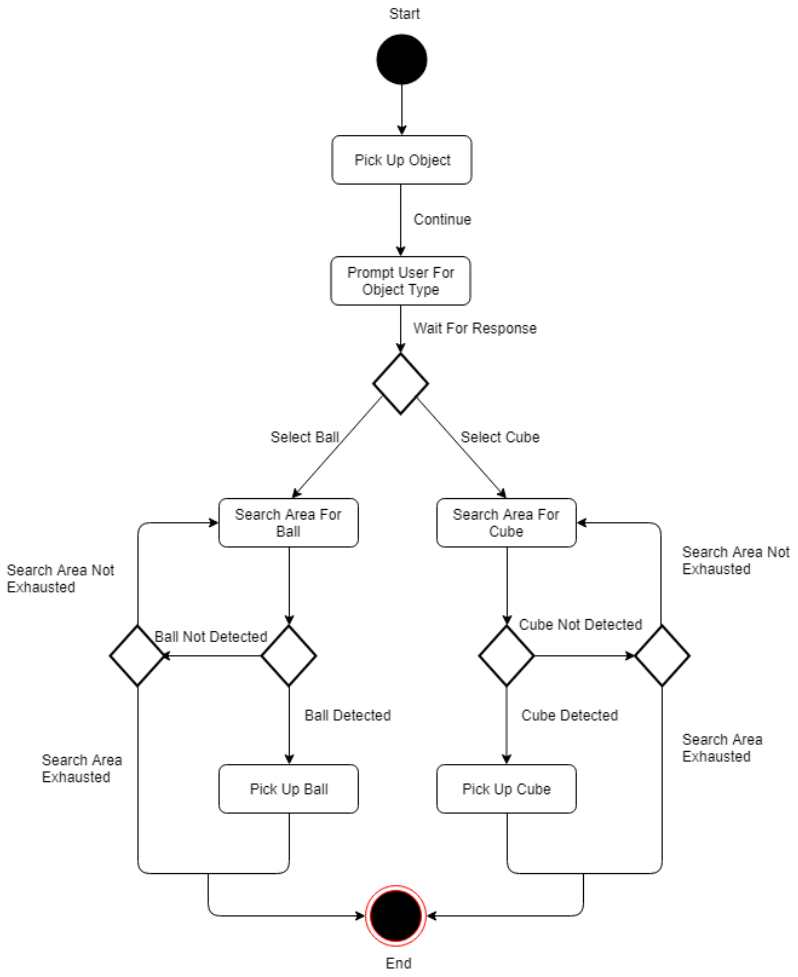
- Objects and Containers might not have known locations at the time.
- A Map might be unexplored or explored. If unexplored the number of objects and containers inside of it are unknown.

4 Activity diagrams

4.1 Pick Up Object

4.1.1 Description

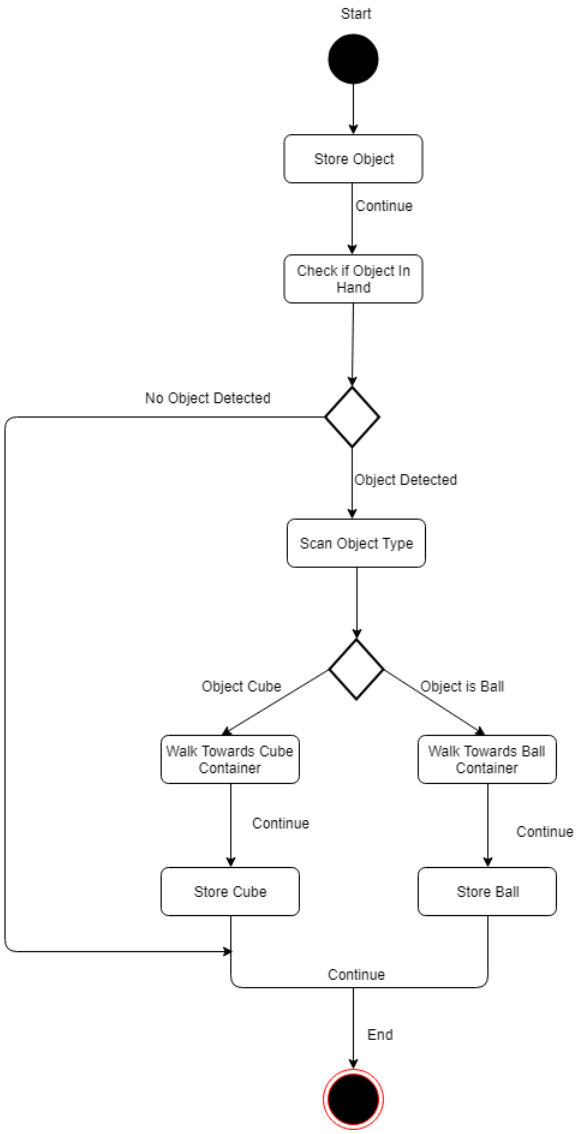
This diagram describes the control flow activity of how the NAO Robot picks up an object. First, prompting the user for what type of object to pick up, then it searches for the specified object until its found or it has exhausted the search area.



