



2<sup>nd</sup> Semester, 2018-2019

## MCT-371: Automatic Control

### Project 2 description

#### Projects Objectives

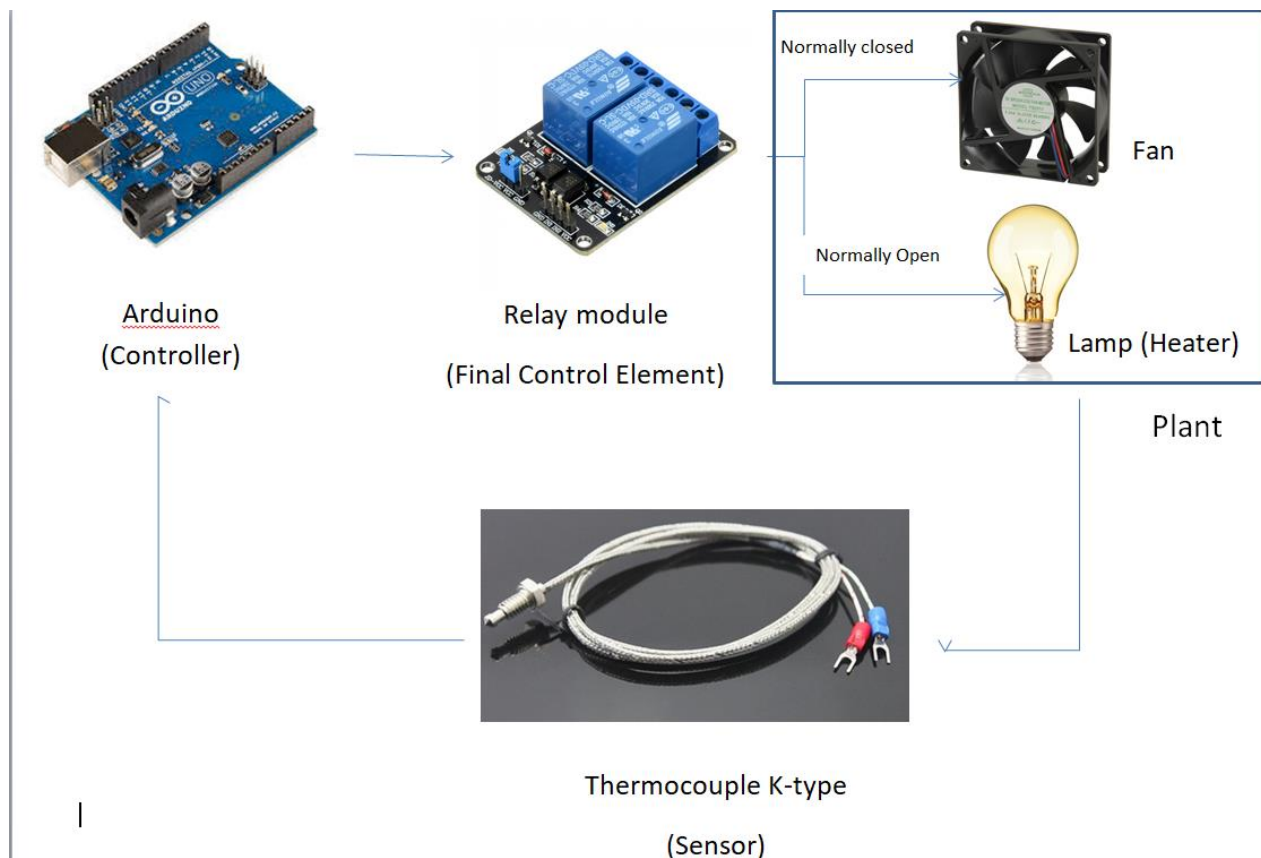
By the end of this project, students should be able to apply the theoretical concepts they learned in the course:

1. Construct a closed loop feedback control system for temperature control system.
2. Find the system model (using theoretical and experimental approaches).
3. The effect of the PID controller parameters on the system performance.
4. The tuning of the PID controller parameter in Arduino and Autronics industrial temperature controller.

#### Project #2

The aim of this project is to design a control system that can keep the temperature of the system at any desired set point. The controller will be built on Arduino first, and then Arduino will be replaced with Autronics industrial temperature controller.

#### Layout



The project setup consists of a wooden box that resembles the furnace; the wooden box contains a lamp that represents the heater, and a fan. The box contains a thermocouple of K-type to measure the actual temperature of the system and acts as feedback.

During the first phase of the project the system will be controlled using Arduino, while in the second phase it will be controlled using Autronics industrial temperature controller.

The system has only two states heating (Lamp is ON and Fan is OFF) or cooling (Lamp is OFF and Fan is ON), the controller will switch between these two states to keep the temperature at the desired set point.



## Components

- Wooden box.
- Lamp.
- DC Fan.
- Thermocouple K-Type.
- Relay module for Arduino.
- Max 6675 module to connect the thermocouple to Arduino.

## Stages

### Stage 1: Hardware system:

In this stage, you should build your system. You should deliver a system consisting of a wooden box inside which there is a lamp, fan and thermo couple along with their electrical and electronic interface.

### Stage 2: Arduino controller

In this stage, the Arduino will be used as the controller of the system. The Arduino will be connected to the thermocouple through Max 6675 module to improve the accuracy of temperature measurement.

You will have to use PID library on Arduino but remember that the output of the controller or the control action has only two states heating or cooling, the PID will only control how long each state will be ON to keep the desired temperature, search for PID Relay Example for more information about this type of control.

The Arduino output (5V DC) cannot control the Lamp or the Fan directly so you will have to use a relay module to control the LAMP and Fan using Arduino.

Then you will have to use Autotuning function in PID library to find the best system performance.

### Stage 3: Autonics industrial controller

In this stage the arduino controller will be replaced with Autonics industrial controller, you will have to connect the controller with your system and compare between the performance of this controller and the arduino. You will also use autotuning function in the controller to find the best parameters of the controller to reach the most stable and desired performance.