Documentation: Arduino party glasses

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***Abstract*—The course "Researching and Designing Wearable Interfaces" at the Bauhaus University of Weimar introduced us into the work with Arduino Uno applications. The intention of the course was to design a wearable device. Each team was equipped with a sensor, in our case the alcohol gas sensor, and should come up with a wearable idea in combination with the Arduino board. Our idea was to build party glasses which can light up in different colours according to the alcohol level supported by an Android application.**

I. Introduction

Our first draft was an implementation on the computer. We fixed 3 LEDs (a green, a yellow and a red one) onto the Arduino board and connected the gas sensor with the Arduino. The implementation in the Arduino code made the LEDs blink (alcohol level $<$ 150 $\rightarrow$ green, low frequency; 150 $\leq$ alcohol level $\leq$ 300) $\rightarrow$ yellow, medium frequency; alcohol level $>$ 300 $\rightarrow$ red, high frequency). We extended this version in the Processing code to generate an user interface on the computer.

II. Implementation

The user interface on the computer was a ranking of different devices. The user or the sensor with the highest alcohol value was listed on top of the ranking (c.f. Fig.1). The implementation can also be used via bluetooth connection between the Arduino board and the computer. In our code only "H01" is a real device, the other devices are supplied with random values, since it was quite hard to combine incoming values from three devices into one ranking, especially via bluetooth (it was not possible to connect to multiple bluetooth devices with the computer).

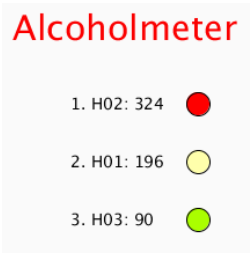

Fig. 1: Ranking algorithm

Now there was the question how to integrate these functions into a wearable design. We came up with the idea of party glasses, because alcohol is often associated with party and the LEDs are a nice effect, when it is a bit darker around. Moreover, the LED light can be seen by the user and by others when wearing it. Since the user probably wants to see the exact value of his alcohol level, we created an application for a smartphone (in our case an Android phone Sony Xperia L) to provide him with live data. Quite soon, we discarded the idea to take over the ranking algorithm in the Android application. We didn't want the project to become too complicated and thought, it wasn't so useful anyway. So, we focused on presenting the alcohol value to the user and added some nice extra functions in the Android application(c.f. III-B).

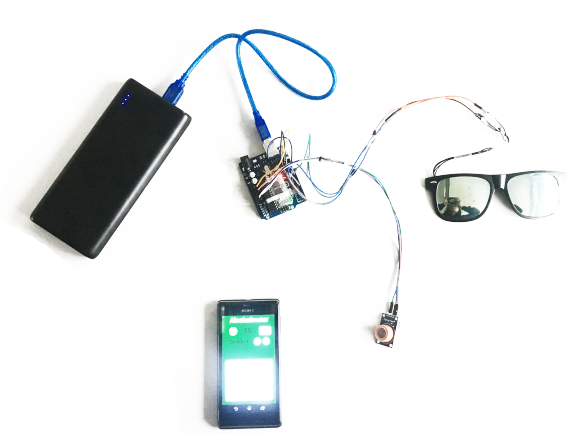

Fig. 2: Overview of our project components: Battery, Arduino board, bluetooth module, gas sensor, LED SMD glasses, Android phone with application

III. Design components

A complete wearable design consists out of different components. First their is the electronic part, where all wires and LEDs must be connected in the right way. Second, there is the programming part, so the design can have different functions according to a certain scenario. At last, there is the appearance or design of the wearable device, so the user likes to wear it.

