# Problem Definition

In this assignment we are asked to create a multi threding library. I used arduino. We are asked to create a task structure and a task control block structure that schedule which task is going to be executed.

# Arduino

In arduino we have only 1 processor that means we can execute only 1 instruction at a time. We cannot execute multiple instructions at the same time. But we can schedule the tasks or instructions that looks they are executing at the same time. To be able to do that I used task TCB, task structure and interrupts.

# Task Control Block

Task control block has a current task id, A enum state which can be either Idle,Processing or Blocked. I used TCB to schedule and control the function that currently processing task has.

# Tasks

Every task has an id, last processed time, a delay time, a status for its LED either 0 or 1, a counter and a pointer to its function. Every task when processing executes its function body and send an interrupt to the system. ISR of the arduino change the TCB’s currently executing task’s id and return to main process. Before sending an interrput it saves its last processed time to control the delay time with TCB and ISR. For inter comunication of the tasks I used shared memory which is a pointer that every task has and that task has right to write and read from there. A task can send a specific task a messege with its id or it can send to every task. But in this project I didn’t write the code of the communicaiton. Because in my project every task responsile by its own funciton body for now.

# Schedule

The most difficult problem I encountered is switching task and calculate the delay time of it. I used a usigned long for every task that holds the last processed time. When TCB switched to a specific task it firstly check if current time – last processed time >= delay time. If it is then change the TCB’s current task id to its and start executing its function body. If not then switch again to other task and do these steps again until one of them avaliable to execute. In this search time the state of TCB is Idle. And when executing function body its state is Processing. The main program starts with Task 1 which is a task to blink a LED and increment a counter. The task starts executing function body and change its state to 1 and send high signal to LED. And sends an interrupt to system and ISR begins executing. What ISR does is just change TCB’s current task id to other task’s id. And It return to main process. After that main process looks TCB’s state wheter it is Idle or Processing. If it is Idle then start the current task’s function’s execution. And do these steps again and again. Every task can have different or same delay time, different or same functions. In this demo Task 1 and Task 2 have same function but different delay times. Task 1 has 1000 ms Task 2 has 2000 ms. That means Task 1 executed 2 times when Task 2 executed 1 time. Task 1 starts its function’s execution and when it finished it send an interrput to system. ISR change TCB’s current task id to 2 and Task 2 starts execution. When it done it sends an interrput to system and ISR change TCB’s current task id. When TCB checks the delay time of Task 1 it is not satisfied. So the TCB sends an interrput to system and ISR change again TCB’s current task id to 2. And do these steps until delay time check satified. I don’t have to use interrupts but using interrputs gave me a control on the system. I have 2 tasks in this project but I can have multiple of them. And I have to create a priority queue to select the task I want to execute after executing current one. TSB can read the queue and dequeue the current task from the queue and starts its execution.