**崇新学堂**

**2022－2023学年第一学期**

实 验 报 告

课程名称： Experiments of Introduction to EECS

实验名称： A Real Head-Turner

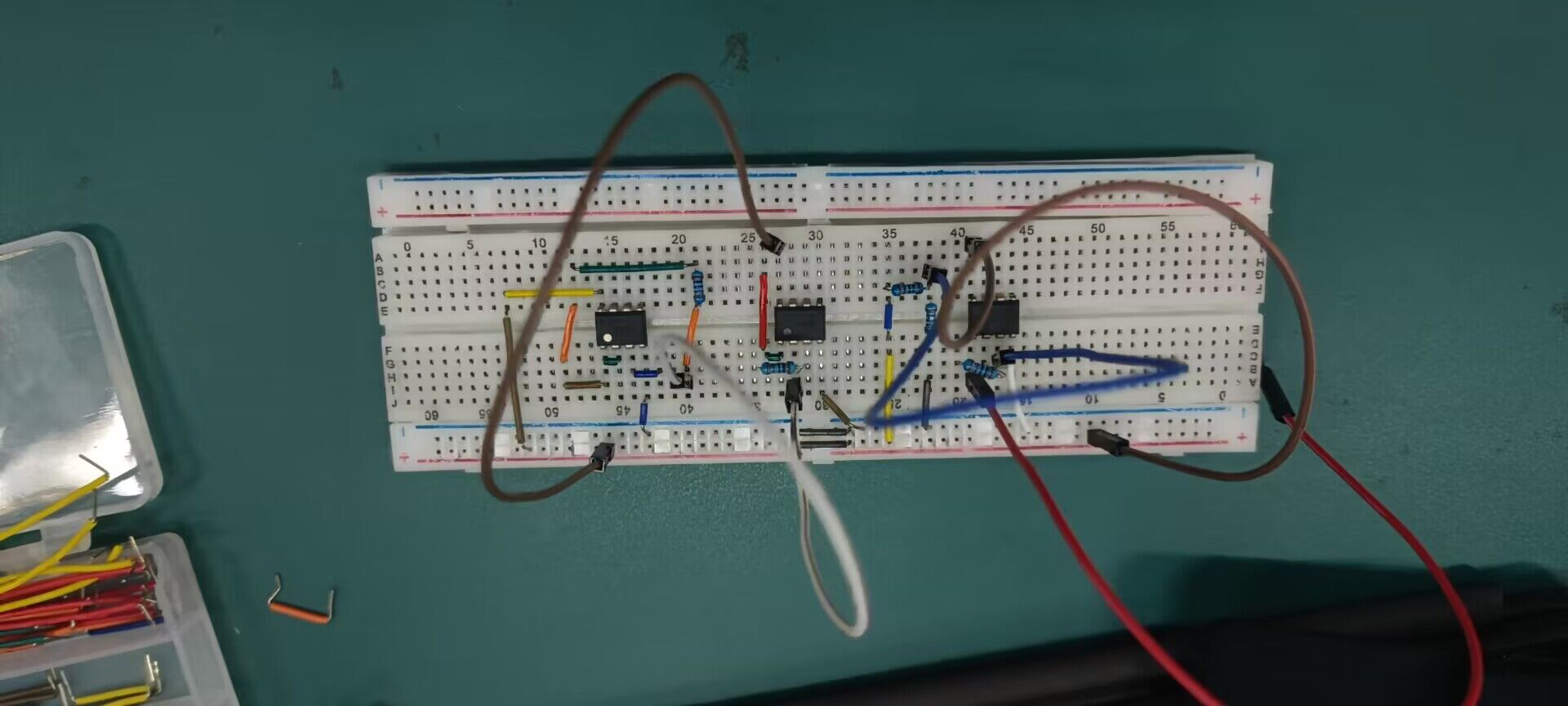
专 业 班 级 崇新21

学 生 姓 名 余昊 葛明烨 崔宇鑫

实 验 时 间 2022年11月23日

**Step1**

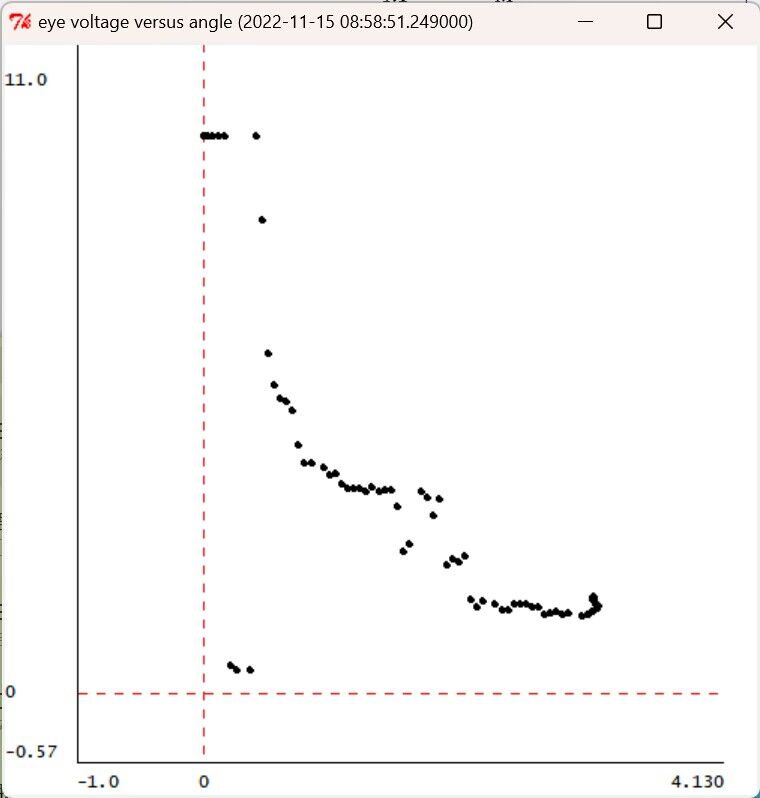
We connect the following circuits according to the circuit diagram in homework3.



Change the gain by changing the resistance value of the resistor at the output of the sensor.

**Step2**

**SL9测量结果：**

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*neck= 0.127077223851 left= 10.0 right= 10.0  
neck= 0.127077223851 left= 10.0 right= 10.0  
neck= 0.127077223851 left= 10.0 right= 10.0  
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Starting to rotate 3.09159265359*

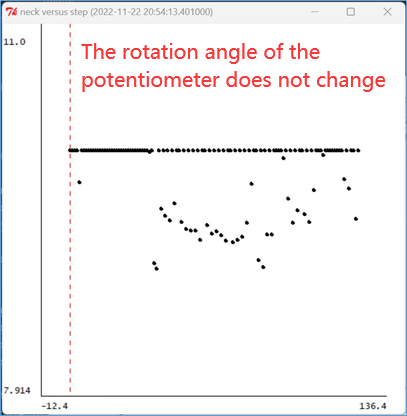
In softwarelab9, we find that the v\_s signal as a function of rotation angle generated by soar is not ideal, and even tends to a straight line. So we use the best gain in homework3 for the experiment. According to homework3, we can calculate the best k\_c = 2.1. But in the actual experiment, we use k\_s=2, which has the same good convergence effect.

We connected the circuit to the head according to the infrastructure guidelines and set up a strong light source near the head to turn it. We found that when we moved the light source, the head moved with the light source. Under the condition that the gain k\_c is 2, the trolley can be rotated to the location of the light source at the optimal convergence rate.

