

# Intermediate Project - Embedded Robotics

## Final Report

Embedded system for an intelligent desk

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Class: Intermediate Project

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January 23, 2018

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### Abstract

This report shows results of building and programming lighting part of system for an intelligent desk. Lighting in workspace, both for precise work as well as rest, are specified in standard ISO PN-EN 12464-1:2012(E). Described controller is following this standard and is mounted on a desk in constructor's dormitory. The lighting is automatically switched on/off.

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# 1 Introduction

The aim of the project was to create an embedded system which controls light both above the desk and in the whole room. It should be integrated with another system which should be responsible for controlling a cooler for a laptop based on a Peltier cell. Systems were constructed on the desk in the author's dormitory.

## 2 Description of the project

The lighting system fulfills the following criteria:

- Light intensity above the desk can be approximately equal:
  - 200 lx - for normal use (non-working mode),
  - 500 lx - for normal work (work mode),
  - 1000 lx - for precision work like soldering (soldering mode) .
- light intensity in a room should be approximately equal 200 lx all day (except at night when all residents are sleeping) ,
- covering one of the light sensors does not change lighting,
- light changes are logarithmic (visible change is linear),
- lighting switches to working mode when increased activity is detected,
- after 10 min of inactivity at the desk, desk lighting is switched off,
- control of light intensity over the desk is possible to switch off/on,
- actual light intensity measurements are displayed on LCD-display,
- user is able to change mode of lighting,
- system deactivates non-working mode when computer is connected via USB.

### 2.1 Description of used hardware

#### Powering

The execution system is powered by ATX power supply and the control system is powered by USB docking station.

#### Controller

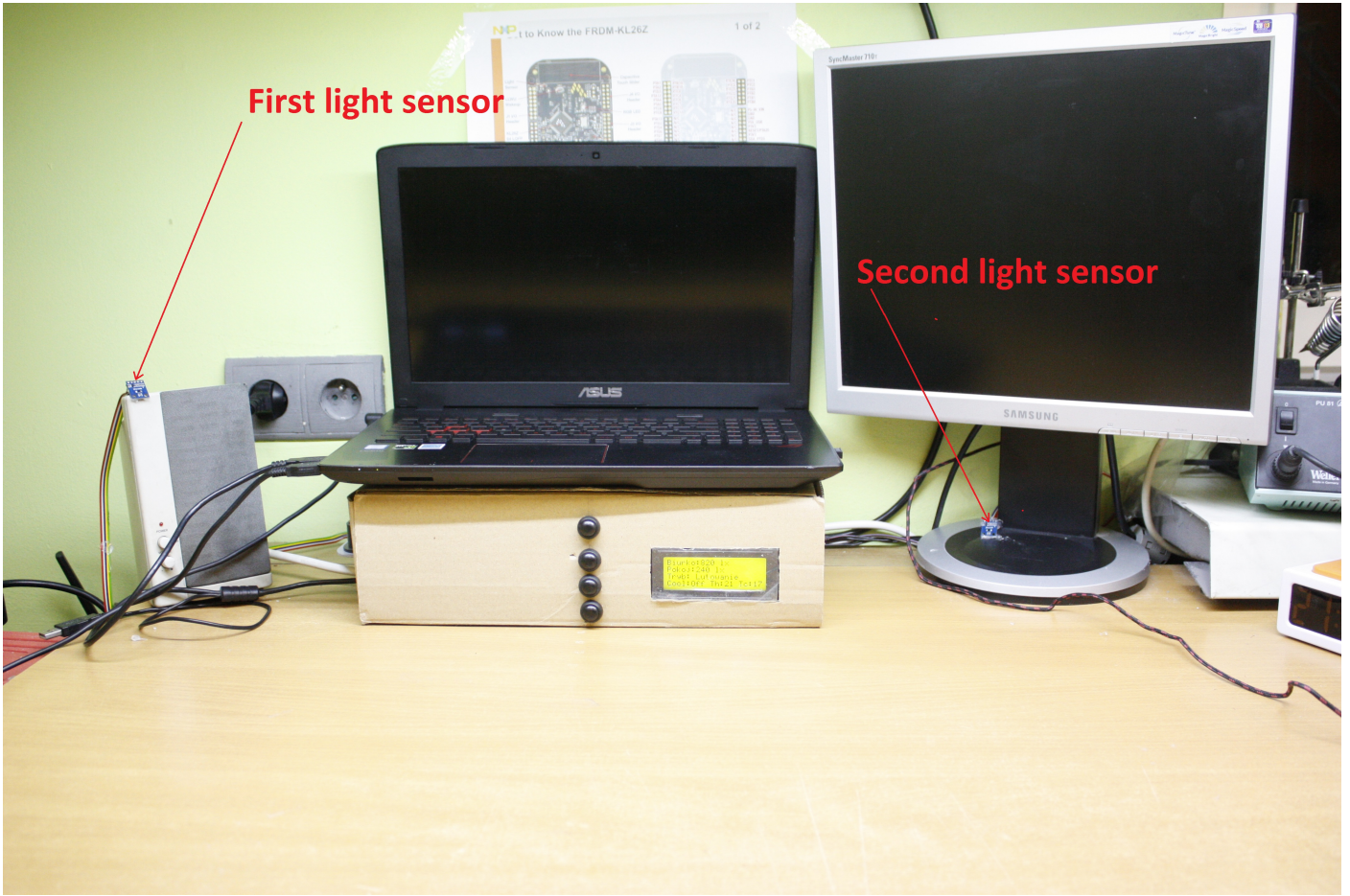
Controller uses MKL26Z128VLH4<sup>?</sup> microcontroller (Cortex-M0+) which is installed on development board FRDM-KL26Z<sup>?</sup> .

