**Goals:** Using a real robot head, you build the light sensor circuit you designed in **Homework 3**, and characterize its performance, including its gain $k_s$.

**Resources:** This lab may be done with a partner (of your choice), or individually. You will need a robot and lab laptop, and in addition:

- Proto board
- Silver lamp
- Red cable
- Robot head
- Robot
- Two eight-pin connectors

Do `athrun 6.01 getFiles` to get the following file (in Desktop/6.01/swLab09):

- `eyeDataBrain2.py`: A brain which collects data on your light sensor circuit as a function of head angle.

1 **Introduction**

The main goal of this “software” lab is to measure the sensor gain $k_s$ of the light sensor circuit you have designed for Homework 3.

**If you have not yet completed your light sensor circuit design, and Tutor problem Wk.8.4.1, do that first.**

Once you have a circuit design, then do the following (either with a partner of your choice, or individually).
2 Light Sensor Gain

To estimate $k_s$ we will need a plot of $v_s$ as a function of angle to the light. We’ll feed the voltage $v_s$ generated by your sensor circuit into an analog-to-digital input of the robot. Then $v_s$ is measured by the robot as it turns 180°, while facing a fixed light source. The result is plotted in soar.

**Step 1.** Draw a diagram of your light sensor circuit in the box below, showing how it is connected to the **head connector**. Also show how you use the **robot connector** to provide power supply connections. And connect the output voltage $v_s$ of your sensor to the AIN2 analog input port of the robot. The motor pins may be left unconnected.

![Diagram of light sensor circuit](image)

**Step 2.** It is convenient to mount the head on the robot. Connect the head to your circuit, and your circuit to the robot, just as you did in Design Lab 8:

![Diagram of head connection](image)

**Step 3.** Position the photoresistors so they are roughly 90° apart.

**Step 4.** Connect the output of your light sensor circuit, $v_s$, to analog input #2 (pin 3) on the **robot connector**. This pin connects to an **A-to-D (analog to digital) converter** within the robot; for more information on how these work, see the *Infrastructure Guide*.

- Find one of the silver lamps and hold it near the robot at approximately one meter distance.
- Make sure the head/circuit is connected to the robot and turn the robot on.
- Start soar and select the eyeDataBrain2.py brain.
- Line up the robot in front of the lamp, so that the head is pointing at the lamp and the robot is about a meter from the lamp. Now manually turn the robot **clockwise** by 90 degrees.
• Click Start in soar. This will turn the robot through 180 degrees.
• Click Stop when the robot has fully turned.

One plot should appear when you click Stop: the $v_s$ signal as a function of rotation angle (you need to figure out what the units are).

**Step 5.** Reload the brain file in soar and repeat this procedure holding the lamp farther away, say around two meters.

**Step 6.** Now, keeping in mind what $k_s$ means in *Homework 3*, think about how you can estimate $k_s$ from these plots, and give a good estimate. Does the value of $k_s$ depend on distance?

Save your plots, labelled with the distances. Mail these results to your partner. We will discuss them at your next interview.

**Checkoff 1.** **Wk.9.1.1:** Explain your sensor design, and how you estimated $k_s$, to a staff member.