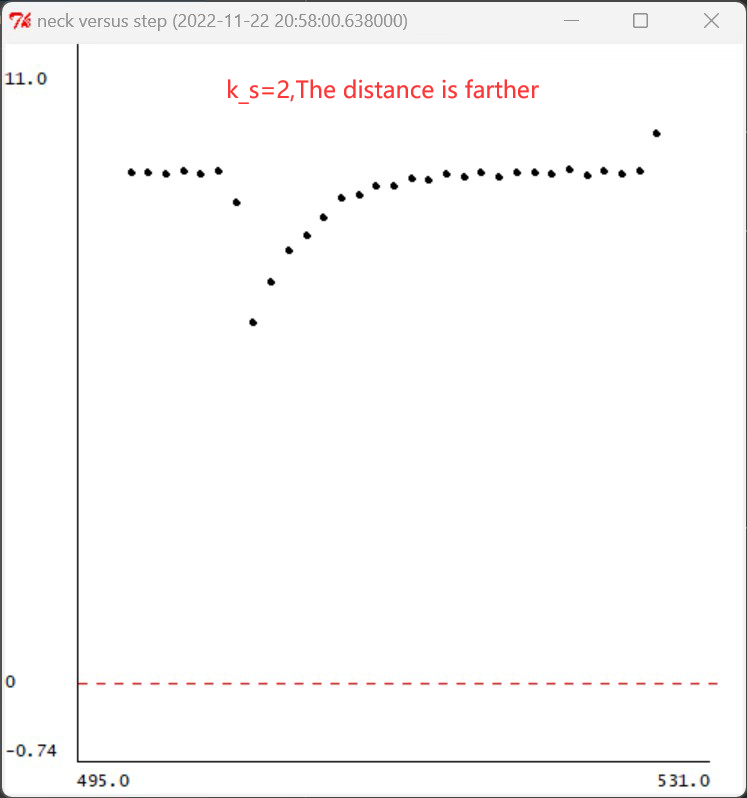
**Step3 ＆ Step4**

When we used the only intact potentiometer connector sensor, we found that when the potentiometer can perform unlimited rotation. This will lead to very strange voltage measurements.

We try to study the output voltage of potentiometer without rotating the potentiometer. In theory, the output voltage should be a constant value, but in practice, the output voltage value is shown in the figure below.

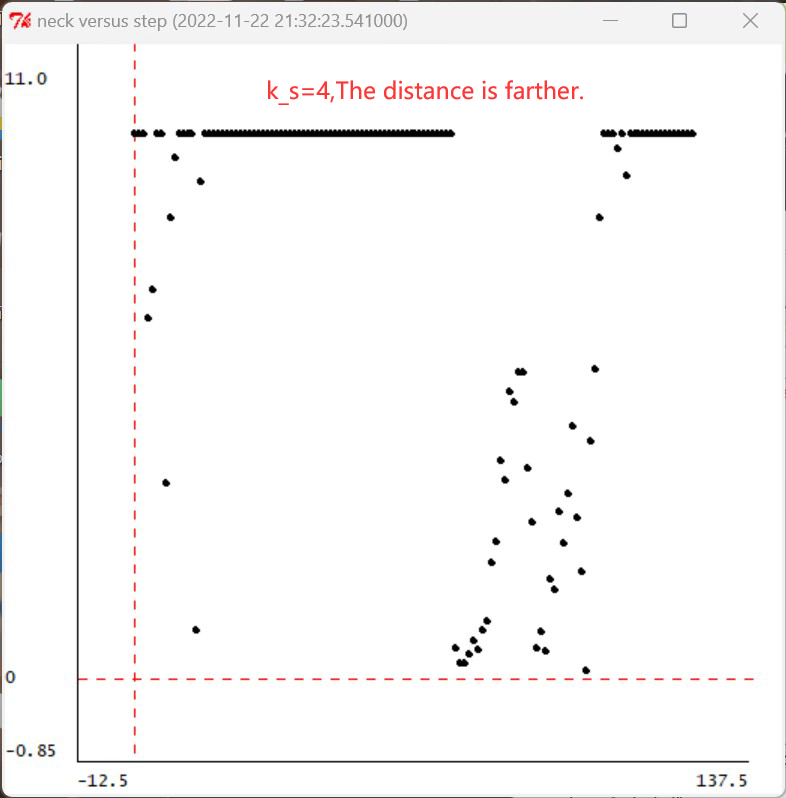


This is a very strange figure. Because even if we turn the Angle of the potentiometer, the output voltage of the potentiometer seems to be 10V without the connection of the head sensor. This is contrary to the theoretical value. In theory, when we turn the potentiometer and leave it unchanged, the potentiometer should output a different voltage stabilizer. The Angle alpha of the potentiometer should be proportional to the output voltage, but it is not.