#### Sensors

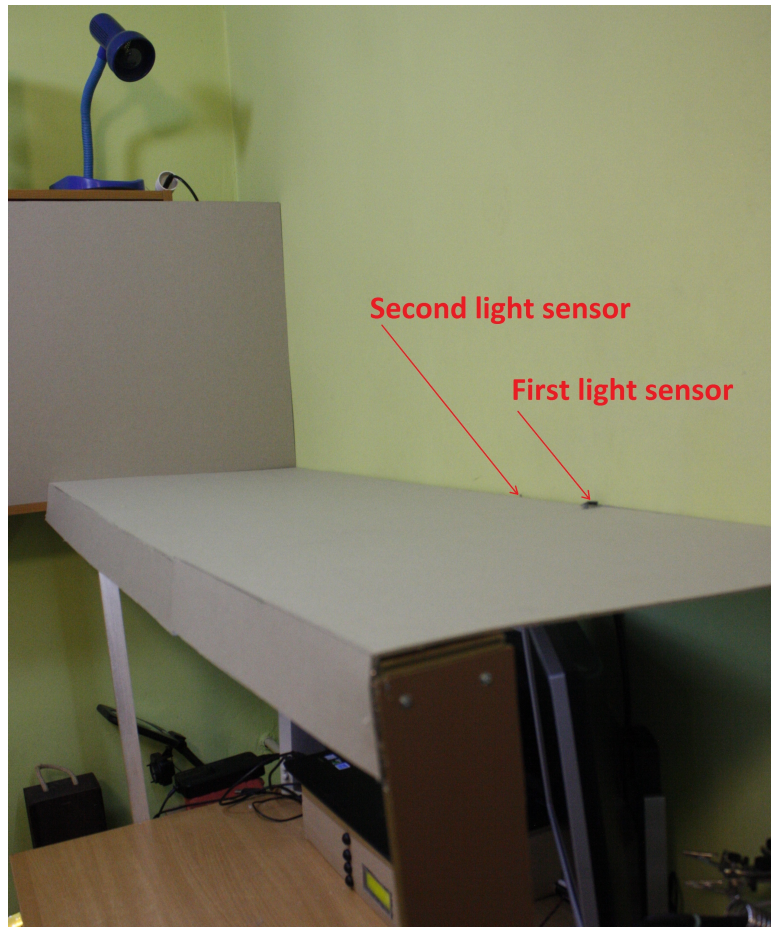
Project consists of four light sensors. First one is analog sensor ALS-PT19-315C. The rest of them are BH1750<sup>?</sup> . Two of these are mounted on the desk and the last one with analog sensor is mounted in a strategically designated place in the room (see figure 1).

#### Actuator

One meter of white LED tape and one bulb was used as actuator. Control of light in a room is simulated because the system is installed in a dormitory where electrical installation cannot be changed.