4.2 Store Object

4.2.1 Description

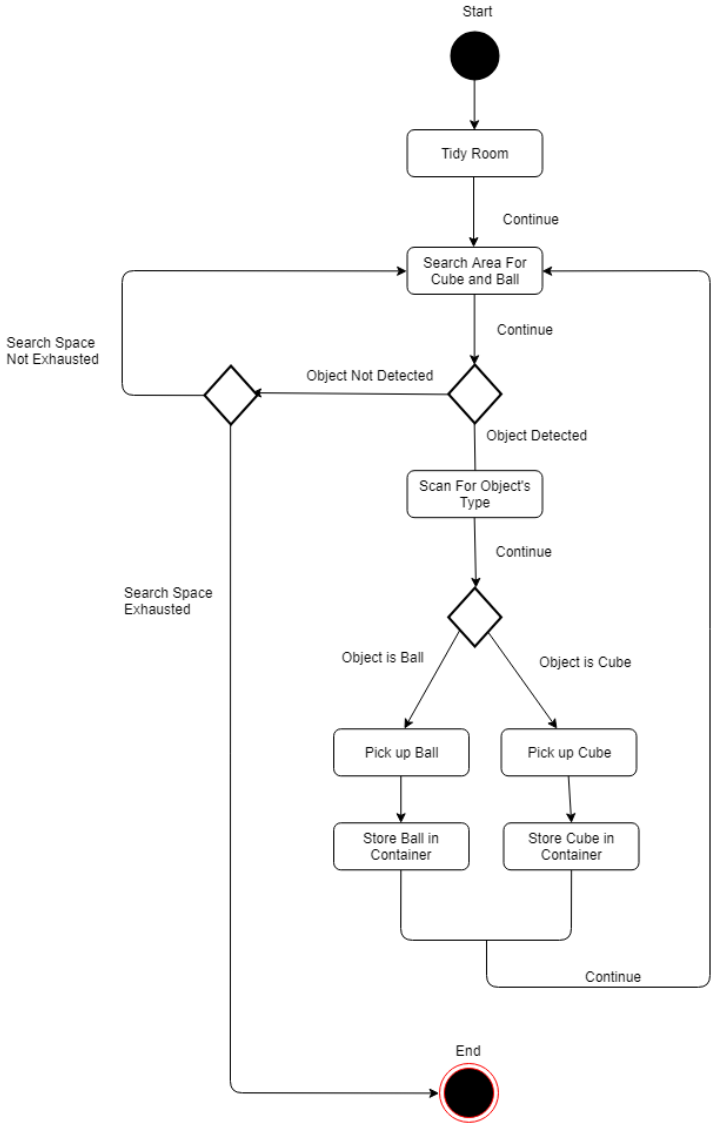
This diagram describes the control flow activity of how the NAO Robot stores an object. First, checking if its hand has an object available; if an object is in its hand, it simply stores it in the appropriate container, otherwise it just goes to the end state.



