# ROBO.666

# Group 2: Industrial Robot in Harsh Conditions

## System Design Specification

Version: 0
Date: 15.10.2024

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# Contents

# 1. System Overview

The robot system is designed to automatically assemble rock bolts from steel plates and rebars. The system performs this task in an efficient, repeatable manner, capable of operating under harsh environmental conditions. The assembled bolts are placed in a designated bolt tray for collection.

## 1.1    Environment Conditions

Operating Environment: Indoor and outdoor.
Temperature Range: –40 to +40 °C.
Lighting Conditions: All lighting conditions, including direct sunlight and complete darkness.
Environmental factors: Dust, mud, moisture, snow and rain.


## 1.2    Specification of materials

Steel Plate:
Dimension: 200x200x8 mm
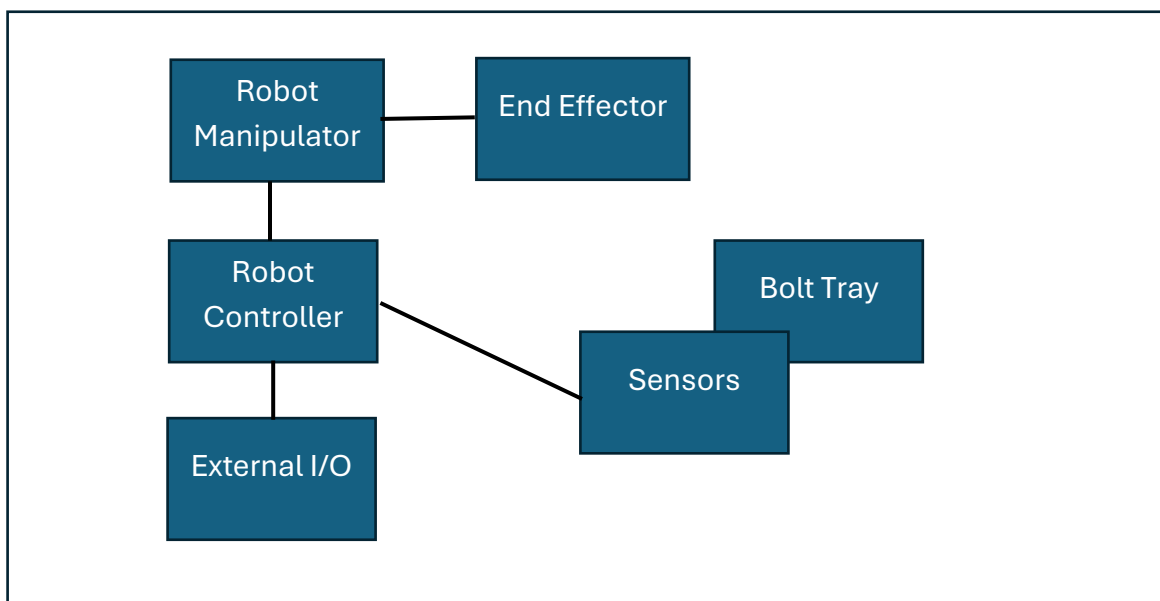Weight: approx. 2.5kg


Rebar:
Dimension: 25mm Dia x 3000mm long
Weight: 11.56kg


# 2. System Architecture

The system is composed of several components working together to assemble the rock bolt.

# 3. Hardware Components

## 3.1 Manipulator

Description:
A 6 DOF robot manipulator to move the end effector within the workspace to perform rock bolt assembling task.

Primary Function:
1. Move the end effector to pick and place rebars
2. Move the end effector to pick and place plates
3. Move the end effector to insert rebar into the place as part of the assembly process
4. Withstand harsh environmental conditions

## 3.2 End effector

Description:
Multi-tool end effector with magnetic gripping capabilities.

Primary Function:

1. Pick and place a rebar from the rebar stack
2. Pick and place a plate from the plate stack
3. Push rebar into plate
4. Withstand harsh environmental conditions

## 3.3 Bolt tray

Description:
Robust structure designed to hold multiple rebars and rock bolt plates.

Primary Function:
1. Line up rebar and plate
2. Hold as much as 4 assembled rebar
3. Allow another mechanism _(out of scope)_ to pick up assembled rock bolts
4. Withstand harsh environmental conditions

### 3.4   Sensors

Description:

Various types of sensors to provide feedback information to the control system.

Primary Function:
1. To sense if the slot for the plate on the bolt tray is available
2. To sense if the holder for the rebar on the bolt tray is available

## 4. Software Components

### 4.1   Control system

Primary Function:
1. Control the manipulator and end effector to perform their functions
2. Process information from the sensors
3. Process user's command

## 5. Workflow

Step 1: Initialisation of system.

Step 2: Robot picks up plate.

Step 3: Robot places the plate on the bolt tray.

Step 4: Robot picks up rebar.

Step 5: Robot places the rebar on the bolt tray.

Step 6: Robot pushes the rebar into the plate.

Step 7: Repeat step 2 – 6 until bolt tray has 4 assembled rebars.

Step 8: Robot returns to home position and stand by.