

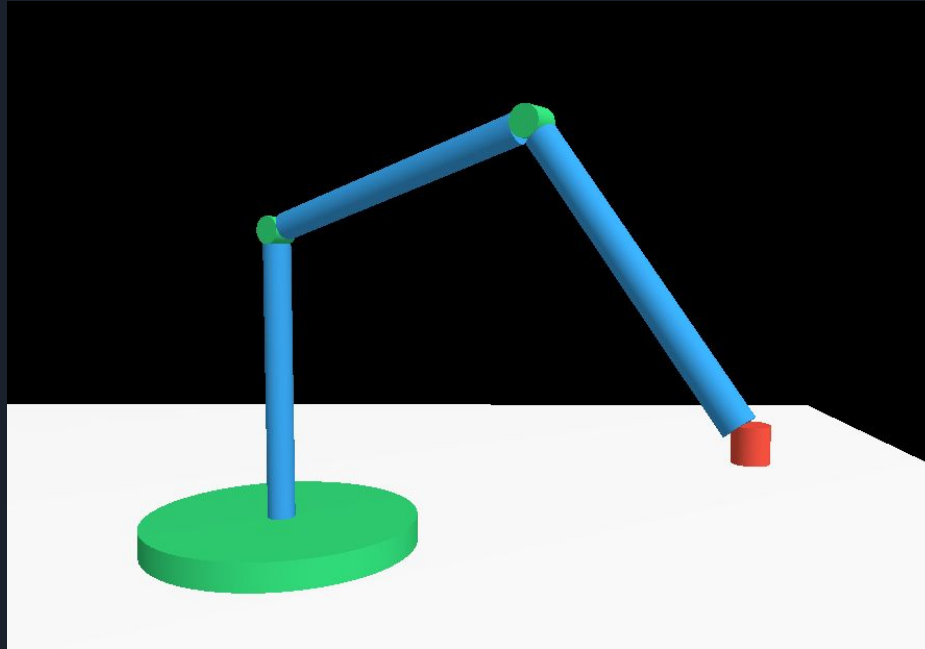
A decorative graphic on the left side of the slide consisting of two overlapping parallelograms. The front one is blue and the back one is a light green. They are positioned diagonally, with the blue one partially covering the green one.