4.3 Tidy Room

4.3.1 Description

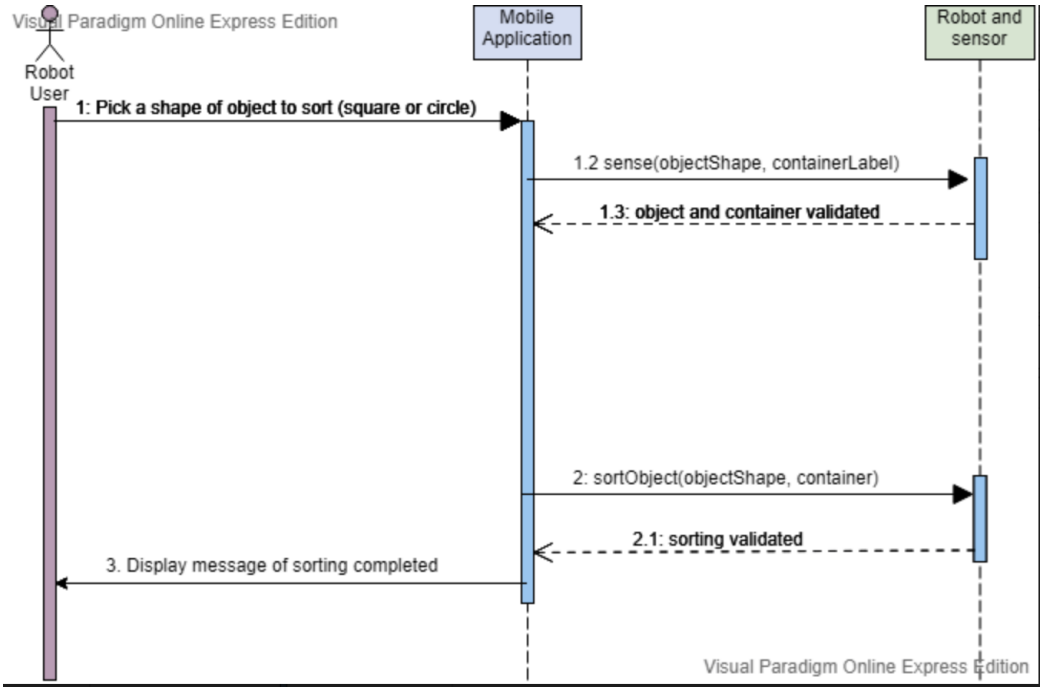
This diagram describes the control flow activity of how the NAO Robot tidies an area. First, it searches for a ball or a cube object, and upon finding an object, it stores it in the appropriate container; all while continually checking if the search area has been exhausted in between searches.