We tried to fix the position of the light source, and we tried to connect the motor on the head sensor to the potentiometer. When k\_c=2, the result obtained was shown in the figure below. 

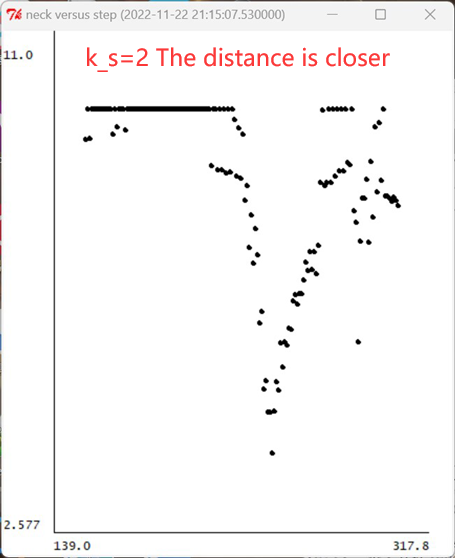
We found that when the motor of the head drives the potentiometer to rotate, the output voltage of the potentiometer always starts from a certain voltage value and finally tends to 10V. Theoretically, the output voltage of the potentiometer should indeed start from a certain voltage value and end at a certain voltage value, but it should not always be 10V. As we mentioned in the previous paragraph, when the potentiometer does not rotate, the output voltage is constant 10V, so we only pay attention to the change of the rising part of the output voltage of the potentiometer, not the voltage value when the output voltage is stable.

When we continue the experiment by changing the resistance increase k\_c we get the following results. At this point, k\_c equals 4.



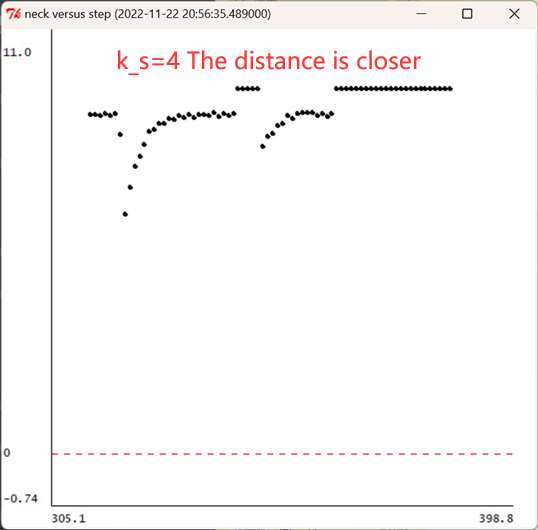
We found that the potentiometer output voltage changes significantly more than when k\_c equals 2. This is because the increase in the k\_s increases the speed of the motor.

We decrease the distance of the light source and adjust k\_s=2 to get the following output.



We found that the potentiometer output voltage changed to 10V faster than before the distance decreased.

We decrease the distance of the light source and adjust k\_s=4 to get the following output.



We found that the potentiometer output voltage oscillates around 10V. This is because the motor speed is too fast due to large k\_s, which produces small oscillations near the light source and cannot converge quickly and directly.

**Summary**

1. During the experiment, we observed that the quiescent voltage of the potentiometer was always 10V. It is better to ignore the value of the output voltage at this time, use the voltage output of 10V at stable time as the steady state of the potentiometer at rest, and observe the change trend of the output voltage.

2. When the potentiometer starts to rotate, the initial value of the output voltage of the potentiometer will always change to a certain small value and gradually rise. This is consistent with the result in 1. When the potentiometer starts to rotate, the steady state of the output voltage of 10V will be broken, and the measured voltage will be the real voltage, and the output voltage will gradually increase as the angle increases.

3. 从理论上来说，当电位器从α=1开始，顺时针旋转时，我们想要得到的电压随采样点的变化趋势应该如下图所示：

