ELEKTRONICA-ICT
Project Ontwerpen

RGBDigit Clock

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1 Content

2 Introduction

The project started with the question “What are the least requirements to design a system that is both safe and user friendly for an RGB Digit Clock”. The content of the application note has the methods used for the project, the Information about the materials and it also includes the result.

This project is about RGB Digit Clock which means the clock can change into many colors. If we connect a BME280 break-out board (BoB) then it is possible for this circuit to also display temperature, humidity, or air pressure very well. It is an interesting piece of equipment that has many useful functions, it is definitely worth taking a deeper look at. In the course of this project, the following auxiliary materials were used as a starting point: Elektor magazine.

The application note is structured as follows. Later to this introduction, all the materials and methods that are used can be found/retrieved. This chapter also explains the purpose of each component.

3 Material and methods

3.1 ESP-12

The clock is controlled by an ESP12 module, so it can be synchronized with a time server on the Internet, controlled with a mobile device or computer in the network, or receive sensor data via Wi-Fi. [1]

ESP-12 is a miniature Wi-Fi module present in the market and is used for establishing a wireless network connection for microcontroller or processor. [2]

Figuur 1 Esp-12

3.2 Arduino IDE

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.

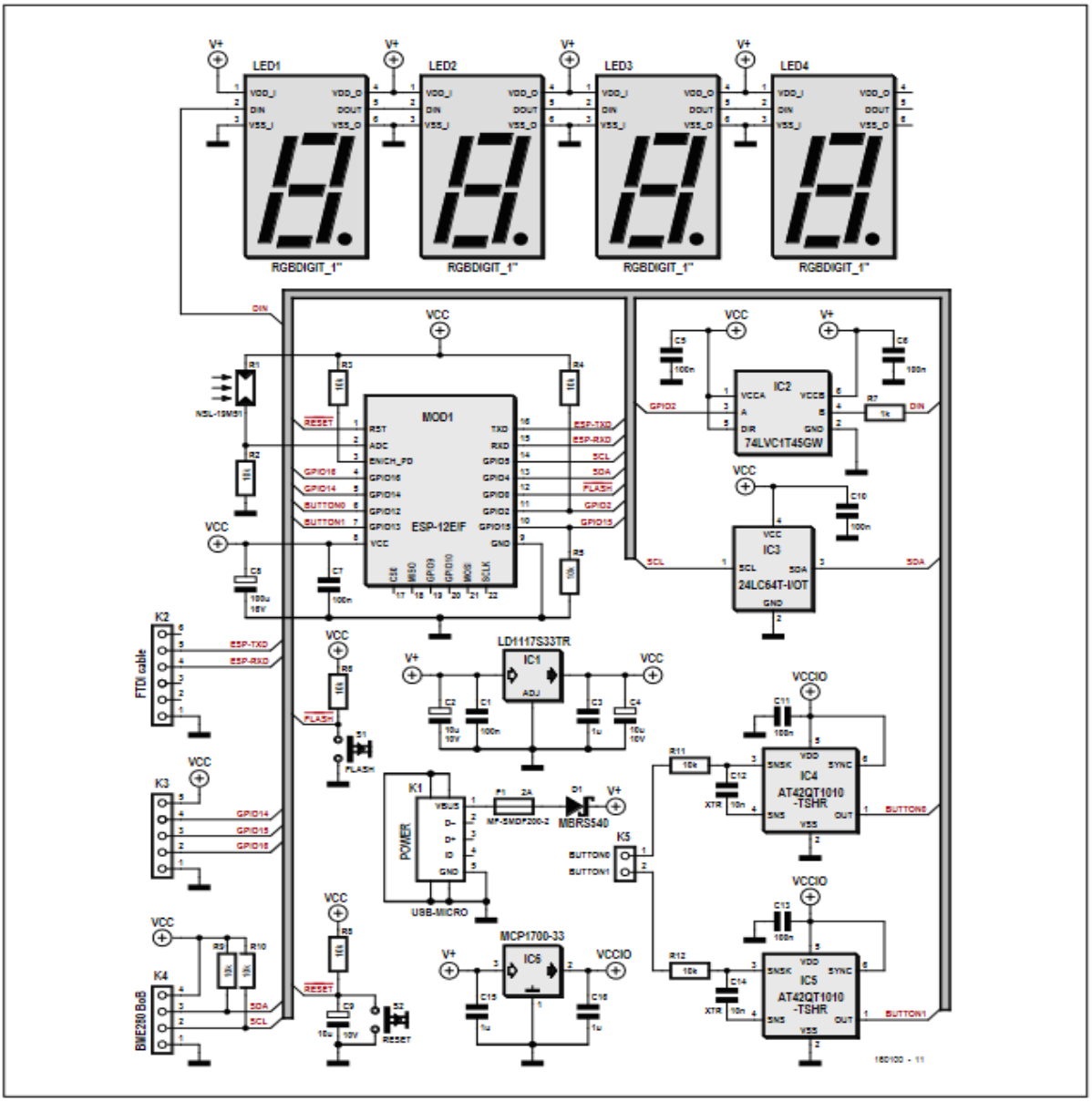
In this project, it will be used to write the main software of the RGBDigit Clock. There are a lot of libraries and support online for this IDE what makes it easier to write the desired code.

