

Embedded Systems Project Proposal

A Word Clock

Abstract

The designer clock “QLOCKTWO CLASSIC” inspired us with its timeless, minimalist design and the ability to show the time written. We want to take the design and create more ways to integrate it into daily life. Therefore we added the ability to show the weather, which will be received through WiFi. Our clock can be switched from showing the time to the weather through a proximity sensor on the side of the clock. This will feel to the user similar to a touch surface, without having to touch anything. When the clock is switched to the weather mode, a colorful animation, using the letters, will first show the weather and then switch to a text based view. Using a second proximity sensor the light can be switched off at night, so that the clock can be situated in a bedroom. For even more convenience we want to add a brightness sensor, so that the light is automatically dimmed in dark rooms and shines brighter if the room is flooded with sunlight.

For the LEDs we want to use RGB LED stripes, which will be controlled using a RGB LED driver over the SPI interface. As the main device an “Orange Pi Zero” was chosen, because it will be easy to program, can run a standard Linux distribution and comes with an wireless antenna. To connect it to WiFi the user will have to insert a config file with the WiFi name and password using USB. We do know that this is in no way secure. However, we think that the alternative WPS is neither and therefore we do not want to use it.

Once connected to the internet, the clock will receive weather information to its location through a weather API.

To stay in budget, the body of the clock will be 3D printed.

Motivation and Goals

The Joy of Owning a Chic Clock

Our primary motivation for this project is the designer clock “QLOCKTWO CLASSIC”. The design and idea behind the clock speak for themselves. Everyone of us is motivated to work for this project in prospect of having his/her own clock.

The Price

No matter how good the “QLOCKTWO CLASSIC” looks it has one downside: the price. At 1.180 € is not affordable to a student. We set our goal maximum expenses to around 40€ per clock and want to try our hardest to stay below it. Since all of us would like a clock in the end we will produce four and hope for some bulk discounts. However in the context of this laboratory only one clock will be discussed, so that the other clocks can be improved with growing experience.

Extended Functionality

Secondly we want to extend the functionality of the clock without ruining its design aspect. Before leaving the house it comes handy to just lightly touch the clock and see if it is necessary to take an umbrella. The short animation played before showing a simple weather forecast draws attention to the clock and will be played only once after switching to weather. So that the clock will look classic and chic most of the time. Also, nobody wants a blinking and flashing clock in the room.

We also think that an automatic brightness adaptation will be handy. In already dark rooms the clock will be dimmed, so that the user's eyes can adjust better and read the time without flinching. In bright rooms it is important that the time is still readable.

Experience in Different Fields

Our group consists of three Information and Computer Engineering students and one Electrical Engineering student. All of us want to learn new skills, look into different areas of our studies and learn from each other. Everyone can offer a different set of skills for this project and instead of everyone doing what he or she is already good at we want to learn from one another. However, we plan to skip the 4 A.M bug searching session the day before the deadline (this time).

Apart from learning in technical aspects we will learn how to work together in spite of our different backgrounds. Most of our group assignments were done with students of the same discipline.

Components

We will buy all of our components on our own, since we do want to keep the clock we build.

- RGB LED Stripes
- RGB LED Driver
- Orange Pi Zero
- 3D Printer Filament
- 2 Proximity Sensors
- 1 Brightness Sensor

Milestones

We divided our project into nine different tasks. For most tasks one person is responsible, however we plan to work in groups on most tasks.

After evaluating delivery times it became clear, that it will not be possible to first build the hardware and then write the code. Therefore we will start writing the code at the beginning and assemble the hardware as soon as it arrives.

1. Design of the Clock: this will be done right after receiving the feedback. We do have a design in mind and will make some prototypes to see which size exactly our clock will be
2. 3D Printing will be done as soon as possible. We want to print the face of the clock and an inlay for the LEDs.
3. LED Assembly using an RGB LED driver and testing of functionality and colors.
4. Clock Assembly with Sensors
5. Sensor Adjustment: Adjustment of brightness and proximity sensors.
6. Code Design Decision: Design of helper functions for low level calls, decide on programming language and operating system, the config file,...
7. Programming of the Clock: This can be done in advance, using low level helper functions that will be programmed later on.
8. Programming of Weather
9. Animations

Tasks	Responsible	Time							
		WN 15	WN 16	WN 17	WN 18	WN 19	WN 20	WN 21	WN 22
Design of the Clock	Andrea								
3D Printing	Thomas								
LED Assembly	Dominik/David								
Clock Assembly with Sensors	David								
Sensor Adjustment	David								
Code Design Decision	all								
Programming of Clock	Dominik								
Programming of Weather	Andrea								
Programming of Animations	Thomas								
Deadline	all								