TECHNICAL REPORT

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Introduction

The technical details of the prototype are presented in given report. Reason for choosing definite components and how they work with our code are also explained. The project video, which we have made, and its description are presented to your attention.

The goal of the project and the prototype

The goal of our project is to make a product which would notify the musicians automatically when the music reaches "harmful level" (by means of color or vibration). After that the musician could take the precaution measures in order to protect the ears. It is important for musicians to understand how loud he/she plays music. Therefore, we did not want to make a device that would decrease the sound of music automatically.

We came up with so many different ideas and variants of multiple solutions. The goal of our project is to inform the musician about loud music. This is up to the musician to decide how to proceed further: listen to loud music, insert earplugs into the ears or decrease the sound of the music. After conducting the interviews and making analyzes of data we ended up with idea about a wristband and a case for it.

Video

Link to the video: Youtube (https://www.youtube.com/watch?v=80gDaEGKxeg)

Video starts from the presentation of issue. The main reason why musicians have hearing problems is listening to/playing loud music. To be more specific «Listening to music over 100 dB for 15 minutes can already damage our hearing». After presentation of issue we showed our solution. We have made a product that notifies a user about too high level of music. In the video we are showing all functions of the device and explain how to use the device itself. At the end of the video you can see technical parts of both devices.

The product, which is displayed in the video, is real and looks exactly as in video. The functionality of the product is the same, as presented in the video. Music is playing during the whole video just for atmosphere. No other montage has been done during the functioning presentation of the product.

Technical specification

The main part of each device is Arduino Nano. We wanted to make our product perfect, so we ordered smaller Arduino (Arduino Pro Mini). Unfortunately, we did not receive it in time. We decided that the device should be portable. In the wristband we use a small battery (300mha) that can be charged in 10 minutes, and for the case we use 8 times bigger battery (2600mha). We use a bigger battery for the case because we wanted to make wireless charging possible. Therefore, when user would put the wristband in the case it could be charged there. This feature can be made in product 2. For this product we decided that charging time equal to 10 minutes is fast. We also needed a charger module for charging the batteries in the devices. We found one type of charger module that had protection from overcharging, and we used it with both batteries.

We connected microphone (Adafruit MAX4466) to Arduino's analog input. We got a dB value, as output, with help of the code. This microphone has potentiometer that we have used to adjust gain. We placed a smartphone with running dB meter application and our device side by side and calibrated it to make output values to be as close as possible to the real ones. But with our microphone the max dB value that we could get was 95. We set maximum value when it is too loud to 93 instead of 100 as it should be.

We have transferred dB values to our second device through the Bluetooth connection. We have considered an option with an infrared transmitter as well, but decided to go with Bluetooth. Devices, that use Bluetooth, do not need to be in a field of view of each other but must be in the area of 10 meters. For example, you can leave a case in a bag and information will be transmitted from a wristband to a case in any case. We have used BC-05 model for Bluetooth connection because it can work in both modes: Master and Slave mode. Master Mode was used in wristband while in the case it was set as Slave mode.

At the beginning we were not sure what will work best, LEDs or vibration to alert the user about the sound level. After conducted interviews we found out that for some people it would be comfortable to "feel" while for others to "see" the device. For "feel" notification, we chose 5v vibration motor. One end of it we connected to the ground and another to the digital input on Arduino. So, we could easily control the device with code. For the "see" notification we used addressable NeoPixel ring with 8 LEDs. WS2812b LEDs has only one pin to send data about colors. Therefore, they are easy to use, do not have a lot of wires connection and can light different colors. As a result, we could indicate the sound level.

LEDs can be very bright in some areas. We added simple push-button for the end user to have control over LEDs brightness. The same button used to change between modes: LEDs + vibration/ only LEDs / only vibration.

The 1.8 tft screen on the top of the case shows the statistics over the sound level of listened music. To connect the screen to Arduino we needed 5x 1kohm resistors.

