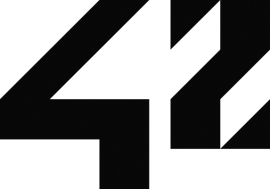
Rainbow Clock

Electronics

User’s manual

*Document Revision. A*

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# Glossary

1. Microcontroller

An embedded computer integrating a whole range of peripherals in a small package for convenience.

1. Bluetooth

A wireless communication standard permitting short-range exchange of data between electronic devices.

1. Refresh rate

A measure of the number of times an image can be drawn completely over the period of a second; this value is expressed in Hertz. Synonymous to *“FPS”*.

# Product overview

## Description

Rainbow Clock is an unusual timekeeping device characterized by an exotic look and designed with electronics in mind.

## Capabilities

* Display the current time of the day
* Synchronize itself via a Bluetooth connection
* Alter its color scheme depending on events

## Quick specs

* Microcontroller: PIC32MZ series
* LEDs: 60, RGB type
* Refresh rate: ~10Hz
* Power: 15Watt max, 0.5Watt minimal, 0.6Watt typical (measured on a prototype)

# Basic operation

## Reading the time of day

Each color encodes a distinct time unit. For each unit:

* 3 red adjacent LEDs represent the hours.
* 2 green adjacent LEDs represent the minutes.
* The remaining blue LED represents the seconds.

To ease reading, the clock’s display is subdivided in four quadrants.

## Changing the color scheme

Using the central dial, navigate the menu looking for “Color Config.”

Validate your choice. You will be presented with a choice of colors on the screen. Use the dial again, select a color and validate your choice.

## Updating the time on the clock

Using the central dial, navigate the menu looking for “Time Config.”

Validate your choice.

# Advanced operation

## Synchronizing the clock using Bluetooth

Initiate a serial connection to the Rainbow Clock’s Bluetooth module configured for a rate of 115200 bauds. The code to be sent is structured as follows:

“T**ssmmhh**ddMMYYYY”

With ‘T’ designating the Time config function.

# Technical details

1. Block diagram

Buzzer

PIC 32

IR/Light sensor

Raspberry Pi \*

Pressure sensor

Bluetooth

Temperature sensor

AC to DC Power supply

1. Electrical consumption

* Leds consumption: powered between 3.5v and 5.3v, consumption is about 60mA in maximum, 60mA x 60 = 3.6A.
* PIC32 consumption: powered between 2.3v and 3.6v and consumption is 100mA maximum.
* BMP280 consumption: powered between 1.71v and 3.6v and consumption is in maximum 4.2µA.
* HC-06 consumption: powered between 3.1v and 4.2v and consumption between 8mA and 40mA.
* In line 3.3v the consumption of current is about 141mA, in line 5v current consumption is about 3.6mA maximum, the total consumption is 3.741A maximum.

1. Components required for the project

* 1 *(one)* PIC32xxxxxx microcontroller. Ref:
* 1 *(one)* strip of 60 RGB LEDs. Ref fab: WS2812b
* 1 *(one)* incremental rotary encoder Ref: 1191733
* 1 *(one)* 20x4 alphanumeric LCD screen Ref: 2063162
* x *(xxx)* resistors xΩ Ref: xxxxxxx
* x *(xxx)* capacitors xF Ref: xxxxxxx
* 1 *(one)* tension regulator 3.3v Ref: 1825291RL
* 1 (one) digital pressure and temp sensor Ref fab: BMP280
* 1 (one) Bluetooth communication module Ref fab: HC-06
* 1 (one) 5v Supply Ref: 1625685
* 1 (one) buzzer Ref: 2361105
* 2 (two) push buttons Ref: 1550267

…

* Leds, we choose to use leds WS2812b because we can drive it with 1 wire with a simple protocol descripted in the datasheet of component. (not going to be bought in farnell)
* Temperature and pressure sensor, BMP280 or BME280 sensor chosen because it’s include a temperature and pressure, it’s communicate with i2c protocol. (not going to be bought in farnell)
* Light sensor, we want to use a classic light sensor in voltage divider montage and connected in an analog input pin.
* Incremental rotary encoder, we choose a rotary button because it will permit to us usage of rotary button and its look like a rotary button in analog clock.
* Bluetooth module, we want to use a serial to Bluetooth module because it’s an easy way to communicate with android smartphone and computer.
* 5v Supply, delivery 4A at 5v, it can support maximal charge if we set all LED in maximum brightness.
* Tension regulator, can delivery up to 1A in 3.3v for modules using this tension.

# Planned features

* ***Display basic weather data and forecast using built-in sensors***

Data gathering could reveal itself being a nice addition to the project.

# Contributions

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# Endnotes