5 Message sequence chart

5.1 Description

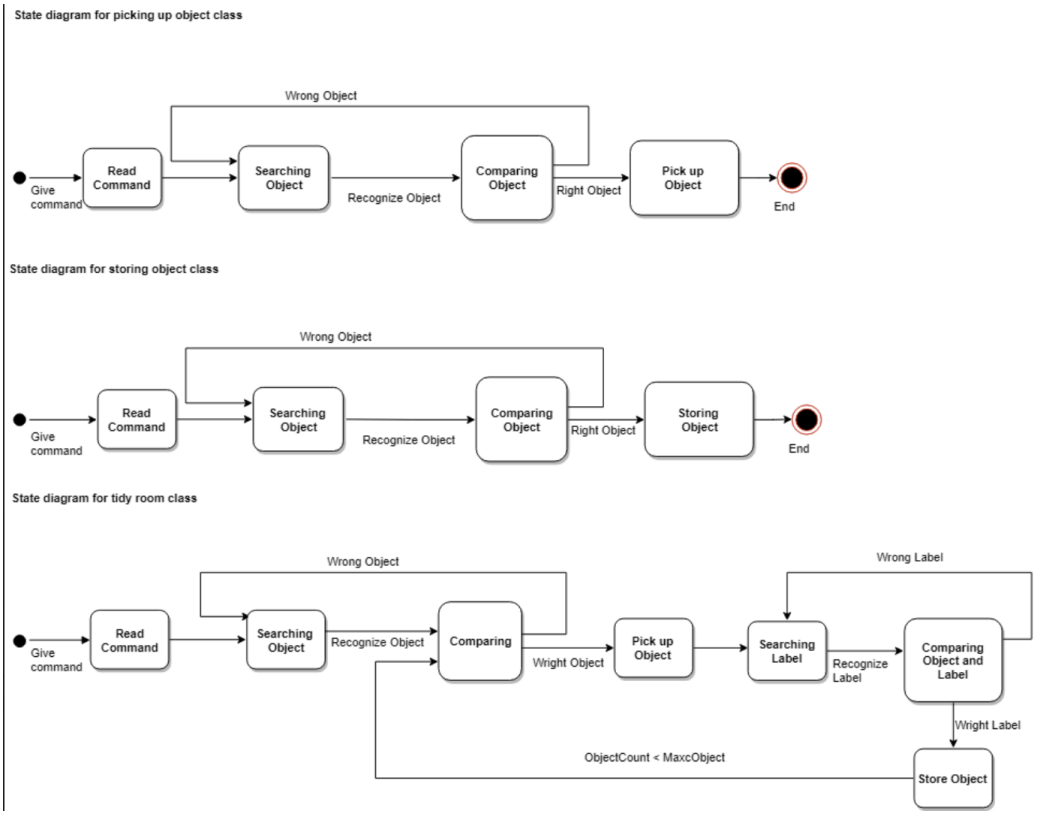
The main case of user in the message sequence chart is to select the shape of object to sorting (for the NAO Robot to pick up and drop off). The user can select the shape of object and container via mobile application. Mobile application will tell the robot to use the sensor and will search through the environment. When the robot is complete sorting, it will sent the signal to the mobile application. The mobile application will display the message to the user that the task is completed.



6 State Diagram

6.1 Description

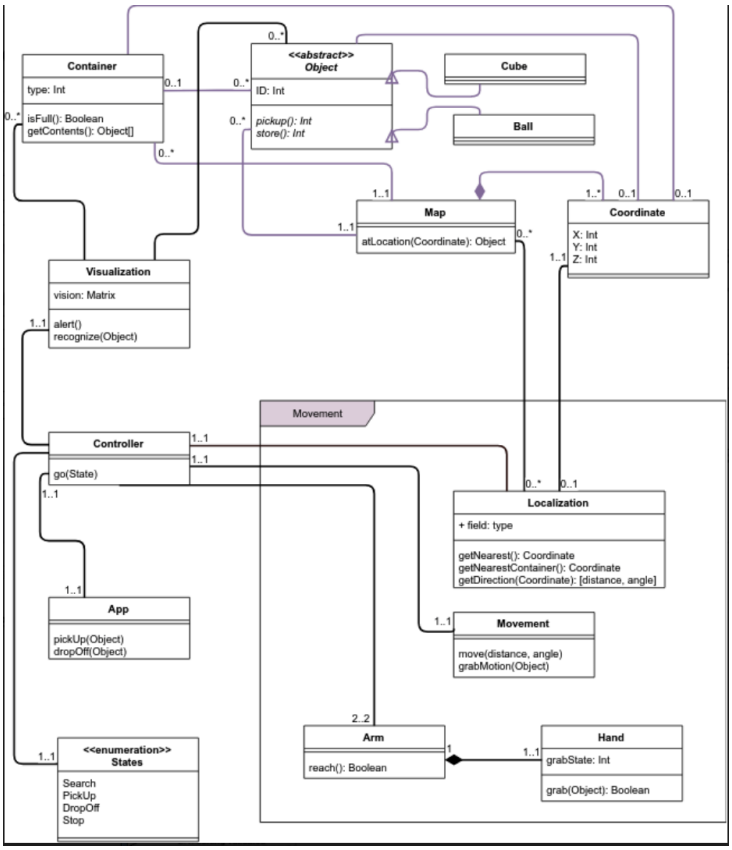
Our state diagram consists of multiple state diagrams, each state diagram shows behavior of each class. State diagram is started by user command, then it moves from one state to another state. In order for transition occur, it has to satisfy the given conditions. Storing object and pick up state diagrams ends when it hit the end point, but the tidy room state diagram will be ended if ObjectCount ¿= ObjectMax.



