



Cheers Sprint 4

Master Practical: Edge Computing and the Internet of Things - Team GAD

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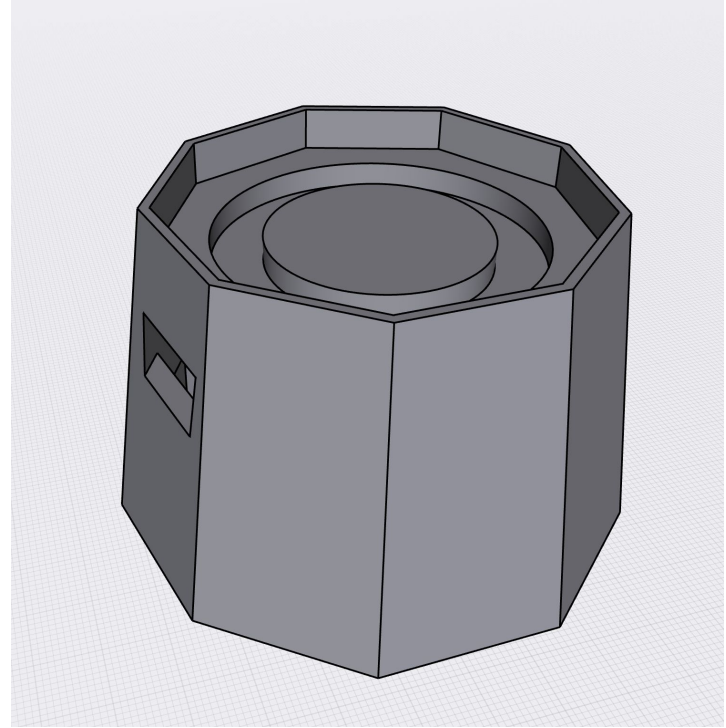


Planned Tasks for Sprint 4

- Finalize hardware prototype
 - 3D Case
- Work on Zigbee
- Improve gateway functionalities
- Evaluate the whole system

3D Case

- Slightly larger
- Now all the hardware fits into the case





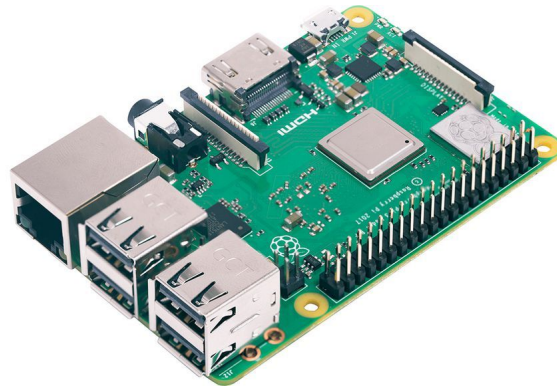
ZigBee

- Tried a lot but could not solve the problem
 - ZigBee modules do not connect properly



What would change if we use ZigBee?

- Use advantages of ZigBee
 - Low power
 - Mesh Network
- Add Zigbee2Mqtt on PI
 - MQTT Broker



CUP

ZigBee



What would change if we use ZigBee?

- Cup Provider (Bar) can decide what to use
 - ZigBee
 - or
 - WIFI

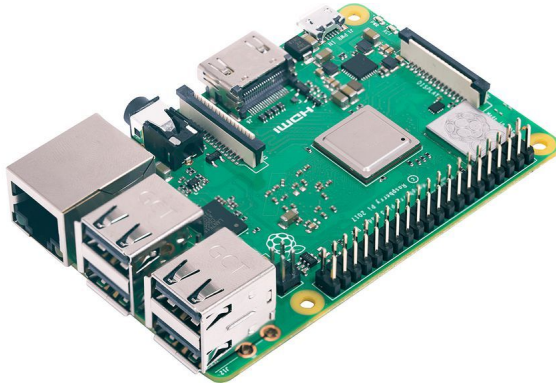
Cup Wi-Fi Manager

SSID

Password

Submit

What would change if we use ZigBee?



