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Project Plan Documentation
“Cheers”

1. Description

Fig 1 Design draft of the smart cup

The aim of this project is to develop smart cups.
These special cups have a wide field of application and can be used for example at events or parties. They offer different advantages to the provider as well as to the user.
A first design draft of these smart cups can be seen in fig 1.

Strictly speaking, it is not the glass itself that is smart, but an attachment. It can make any glass smart as long as it can be attached to it. The attachment will be 3D printed, waterproof, and should have a low profile. It contains various components which are described in more detail in the section Required Components.
The advantages of a smart cup are immense. Users can play different games with it, order drinks digitally using the cup and pay at the end or win drinks. But there are also many advantages for the provider. The cups generate a lot of data that can be analyzed, track consumption behavior, attract new customers, as well as entice the customers to purchase more drinks to continue participating in the games.

A cup is assigned to a user at the beginning of an event, with already created accounts or a guest account. To create an account, some personal data must be entered, which can then be used for evaluation and unlocks additional functions. Like paying at the end or estimating the alcohol level of a user.

The smart cups also have RGB LEDs, these can provide visual feedback to users and they can be used during games.

A gateway is provided for the operator. This gateway communicates with the individual cups, can set them to different modes, and change the color of the cups. In addition, the gateway can communicate with the cloud and calculate all the necessary things for any games that can be played with the cups.

2. Connections

This diagram in fig 2. visualizes the different connections between the individual components in the project. A user can create an account on a website. If the account was created, it can be assigned to a cup in the gateway. The gateway then communicates with the cup and, if necessary, uploads relevant data to the cloud, which the user can view again via the website.

Software Areas	Tech Stack
Microcontrollers (ESP32)	Arduino
Gateway (RPi)	Golang
Frontends: Webapp & GW Interface	ReactJS
Backend	Firebase

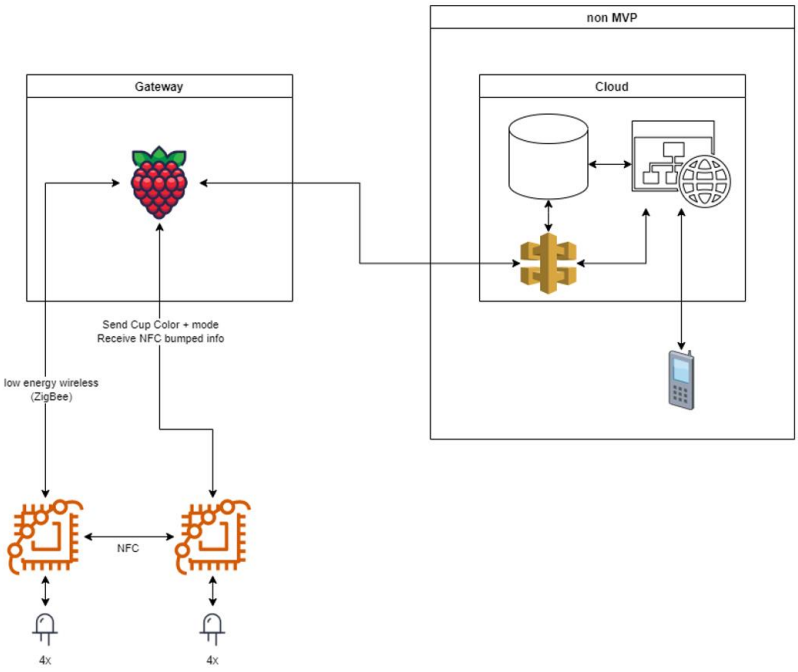

Fig 2 Communication Diagram

3. Required Components

The following table lists all components needed for this project and describes how to use them. Components of the gateway are shown in green, those of a cup in yellow, and the cloud in blue.
The table above contains the software tech stack for the components in question.

Equipment	Operational area
Raspberry Pi Model 3B	The Raspberry PI is used as a gateway. On the one hand, it communicates with the cloud, but also with the individual cups to switch them to different modes or change the color
Zigbee Gateway (ioBroker ITSTUFF CC2531) (or Raspbee)	A gateway that can be connected to the Raspberry Pi and enables it to communicate via Zigbee.
ESP32	This chip is used to control all components in the cup, like the LEDs or the NFC chip.
NFC PN532	The NFC chip is used for communication between the cups. If two cups are close (approx. 5 cm), they exchange IDs.
Battery LiPo	Supplies power to all components in a cup

IoBroker:https://www.amazon.de/gp/product/B07V9K3GHH/ref=ppx_yo_dt_b_asin_title_o00_s00?ie=UTF8&psc=1
Raspbee: https://phoscon.de/de/raspbee2
NFC PN532: https://www.amazon.de/gp/product/B07VT431QZ/ref=ppx_yo_dt_b_asin_title_o02_s00?ie=UTF8&psc=1
Battery: https://www.amazon.de/1100mAh-Schutzplatine-Isolierband-1-25-Stecker-ESP32-Entwicklungsplatine/dp/B087LTZW61/ref=sr_1_5?__mk_de_DE=%C3%85M%C3%85%C5%BD%C3%95%C3%91&crid=3B6OHFE49L7AC&keywords=esp32+lipo+battery&qid=1653394384&s=ce-

Induction charger (cups,mat) 2.5-3.6V, 80-180mAmp	Since the cups should be waterproof but still rechargeable, the Induction charger is used to recharge the battery.
Voltage Regulator (could be included in ind. ch.)	Regulates the voltage between the Inductions charger and the Battery
ZigBee module Z1-Mini	Enables communication between cup and gateway
Button	Additional interaction for specific games: point tracking
RGB LED	Illuminates the cup for games and animations
Cloud	The profiles of the users are stored in the cloud

Induction charger + Voltage Regulator: https://www.amazon.de/Youmile-Wireless-Ladeger%C3%A4t-Empf%C3%A4ngermodul-Mobiltelefone-Schnellladung-Wireless-Ladeger%C3%A4t-Sendermodul/dp/B0897KLDB3/ref=asc_df_B0897KLDB3/?tag=googshopde-21&linkCode=df0&hvadid=510037827520&hvpos=&hvnetw=g&hvrand=10543404151158266310&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9042506&hvtargid=pla-1253075042151&psc=1&th=1&psc=1

Z1-mini: https://www.tindie.com/products/gio_dot/z1-mini/

4. Sprints

The project will be divided into 4 different sprints, below is a description of what features we would like to implement after each sprint.

Sprint 1:

- Basic Hardware Prototype, gateway and website
- Define Hardware dimensions (for the improved prototype in the next sprint)

Sprint 2:

- Improved Hardware Prototype with 3D printed case
- Expand gateway functionalities and add basic cloud functionalities

Sprint 3:

- Add at least 2 Games
- Add position tracking if we have enough time with UWB or camera
- Add points system + leaderboard

Sprint 4:

- Optimizations and evaluations
- Bug fixes

5. Potential Issues

Some hardware elements are hard to get or relatively expensive. This could mean that we have to find alternative solutions. For example, the first prototype will communicate with WiFi until we get the appropriate ZigBee hardware elements.