(a) Over the desk



(b) In the room

Figure 1: Places where light sensors are installed

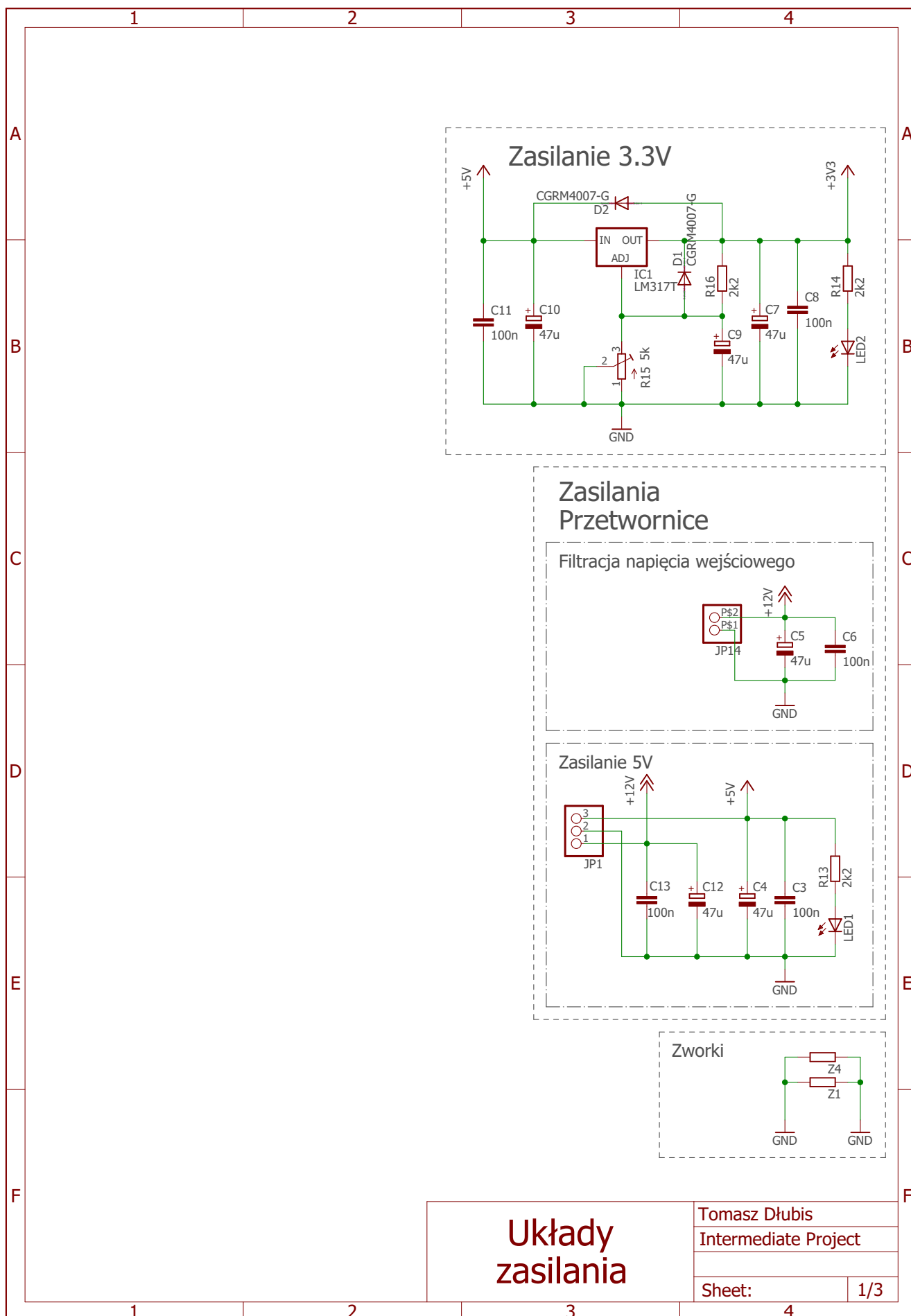
## Executive system

To execute control of the system was designed and created PCB shown on appendix A and B. The system is designed to be resistant to interference actuator ? ?