Materials

Wristband

As a base, we used a reflective band. All components were glued to the base. Connection between all parts were made by soldering small wires. We covered the wristband with textile after testing the product and making sure that everything worked fine.

Image 1: Wristband

Case

We have made a case from scratch. Firstly, we made a sketch and, secondly, 3D Model that was used for 3D printing of the case. We chose PLA material for printing and 10% infill because the case would be pretty light. For the decoration we used fiber vinyl to make the case look more presentable.
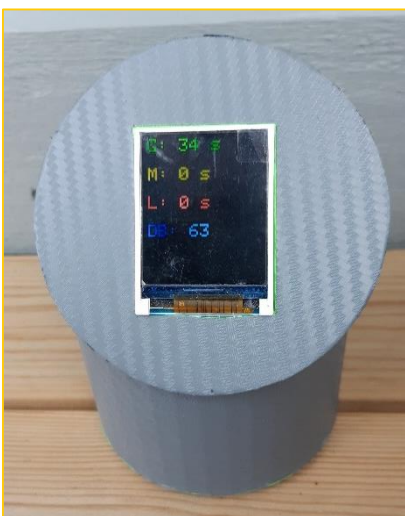

Image 2: Case

Image 3: Case's inside

List of components that were used

For the wristband:

- 1x Arduino Nano
- 1x Bluetooth module BC-05 (master mode)
- 1x Microphone sensor MAX4466
- 1x NeoPixel ring with 8 leds
- 2x push-buttons
- 1x 3 position slide switch
- 1x 5v vibration motor
- 1x Li-po battery 300mha
- 1x Li-po battery charger/protection module
- Wires to connect components

For the case:

- 1x Arduino Nano
- 1x Bluetooth module BC-05 (slave mode)
- 1x 1.8 tft screen
- 1x 2 position slide switch
- 1x Li-po battery 2600mha
- 1x Li-po battery charger/protection module
- 5x 1kohm resistors
- wires to connect components

Wiring diagrams

To show the products' inside and connections as accurate as possible, we took the picture and made a wiring diagram of both products. There are some components that are not the same model as in the diagram, because the software doesn't have exactly the same models as we used in our project. To illustrate all connections, we found similar models.
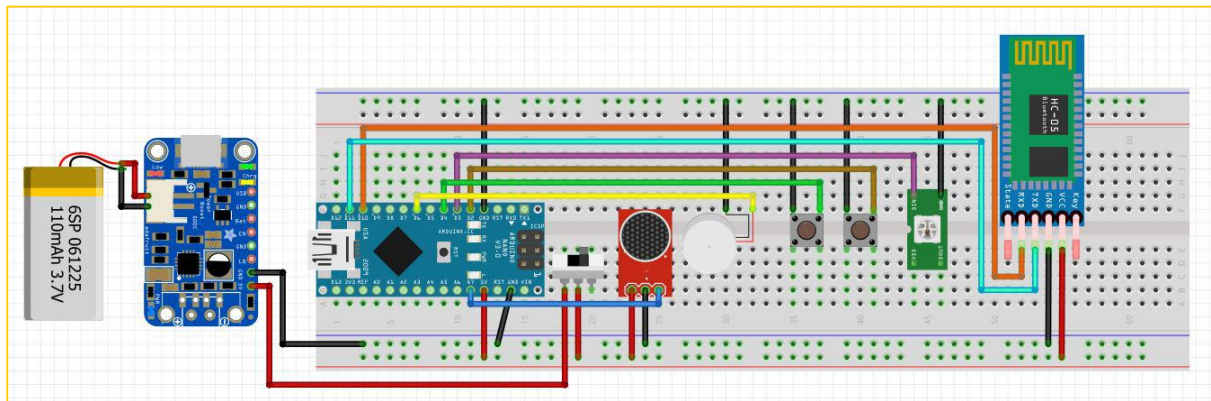
Diagram of the wristband:

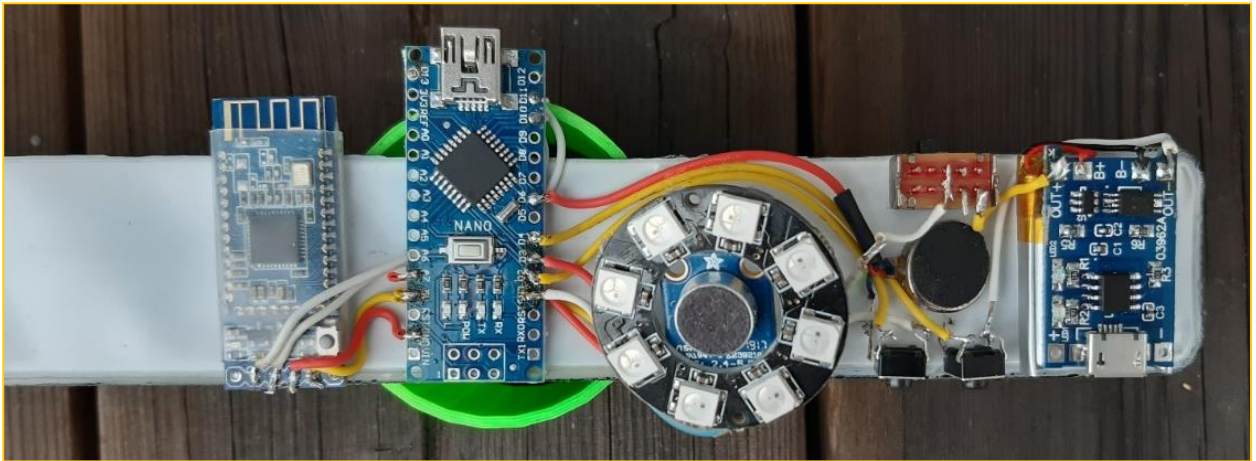*Image 4: Diagram of the wristband made in software*

