**Hardware Architecture**

***SteerTurnIllum***



|  |  |  |
| --- | --- | --- |
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| Version: |  | 1.0 |

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# Glossary

This section contains a glossary of all the important terms and acronyms used inside the document.

|  |  |
| --- | --- |
| **Term / Acronym** | **Description** |
| ECU | Electronic Control Unit |
| uC | Microcontroller |
| PWM | Pulse Width Modulation |

Table - Glossary.

# Introduction

## Purpose of the Document

The purpose of the document is to define the hardware architecture of the ***SteerTurnIllum*** embedded academy project.

## Overview

The hardware architecture of ***SteerTurnIllum*** consists of the ECU schematic, which describes all the needed connections between the hardware components, and the microcontroller pin configurations which describes the pin modes and directions.

# Schematic

The ***SteerTurnIllum*** ECU shall contain the following general hardware components:

* 1 x STM32F4DISCOVERY development board based on a STM32F407VG uC: STM32F407G-DISC1.
* 1 x pair of STM32F4DISCOVERY development board to breadboard adapters (not visible in the schematic since they are just connectors).
* resistors for pull-up, pull-down topologies and for current limitation.
* breadboards and wires for connecting all the hardware components.

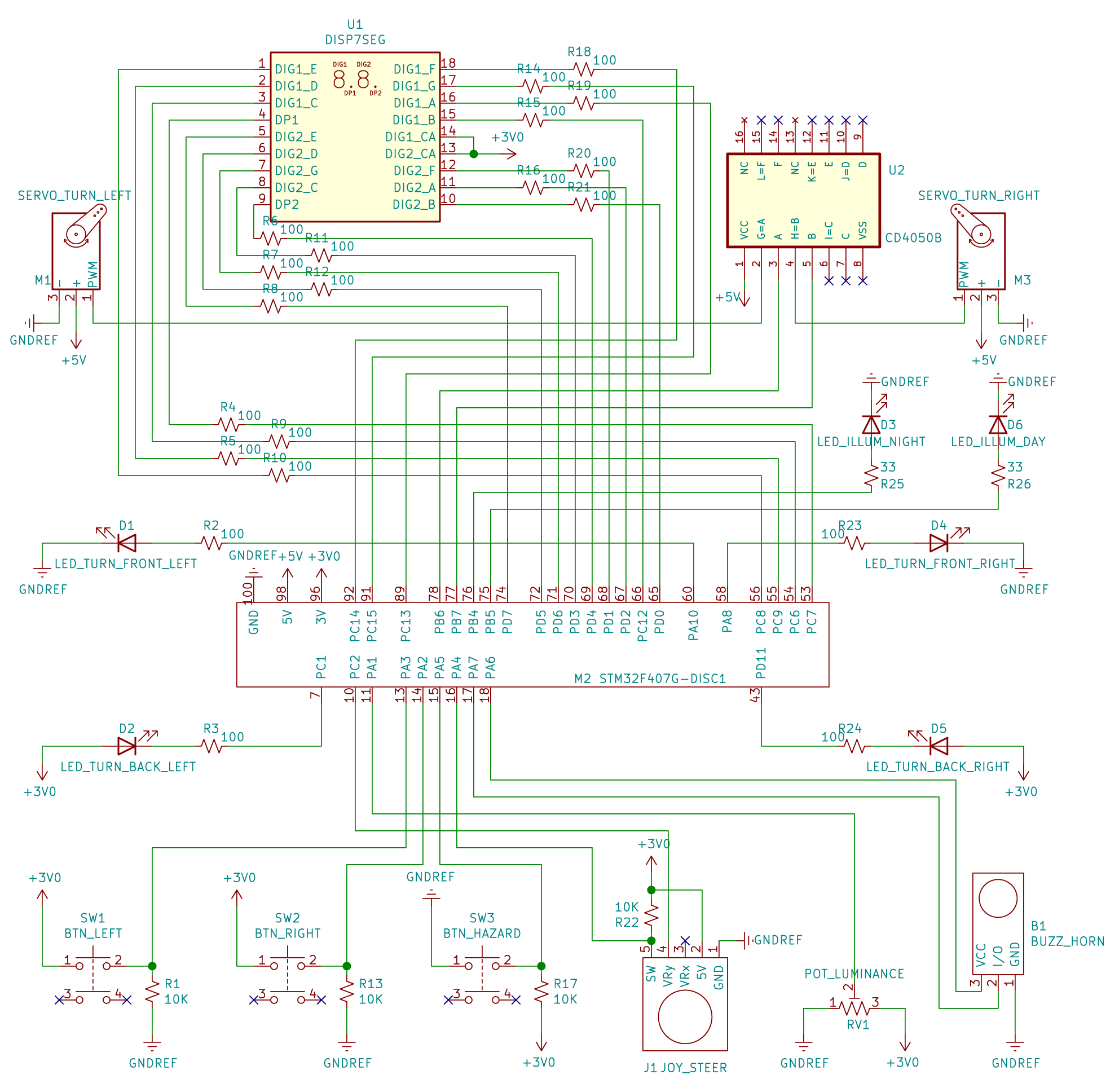
The ***SteerTurnIllum*** ECU shall contain the following input hardware components:

* 3 x buttons for controlling the turn signals: BTN\_LEFT, BTN\_RIGHT, BTN\_HAZARD.
* 1 x joystick with incorporated button for controlling the servomotors and the horn: JOY\_STEER. The incorporated button represents BTN\_HORN.
* 1 x potentiometer for controlling the luminance: POT\_LUMINANCE.

The ***SteerTurnIllum*** ECU shall contain the following output hardware components:

* 1 x buzzer for indicating the activation of the horn: BUZZ\_HORN.
* 4 x yellow LEDs for indicating the turn signals: LED\_TURN\_FRONT\_LEFT, LED\_TURN\_FRONT\_RIGHT, LED\_TURN\_BACK\_LEFT, LED\_TURN\_BACK\_RIGHT.
* 2 x red LEDs for indicating the board illumination: LED\_ILLUM\_NIGHT, LED\_ILLUM\_DAY.
* 1 x dual 7 segments display for indicating the configuration states: DISP7SEG.
* 1 x CD4050B buffer for amplifying the servomotor PWM signals: CD4050B.
* 2 x servomotors for indicating the steering of the wheels: SERVO\_TURN\_LEFT, SERVO\_TURN\_RIGHT.

The schematic of the ECU is presented in **Figure 1**. The schematic is also available as a .pdf in the ./../2\_Schematic folder.

Figure 1 – ECU schematic.

# Pin Configurations

The uC pin configurations that shall be used are presented in **Table 2**.

|  |  |  |  |
| --- | --- | --- | --- |
| Pin Name | Pin Mode | Pin Direction | Peripheral |
| PA3 | Digital | In | BTN\_LEFT |
| PA2 | Digital | In | BTN\_RIGHT |
| PA5 | Digital | In | BTN\_HAZARD |
| PA4 | Digital | In | JOY\_STEER |
| PA7 | Digital | Out | BUZZ\_HORN |
| PA6 | Digital | Out | BUZZ\_HORN |
| PA10 | Digital | Out | LED\_TURN\_FRONT\_LEFT |
| PA8 | Digital | Out | LED\_TURN\_FRONT\_RIGHT |
| PC1 | Digital | Out | LED\_TURN\_BACK\_LEFT |
| PD11 | Digital | Out | LED\_TURN\_BACK\_RIGHT |
| PD0 | Digital | Out | DISP7SEG |
| PD2 | Digital | Out | DISP7SEG |
| PD1 | Digital | Out | DISP7SEG |
| PC12 | Digital | Out | DISP7SEG |
| PC13 | Digital | Out | DISP7SEG |
| PC15 | Digital | Out | DISP7SEG |
| PC14 | Digital | Out | DISP7SEG |
| PD4 | Digital | Out | DISP7SEG |
| PD3 | Digital | Out | DISP7SEG |
| PD6 | Digital | Out | DISP7SEG |
| PD5 | Digital | Out | DISP7SEG |
| PD7 | Digital | Out | DISP7SEG |
| PC7 | Digital | Out | DISP7SEG |
| PC6 | Digital | Out | DISP7SEG |
| PC9 | Digital | Out | DISP7SEG |
| PC8 | Digital | Out | DISP7SEG |
| PA1 | Analog | In | POT\_LUMINANCE |
| PC2 | Analog | In | POT\_LUMINANCE |
| PB4 | PWM | Out | LED\_ILLUM\_NIGHT |
| PB5 | PWM | Out | LED\_ILLUM\_DAY |
| PB6 | PWM | Out | SERVO\_TURN\_LEFT |
| PB7 | PWM | Out | SERVO\_TURN\_RIGHT |

Table - Pin configurations.

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|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Vers.** | **Date** | **Author** | **Chapter** | **Modification description** |
| 1.0 | 10.07.2021 | Nicolae-Bogdan Bacrău | All | Created. |

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