A. Arduino board

The Arduino board is the engine or center of the whole design. It connects all components among themselves. All connections are listed below or can be looked up on the Arduino website [2]:

Arduino board $\rightarrow$ glasses:

- GND: Digital Out, an output channel
- Pins: 10, 11, 13

Arduino board $\rightarrow$ gas sensor:

- A0 $\rightarrow$ A0
- GND $\rightarrow$ GND

- 5V → VCC

Arduino board → bluetooth module:

- RX → TX
- TX → RX
- 5V → VCC
- GND → GND

B. Android Application

For the programming part, we used the Arduino IDE [1] and Processing IDE [3]. When implementing the ranking algorithm on the computer, we got the sensor data via the package processing.serial.*. This package can't be used in the Android environment. So we imported the data with the ketai.*. Other useful advice, when running the code, can be found in the ReadMe.md of the Github repository [4].

Moreover, we wanted the application to have a simple user interface which can easily be understood. When starting the App (make sure bluetooth is activated on your device), one can see all connected bluetooth devices listed on the screen.

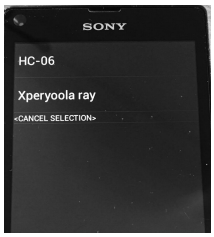

Fig. 3: Bluetooth connection

Selecting the Arduino device (e.g. HC-06, c.f. Fig.3) brings us to the actual application (c.f. Fig.4). It has the following functions:

- **A coloured circle**: Changes the colour according to the alcohol level shown on its right
  ⇒ (alcohol level $< 150 \rightarrow$ green; $150 \leq$ alcohol level $\leq 300) \rightarrow$ yellow; alcohol level $> 300 \rightarrow$ red).
- **Save button**: The current alcohol level can be saved in the white plot box below, the last value saved is always shown on top of the plot.
- **Drinks**: The user can count his drinks by pressing the plus or the minus (when mistyping happened) button. The number of drinks is also recorded in the plot next to the saved value point.
- **Plot**: Shows the saved values in a graph, all value points are connected via a line. When the graph reaches the end, it is cleared and starts again.

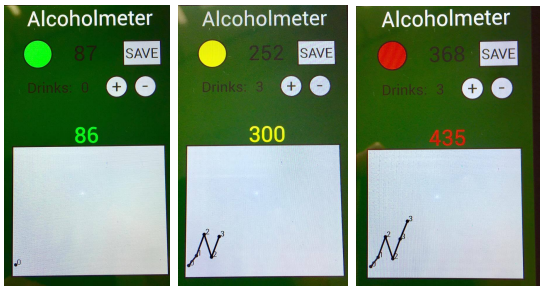

Fig. 4: Android App user interface

C. Design appearance

In our first prototype we fixed normal LEDs onto the glasses. But they appeared too big and hard to handle, so we ordered LED SMDs which are much smaller and can be printed onto the glasses. The lower row is the green light row, the middle one has only yellow LEDs and the top row only red ones (c.f. Fig.5).

Fig. 5: Left: back of the glasses with LED SMDs; Right: coloured light of LEDs shining through the glasses

The battery and the Arduino board were stored in the hood of the jacket, when testing the device (c.f. Fig.6). The sensor is connected to the Arduino board with a long wire, so it can be brought from the back into the front.

Fig. 6: Testing the prototype

IV. Conclusion

In conclusion, we are very satisfied with our end product. It fulfills all desired functions and can be used as a fun effect on a party. The glasses are clip glasses, so they can be fixed on any glasses the user likes to wear. When using it, the visibility could be restricted, but it can also have a bewitching effect to look through lightning glasses.

The whole design is a prototype and therefore unhandy. For future work, the battery and the Arduino board should be compressed to a portable attachment with less weight. The App is also not scaled for other phone than the Sony Xperia L. This could also be changed if desired.

Morally, measuring and knowing the alcohol level can have an advisory effect and a fun effect (positive effect), but could also have a pushing effect to drink even more alcohol (negative effect). We think the negative effect doesn't come up in most cases, since it is already possible to reach very high alcohol values by only leaving the alcohol in the mouth and not even drinking it.

References

[1] https://www.arduino.cc
[2] https://create.arduino.cc
[3] https://processing.org
[4] https://github.com/yoola/GasSensor_Arduino