Image 5: Actual wristband before covering it with textile
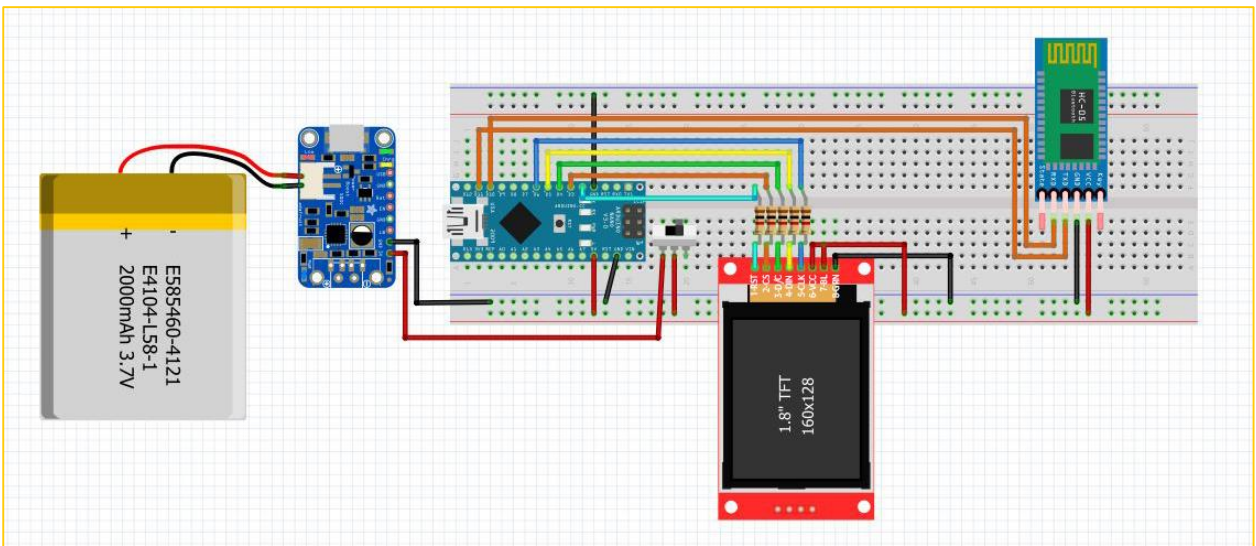
Diagram of the case
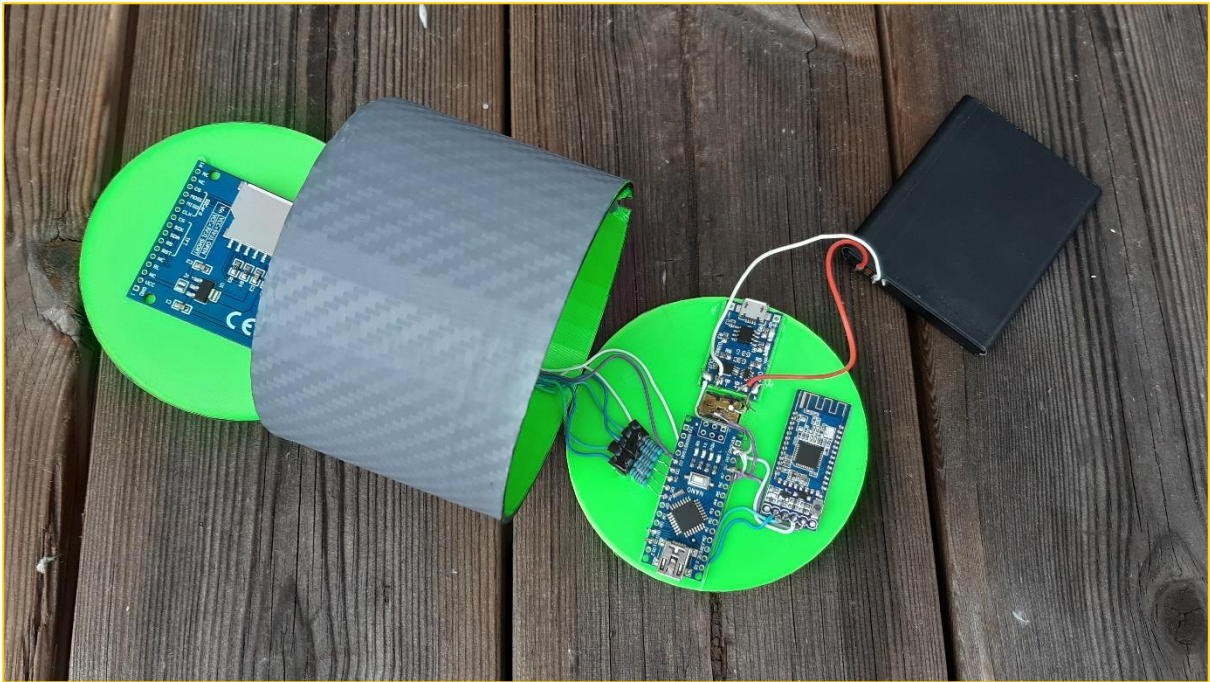

Image 6: Diagram of the case made in software

Image 7: Actual case before putting all together

Code

Code with comments you can find on github:

https://github.com/ArtiomBoo/IN1060-AHAAR-Project

- Wristband: https://github.com/ArtiomBoo/IN1060-AHAAR-Project/blob/master/wristband.ino
- Case: https://github.com/ArtiomBoo/IN1060-AHAAR-Project/blob/master/case.ino

Reference list

- TFT screen manual: https://www.instructables.com/id/Beginner-Arduino-Using-a-18-Inch-TFT-Display/

- Bluetooth manuals: https://view.uio.no/portal/webclient/index.html#/desktop

  http://diwo.bq.com/wp-content/uploads/2014/11/BLK-MD-BC04-B_AT-COMMANDS.pdf

- FastLED library example (for LEDs):

  https://github.com/FastLED/FastLED/blob/master/examples/Blink/Blink.ino