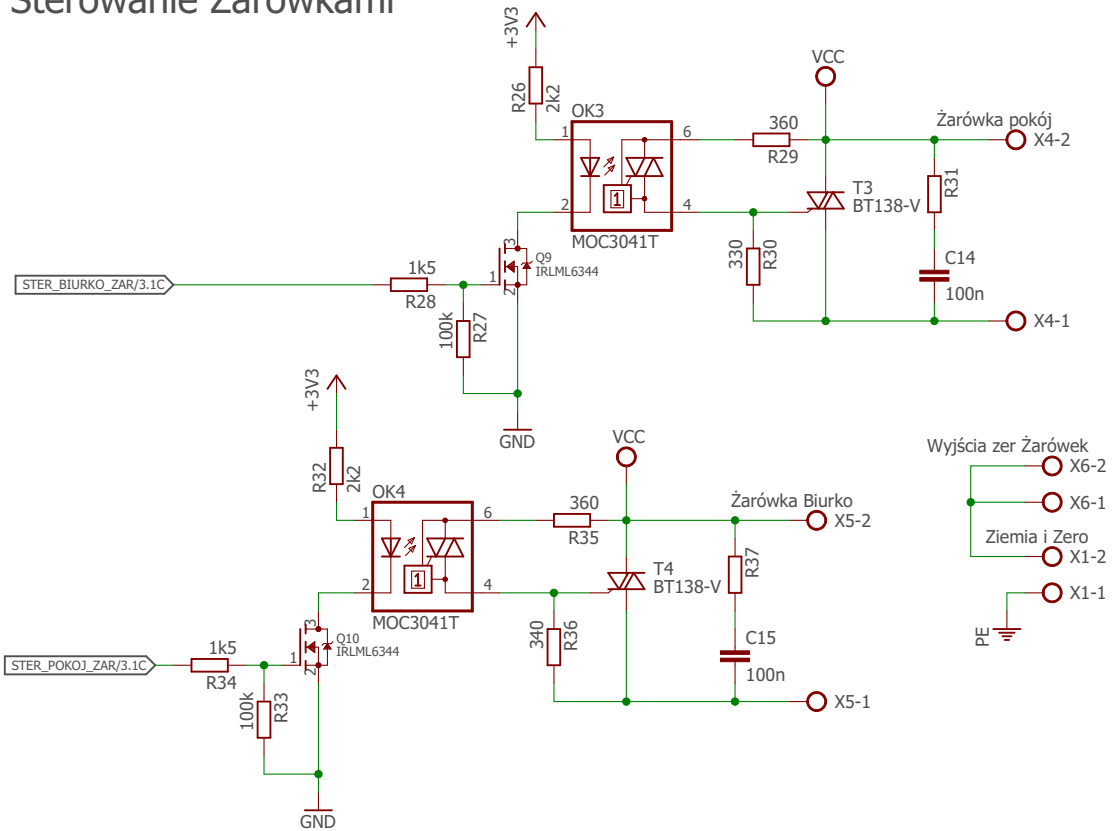
## 3 Results

Main goal of the project was accomplished. The embedded system to control lighting on the desk and in the room was created. The USB connection works only when system is connected directly to the computer. When system is connected via docking station used algorithm does not work. It is detecting constant connection to docking station. There is a need, however, to write a specialized driver in order to detect a computer connected to the docking station.

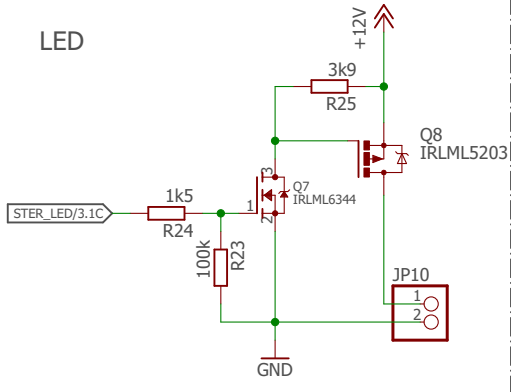
# A Electronic diagram of executive system



# Sterowanie Żarówkami

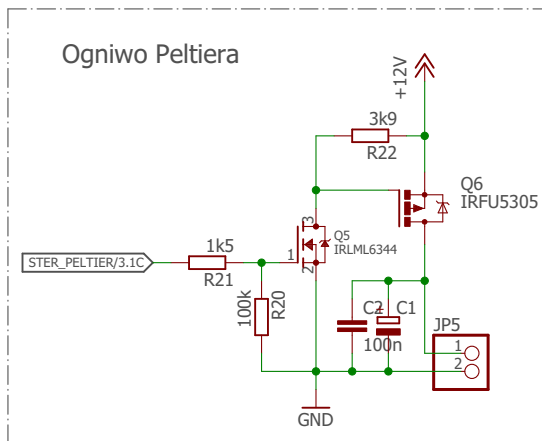


## LED

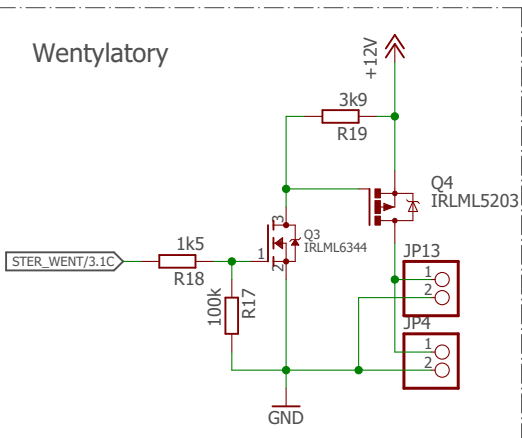


## Układy wykonawcze

### Ogniwo Peltiera



## Wentylatory



## Układy wykonawcze

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