Robotic Arm

Homework 1 - 2022 Computer Graphics

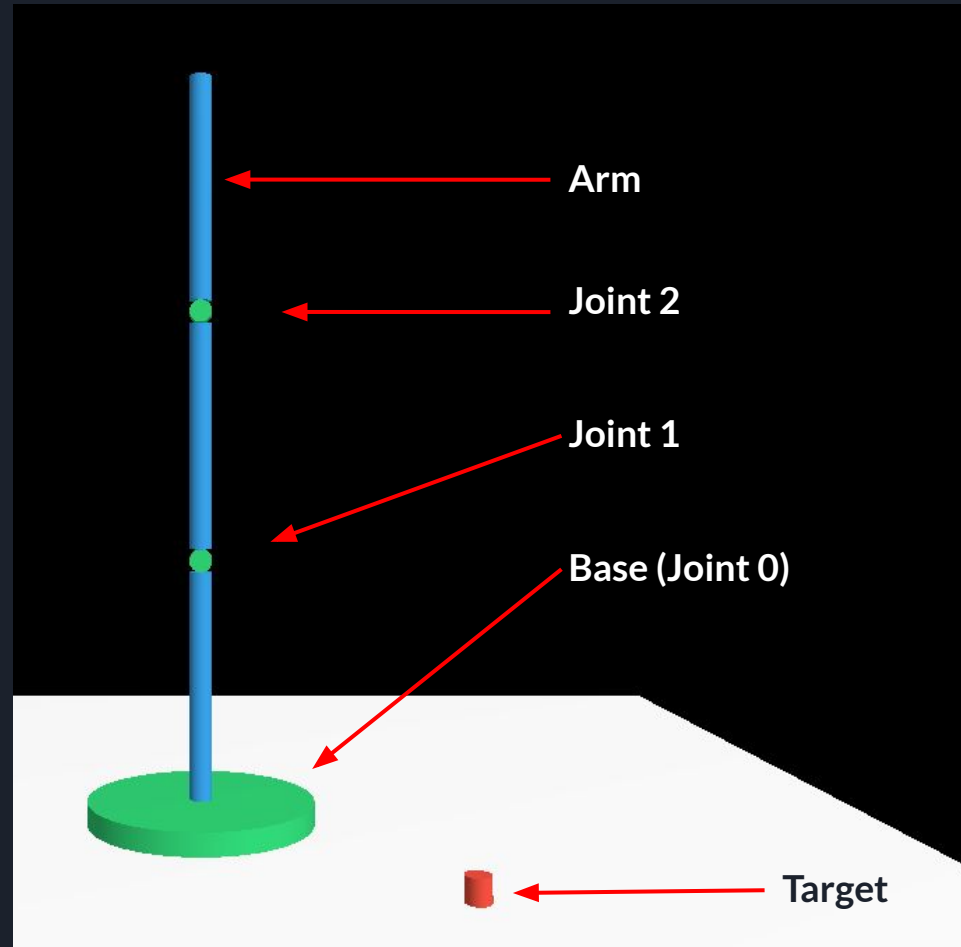
Robotic Arm

- In this assignment, you are required to write a robotic arm based on the provided template with OpenGL, glfw, and glm.



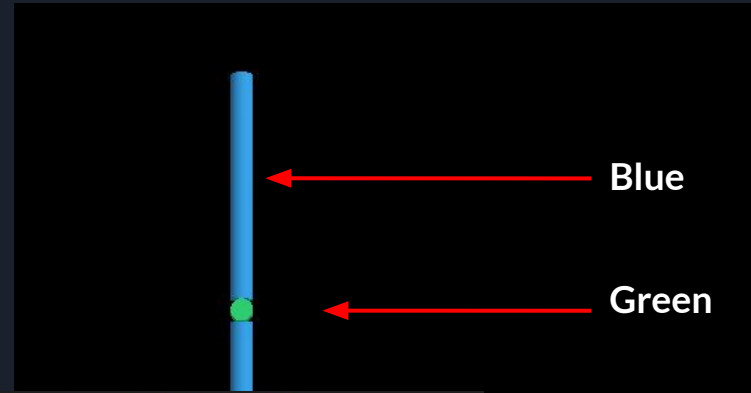
Robotic Arm Spec

- All object are cylinder
- Base
 - Radius: $0.5f$
 - Height: $0.1f$
- Joint
 - Radius: $0.05f$
 - Width: $0.1f$
- Arm
 - Radius: $0.05f$
 - Height: 1.0
- Target
 - Radius: $0.05f$
 - Height: $0.1f$



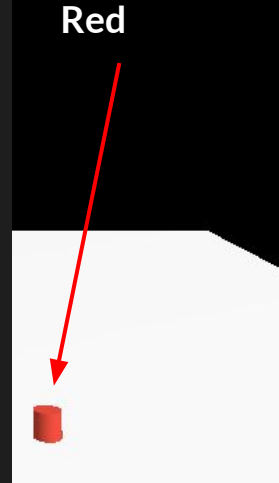
Robotic Arm Spec

- Red: (0.905f, 0.298f, 0.235f)
- Green: (0.203f, 0.596f, 0.858f)
- Blue: (0.18f, 0.8f, 0.443f)
- All parameter are provided in template (main.cpp)
- The bottom centor of the base (joint0) is (0, 0, 0)



