Homework 5 Report
Intro to Robotics

Your Name (Team Name)

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1 Introduction

This report details the design of a **robotic system** capable of solving **two of the five tasks** described in *Tasks.PDF*.

- **Tasks chosen:**
  1. Task #1: *(Describe the first chosen task)*
  2. Task #2: *(Describe the second chosen task)*

Organization of Report:

- Section 2 presents the robotic system schematic.
- Section 3 provides a detailed hardware list and rationales.
- Section 4 shows the modeling approach for the robotic system.
- Section 5 details the software architecture schematic.
- Section 6 gives running flowcharts for our two tasks.
- Section 7 contains additional ideas and anticipated challenges.

2 Robotic System Schematic Drawing (10 pts)

In this section, we present a schematic drawing of our robotic system, showing all relevant hardware components (*e.g.*, robot arms, grippers, sensors, controllers, etc.) and how they are positioned relative to each other.

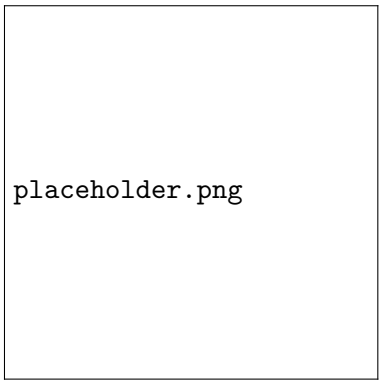

Figure 1: Robotic System Schematic Drawing.

Description:

- *Explain how the hardware pieces are mounted.*
- *Explain communication paths or relevant wiring if necessary.*

3 Selection of Robots, Grippers, and Sensors (10 pts)

Here we describe the hardware choices, including part numbers/models, and the rationale behind each selection.

3.1 Hardware List

- **Robot Arm**: Brand/Model (*e.g.*, UR5, Kuka iiwa, etc.)
- **Gripper**: Brand/Model (*e.g.*, Robotiq 2F-85, vacuum gripper)
- **Sensors**: Cameras, LiDAR, Force/Torque sensor, etc.
- **Controllers/Computers**: If applicable, specify computing hardware.

3.2 Rationale for Each Choice

- **Robot Arm**: *Why this payload, reach, DOF, etc.*
- **Gripper**: *Why two-finger vs. vacuum vs. multi-fingered?*
- **Sensors**: *How do they meet the perception needs of the tasks?*

(Optional) Table summarizing hardware:

Component	**Model**	**Reason for Selection**
Robot Arm	UR5	Good reach, 6 DoF, widely used
Gripper	Robotiq 2F-85	Adaptive gripper, easy integration
Sensor	Intel RealSense D435	Depth camera for object detection

Table 1: Hardware Components and Rationale

4 Modeling (10 pts)

Here we outline the **system modeling process**:

- *Kinematic/dynamic modeling of the robot.*
- *Sensor field-of-view modeling.*
- *Workspace modeling / environment constraints.*
- *Any relevant calibration or transformation details.*

Discuss how these models inform the **software design** (e.g., required coordinate transforms, collision models, etc.).

5 Software Architecture Schematic Drawing (20 pts)

We present the **software architecture** for the two chosen tasks. Include communication protocols, main modules (*perception, planning, control*), and data flows.

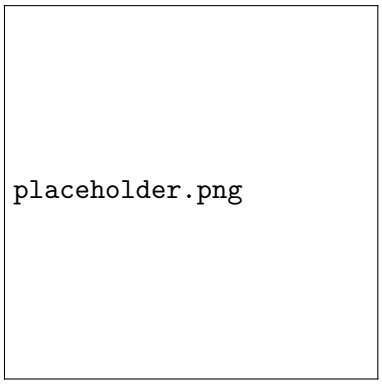

Figure 2: Software Architecture Schematic.

Explanation:

- *Perception modules*: object detection, environment mapping, etc.
- *Planning modules*: path planning, motion planning algorithms.
- *Control modules*: low-level joint control, error handlers.
- *Communication interfaces*: (ROS topics, microservices, or custom APIs).

6 Running Flowcharts of Software for Two Tasks (30 pts)

For each of the two chosen tasks, provide a **detailed flowchart** depicting:

- *Perception pipeline*
- *Motion planning / trajectory generation*
- *Error handling* or any fallback states
- *Gripper logic* (if applicable)

6.1 Task #1 Flowchart

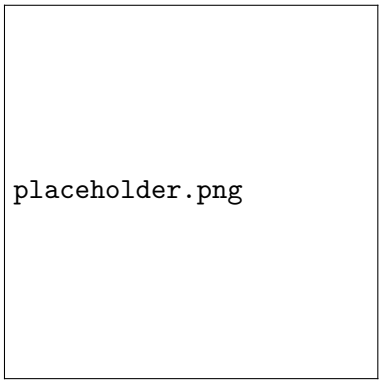

Figure 3: Flowchart for Task #1.

6.2 Task #2 Flowchart

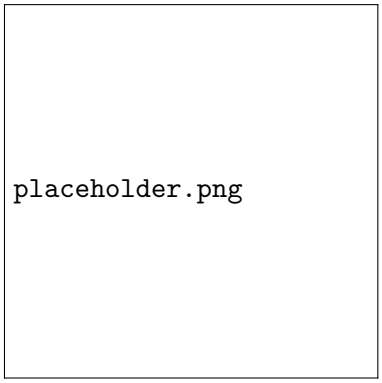

Figure 4: Flowchart for Task #2.

7 List of Ideas (10 pts) & Challenges (10 pts)

Ideas to Explore:

1. Idea #1: ...
2. Idea #2: ...
3. Idea #3: ...
4. Idea #4: ...
5. Idea #5: ...

Anticipated Challenges:

1. Challenge #1: ...
2. Challenge #2: ...

3. Challenge #3: ...
4. Challenge #4: ...
5. Challenge #5: ...

8 Conclusion

Summarize the solution approach: **(i)** the tasks solved, **(ii)** the chosen hardware and modeling, **(iii)** software architecture and flowcharts, and **(iv)** further ideas and challenges.

References: (You can include references or citations to relevant papers, data sheets, etc.)