7 Class Diagram

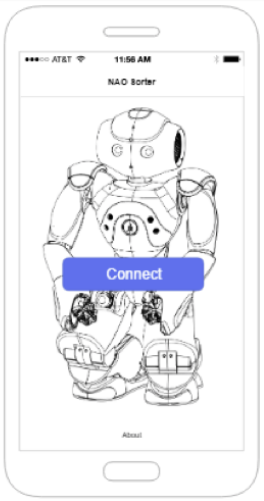
7.1 Description

This diagram describes the implementation of the system with regards to the classes that are created and how they will interact. The user is encouraged to start in the Controller class, as that is the class that ties everything together. The Controller class interacts with classes from the Movement package in regards to anything to do with moving the NAO robot in any way or localizing where the NAO robot is. The Visualization class alerts the controller class of any objects of interest. The Controller class functions in regards to what State the NAO robot is in. All the classes that use the purple to connect are data classes.

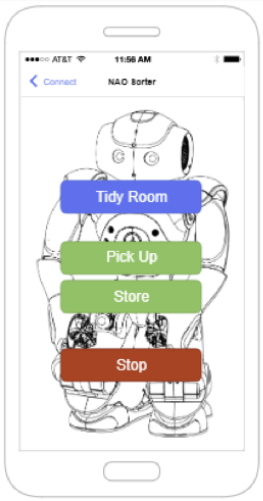


8 Mockups

Main page (not connected):



Main page (connected):

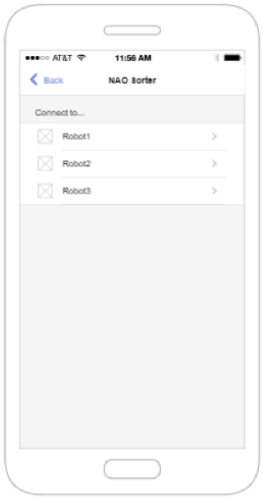


Without a connection to a robot, the application starts on the connect screen.

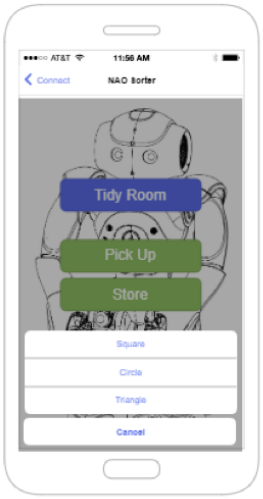
If connected to a robot, this main control screen is displayed.

- Tidy Room: Sends a command to the robot to repeatedly scan the room for objects and deposit them in the appropriate receptacle.
- Pick Up Object: Lets the user choose an object of a particular shape to pick up.
- Store Object: Tells the robot to deposit the current object it is carrying in the appropriate receptacle.
- Stop: Makes the robot cease all action.

Connection page:



Pick up selection page:



- Connection page: On pressing “Connect”, the application searches the wireless network for connected NAO robots.

- Pick Up Selection page: On pressing “Pick Up”, a selection menu pops up allowing the user to choose a shape to pick up.

Pick up <shape>:

Robot searches for specific-shaped object

Robot moves to, and picks up object

Store:

Robot moves to, and deposits object in appropriate receptacle

Tidy room:

Robot continuously scans the room, picking up and storing objects in their appropriate receptacles



Stop:

Robot ceases all actions