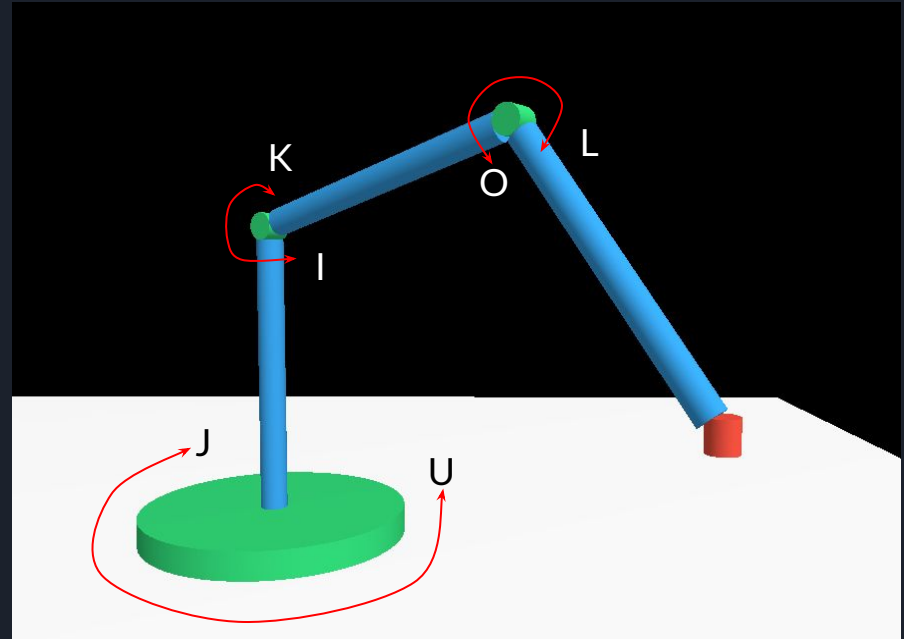
```
/* Components size definition */
#define ARM_LEN 1.0f
#define ARM_RADIUS 0.05f
#define ARM_DIAMETER (ARM_RADIUS * 2)
#define JOINT_RADIUS 0.05f
#define JOINT_DIAMETER (JOINT_RADIUS * 2)
#define JOINT_WIDTH 0.1f
#define BASE_RADIUS 0.5f
#define BASE_DIAMETER (BASE_RADIUS * 2)
#define BASE_HEIGHT 0.1f
#define TARGET_RADIUS 0.05f
#define TARGET_DIAMETER (TARGET_RADIUS * 2)
#define TARGET_HEIGHT 0.1f
#define ROTATE_SPEED 1.0f
#define CATCH_POSITION_OFFSET 0.05f

#define RED 0.905f, 0.298f, 0.235f
#define BLUE 0.203f, 0.596f, 0.858f
#define GREEN 0.18f, 0.8f, 0.443f
```



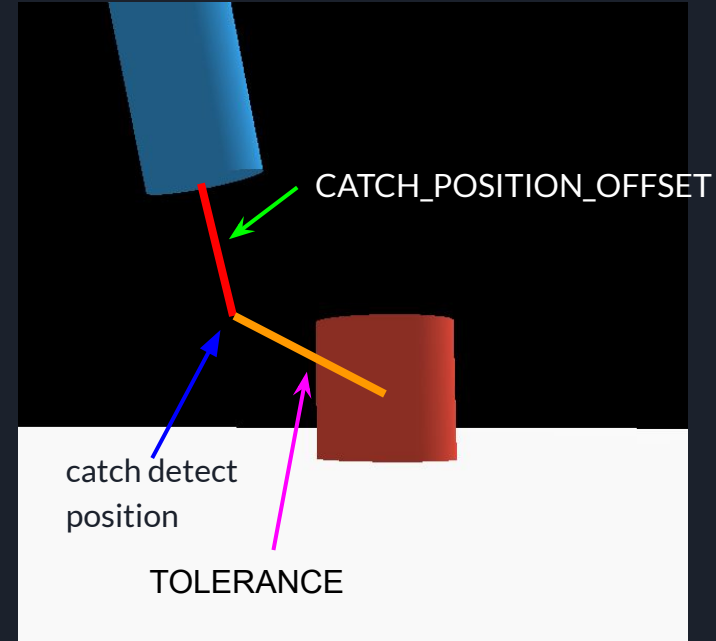
Control

- Press keyboard to control
- Base (U/J)
- Joint 1 (I/K)
- Joint 2 (O/L)
- Press space to catch target
- Release space to release target



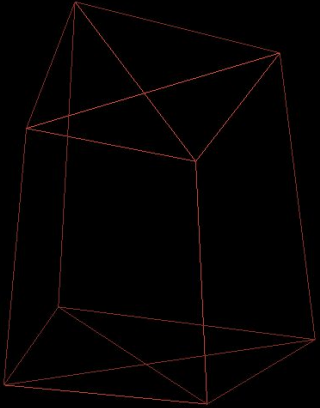
Catch target

- The catch detect position is at end point of the arm add a catch position offset forward
- If the length between catch detect position and center of the target is less than tolerance, the arm can catch the target
- When arm catch the target, you need to keep update the position of target to catch detect position