3.3 Multi-color 7-segment

This display has eight 5050-RGB NeoPixel LEDs (seven segments plus decimal point) with integrated three-chip chips, allowing the user to control the color and brightness of each individual segment via a 3-wire bus (VCC, GND, and DATA). Up to 10 displays can be strung together via the DATA IN and DATA OUT pins. Each LED of a NeoPixel emits a primary color (R, G, or B). And each LED can be set to 256 brightness levels, resulting in an astonishing 256 x 256 x 256 = 16,777,216 possible colors for each segment.

Figuur 2 7-Segtment

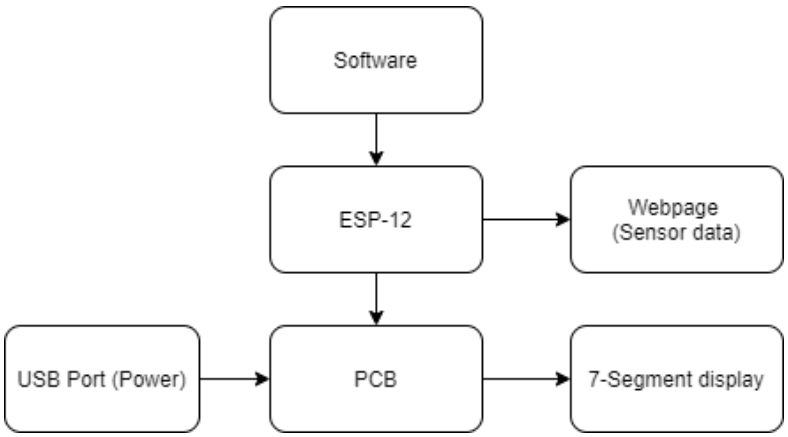
3.4 Schematic



Figuur 3 RGB Digit Clock schematic

In the figure 2, we see the full scheme of this project. The clock is powered with 5 V via micro USB connector K1. The power supply is protected by fuse F1, a 2A self-resetting fuse with a PTC. Schottky diode D1 protects the circuit against polarity reversal. IC1 is the 3.3V voltage regulator for most of the circuit and IC6 is the voltage regulator for the Qtouch touch sensors IC4 and IC5 (which have a separate power supply to prevent interference). The two touch sensors Button0 and Button1 are used to control the display mode of the clock. S1 and S2 are used only for clock resetting and firmware flashing IC2 serve as a level adjuster between the 3.3V of the ESP-12E and the power supply (about 4.5V) of the displays. In EEPROM IC3 the clock settings are saved in the event of a power failure and LDR R1 is used to dim the displays in the dark. On K2, a 3.3V-FTDI cable (or another 3.3V-USB UART) be connected to flash the ESP-12E module; it can also be used for debugging applications. Via K3, the 3.3V power supply, and three I / O pins of the ESP12E are accessible for in-house developments and/or future expansions.

3.5 Flowdiagram



Figuur 3: Flowchart RGBDigit

3.6 Component list

Component type	***Value***	***Quantity***	***Ordered from***
Resistor (R1)	LDR NSL-19M51	1	Aliexpress
Resistor (R2 - R12)	10KΩ	10	Aliexpress
Resistor (R7)	1KΩ	1	Aliexpress
Capacitors (C1,C5,C6,C7,C10,C11,C13)	100nF, 50V, X7R, 0805	7	octopart.com
Capacitors (C2,C4,C9)	10µF, 10V, tantalum, 1206	3	octopart.com
Capacitors (C3,C15,C16)	1µF, 50 V, X5R, 0805	3	Gotron
Capacitors (C8)	100µF, 16V, 2312	1	Gotron
Capacitors (C12,C14)	10nF, 50V, X7R, 0805	2	Gotron
Semiconductors (D1)	MBRS540	1	Gotron
Led's	7-segment RGB display	4	microelectronics
IC1	LD1117S33TR	1	microelectronics
IC2	74LVC1T45GW	1	microelectronics
IC3	EEPROM 8K × 8 bit, type 24LC64T-I/OT	1	microelectronics
IC4,IC5	Qtouch Touch Sensor type AT42QT1010-TSHR	1	microelectronics
IC6	MCP1700T-3302E/TT	1	microelectronics
Fuse (F1)	2A PTC resettable fuse, type MF-SMDF200-2	1	microelectronics
Micro-USB	Micro-USB type B receptacle, underside mount	1	microelectronics
Header	6-pin SIL pinheader, 0.1” pitch, right angled	1	microelectronics
Header	5-pin SIL pinheader, 0.1” pitch, right angled	1	microelectronics
Header	4-pin SIL pinheader, 0.1” pitch, straight	1	microelectronics
Header	2-pin SIL pinheader, 0.1” pitch, right angled	1	microelectronics
Micro controller	ESP8266-12F	1	Aliexpress
Switch (S1)	Tactile switch	1	microelectronics

3 Reference list

[1] C. d. Bruijn, „RGB clock," https://www.elektormagazine.com/, Nederland, 2017.

[2] „ESP-12E - WiFi Module," https://components101.com/wireless/esp12e-pinout-datasheet#:~:text=ESP%2D12E%20is%20a%20miniature,SoC%20(System%20on%20Chip)., 17 October, 2018.