# FEASIBILITY STUDY PRESENTATION

## JOB DESCRIPTION AND DEFINITIONS

1. Welcome everybody. I studied the feasibility of temperature sensing of a 3D printer’s hot end with a PTC1000 thermistor. The requirements of the project are as follows (writes at the presentation)
2. Voltage divider architecture was chosen based on an open source board that is already available on the market. There was an alternative to this architecture which Mr Philipitsch covered in his Sensor Models class but due to its simplicity, voltage divider was chosen. For the sake of clarity of the presentation, let’s define the relevant terms.
3. I believe PTC and voltage divider are well known terms to everyone here, therefore I’ll carry on to other terms. *Goes on to* *define heater block, nozzle, and hot end.*
4. The stability of the material flow is directly related to the overall quality of the end product. To provide a stable flow through the nozzle, temperature sensing has to be precise and accurate enough. We will now see the requirement, then move on to the relevant calculations and eventually decide whether the setup is feasible or not.

## REQUIREMENTS

1. Explain the requirements. They are written on the presentation.
2. Important thing to keep in mind before we go further is that these values are chosen mostly based on intuition and the goal of this study is to find the right setup for the job, rather than prove or refute the correctness of chosen values.

## COMPONENT SELECTION

1. The selected components are quite well known: Atmega328 and TE Connectivity’s PTC1000 sensor.

## PTC1000 CHARACTERISTICS

1. PTC1000 demonstrates a quite linear behavior which is convenient for software applications as linearity less intense for the MCU than nonlinearity. As you will remember from the class, this is its temperature – resistance graph.
2. From this graph it is possible to extract the following scalars for software use later. *Points to the values on the presentation.*

## ATMEGA328PB CHARACTERISTICS

1. Italian company Atmel’s Atmega328 came to fame with Arduino project and Atmega328PB is the latest version for new designs and it bears the following specifications. *Points to the specifications on the presentation.*

## VOLTAGE DIVIDER

1. One thing to mention about the voltage divider is the value of the R1 resistor: There is a trade-off between linearity and voltage range depending on this resistor’s value. The higher the value, the more linear the voltage is but this means much less range which would necessitate a higher resolution ADC or voltage amplification.

## ELECTRICAL REQUIREMENTS

1. The formula you see on the screen gives the voltage on the thermistor. Since we know the resistance range of the PTC, we can easily plot output voltage. *Points to the plot on the screen.* The lowest value is 0.8722V and highest is 1.5545V. This satisfies R4b.
2. The other requirement was that the ADC is able to detect 1 centigrade degree change. Given the voltage range is 0.6773 V and LSB is 4.9mV, it yields to 138 steps of detection. But we need 250 steps of detection, therefore this requirement 1b is not satisfied.
3. Further, it is possible to calculate the temperature with the following formula. *Points to the presentation.*

## POWER CONSUMPTION

1. Power consumption requirement was that the sensor consumes 50 mW at most. Following the formula of P = V.I, the result yields as follows. Highest power consumption is 43 mW, lowest consumption is 37 mW. Therefore requirement 3b is satisfied.

## PHYSICAL REQUIREMENTS

1. Physical requirements are as follows and sensor’s dimensions are as follows. All the physical requirements are satisfied.

## FINANCIAL REQUIREMENTS

1. The budget for the project was set at 10 euros. Total cost of the project is 5.17 USD. Therefore financial requirement is satisfied.

## VERDICT

The result shows that ADC resolution is not enough to satisfy the project requirements. Increasing its resolution to 11 bits would satisfy the accuracy requirement without causing budget overrun.