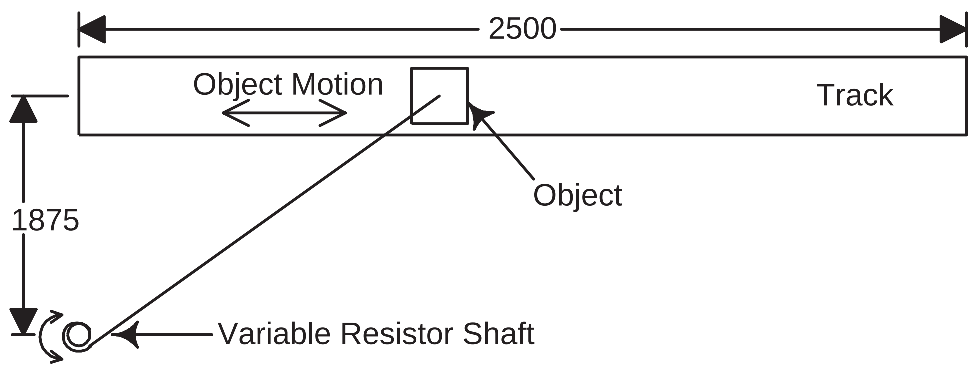
EE 4770 **Homework 1** **Due: 5 February 1999**

Problem 1: Design a circuit and an interface routine to convert temperature, $x \in [200\,°\mathrm{C}, 300\,°\mathrm{C}]$, to a floating point number $H(x) = x/\,\mathrm{K}$ to be written to variable `temp`. Temperature is to be measured using an *integrated temperature sensor*, a sensor with model function $H_{\mathrm{t}}(x) = x\frac{\mu\mathrm{A}}{\mathrm{K}}$. The circuit should use a 10 V, 16-bit ADC, $H_{\mathrm{ADC}(10\,\mathrm{V},16)}$. The full range of the ADC input does not have to be used (in this problem).

- Show a schematic of the circuit showing all component and supply values. (The symbol for an integrated temperature sensor is a current source.)
- Show pseudocode or C code for the interface routine.

Problem 2: Design a circuit and interface routine to convert $x \in [0, 2500\,\mathrm{mm}]$, the position of the center of an object sliding along a track, to a floating point number $H(x) = x/\,\mathrm{m}$ to be written to `dist`.

The center of the object is connected to a cable which winds around the shaft of a variable resistor placed 1875 mm below the track at the zero position (see the diagram). The shaft is spring loaded so the cable is always wound tightly. The shaft will turn exactly one revolution for each ten centimeters of cable unwound. The circuit should use a 10 V, 16-bit ADC, $H_{\mathrm{ADC}(10\,\mathrm{V},16)}$. Try to use the full range of the ADC input by efficient use of the variable resistor.



- As part of the design determine the number of turns from minimum to maximum position, and choose a maximum resistance.
- Find a model function for the variable resistor (rotation to resistance) and find the mapping from object position to shaft rotation.
- Show a schematic of the circuit showing all component and supply values.
- Show pseudocode or C code for the interface routine.