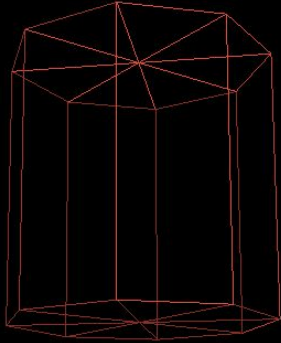


Draw Cylinder

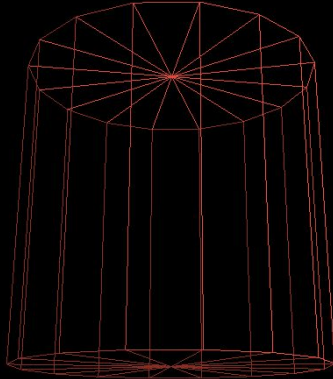
Use segment = 64 in this project



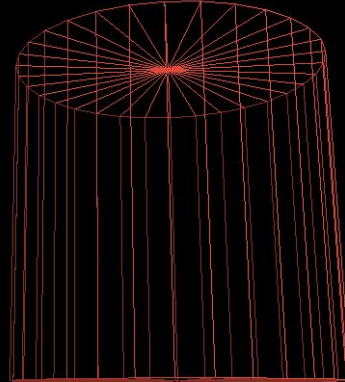
Segment = 4



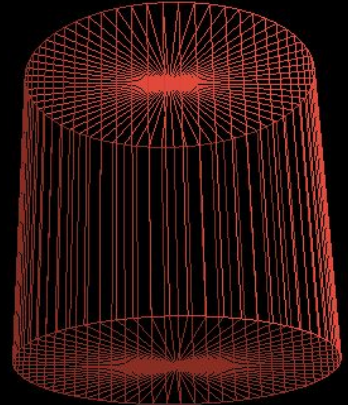
Segment = 8



Segment = 16



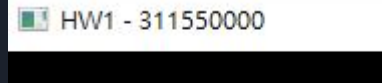
Segment = 32



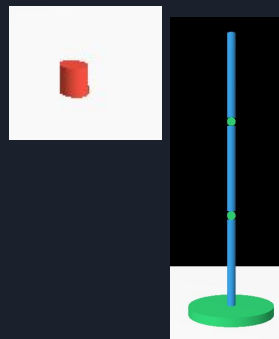
Segment = 64

Spec

- Implementation(85%)
 - Change window title to “HW1 - `student id`” (0%)
 - -10% if title is wrong,
 - Viewing transformation(7.5%)
 - Calculate right and viewMatrix,
 - Projection transformation(7.5%)
 - Calculate projectionMatrix
 - **MUST** use perspective projection
 - Near: 0.1f, far: 100.0f, fov: $\pi/4$
 - Render a cylinder at target_pos(15%)
 - Include color, shape, normal, size
 - Render the robotic arm(20%)



HW1 - 311550000





Spec

- Implementation(85%)
 - Joints rotation control (15%)
 - You **MUST** correctly implement three joints' controls to get all 15% score
 - Object catch control (20%)



Spec

- Report(15%)
 - Implementation(HOW & WHY)
 - Problems you encountered
 - Don't paste code without any explanation
 - File name: report_<your student ID> .pdf
- Bonus(10%)
 - Any creativity
 - Please mention in report
 - Don't break spec requirements

Hint

- Read the TODOs in the template and follow TODOs order
- Read notes and hints to get more hints & ideas
- Before you ask question on E3, make sure you have Googled it

```
/* TODO#2: Render a cylinder at target_pos
 *      1. Translate to target_pos
 *      2. Setup vertex color
 *      3. Setup cylinder scale
 *      4. Call drawUnitCylinder
 * Hint:
 *      glTranslatef (https://registry.khronos.org/OpenGL-Refpages/gl2.1/xhtml/glTranslate.xml)
 *      glColor3f (https://registry.khronos.org/OpenGL-Refpages/gl2.1/xhtml/glColor.xml)
 *      glScalef (https://registry.khronos.org/OpenGL-Refpages/gl2.1/xhtml/glScale.xml)
 * Note:
 *      The coordinates of the cylinder are `target_pos`
 *      The cylinder's size can refer to `TARGET_RADIUS`, `TARGET_DIAMETER` and `TARGET_DIAMETER`
 *      The cylinder's color can refer to `RED`
 */
```



Notes

- Deadline: 10/24 23:59
 - You need to upload `hw1_<your student ID>.zip` and `report_<your student ID>.pdf` respectively
 - `hw1_<your student ID>.zip` (root)
 - `src`
 - `include`
 - Don't add or remove files
 - You can use `script/pack.ps1` (PowerShell) or `script/pack.sh` (Bash)
 - Incorrect submission will -5 points
- No plagiarism
- -10 points per day after deadline
- No demo required
- HW 2 will be announced at 10/25
- For personal problem, you please email to all three TAs from E3



Reference

- <https://www.khronos.org/registry/OpenGL-Refpages/gl2.1/>
- <https://www.glfw.org/docs/3.3>
- <https://glm.g-truc.net/0.9.4/api/>