The project focuses on development of a biochip interface circuit which can form the backbone of a battery operated portable device to perform a polymerisation chain reaction (PCR) and detect the presence of diseases in patients. The reaction amplifies the quantity of DNA by subjecting it to a temperature of 95°C (Denaturation) followed by 55°C (Annealing) and 75°C (Extension) for a time period 60 seconds, 45 seconds and 120 seconds respectively.

**Methodology**

**Hardware Overview**

The user makes use of the interface to control different parameters, such as, the temperature as well as the duration of each stage. The controller then regulates the temperature of the heater by altering the current injected to it, which in turn changes the resistance of the sensor. The Wheatstone bridge detects the change in resistance and accordingly gives out varied voltage results dependent on the resistance of the sensor. This voltage is further amplified using Operational Amplifiers which is then switched into a digital signal by the Arduino input pin. The microcontroller, Arduino then regulates the temperature by injecting current into the heater or the fan as the case may be, depending on the input signal.

**Software Overview**

In order to make the heating and cooling functionality of the device efficient, PID control has been used in the algorithm. The controller output ‘y(t)’ is the PWM duty cycle which is responsible for current injection in the heater. The offset ‘e(t)’ is calculated as the difference between the measured temperature and the set point temperature based on the stage.

**Results**

We can see from the graph of left hand side that temperature is changing over time. This is caused by changing the resistance of a variable resistor. It should also be noted that sensitivity of the device is within 1-2 degree Celsius.

**Detection Module**

The Optical detection method is best suited for the efficacy of the project. Based on the concept of ‘Fluorescence Detection’, LEDs are used for the source of activation owing to their stability, size and cost. The circuit comprises of CCD camera, dichroic mirror and bifurcated optical fibre in addition to the Blue LED. The optical method is highly robust, extremely sensitive and provides a high signal to noise ratio. Precaution needs to be taken to ensure that the excitation light’s amplitude is low while the subjecting the florescence signal to a high gain amplification so as to avoid bleaching effect.