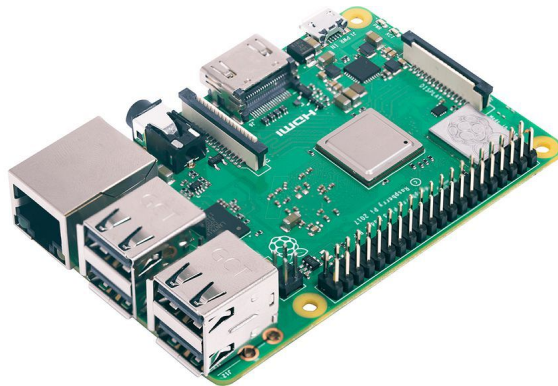
CUP



CUP

Gateway & Frontend

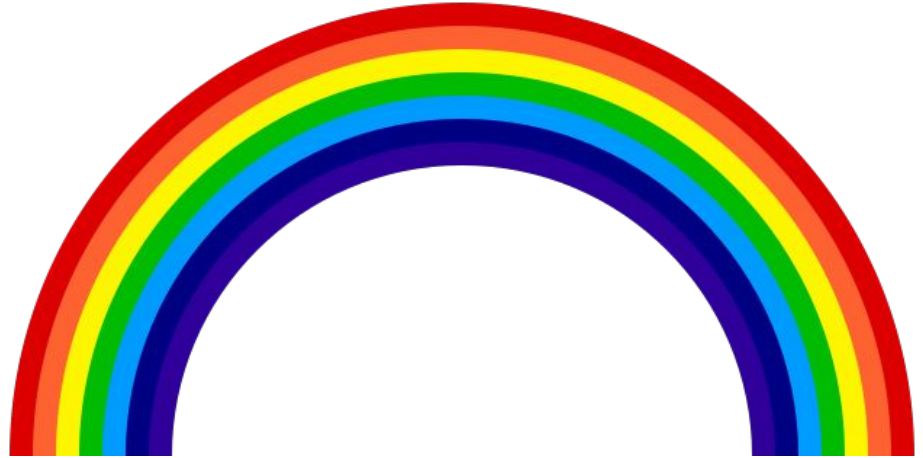
- Improved gateway & frontend functionalities
 - Bug fixes
 - Return amount to pay
 - Added timeouts to increase usability





Games

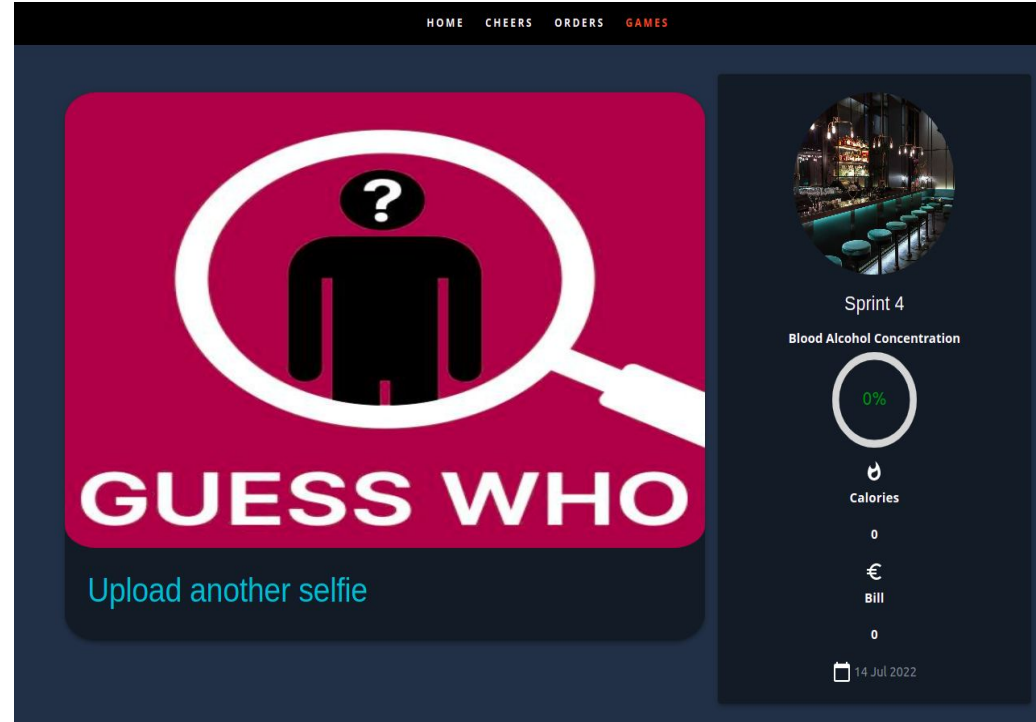
- Rainbow dance mode
- Team cheer
- Guess Who
- Alcohol percentage scale
- Leaderboard
 - Get points for every drink
 - Get points for every won game



Browser:

Guess Who

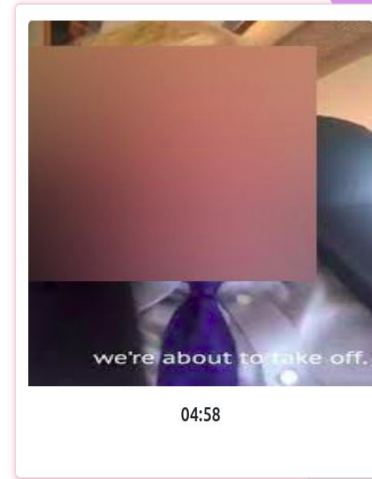
- Coordinating cup, gateway and cloud functionalities
- To participate, a user has to upload an image of him
- The cloud detects faces and blurs them
- The gateway pulls all the images and displays them
- The first player to cheer with the target wins



Guess Who

- Combining cup, gateway and cloud functionalities
- To participate, a user has to upload an image of him
- The cloud detects faces and blurs them
- The gateway pulls all the images and displays them
- The first player to cheer with the target wins

Gateway:

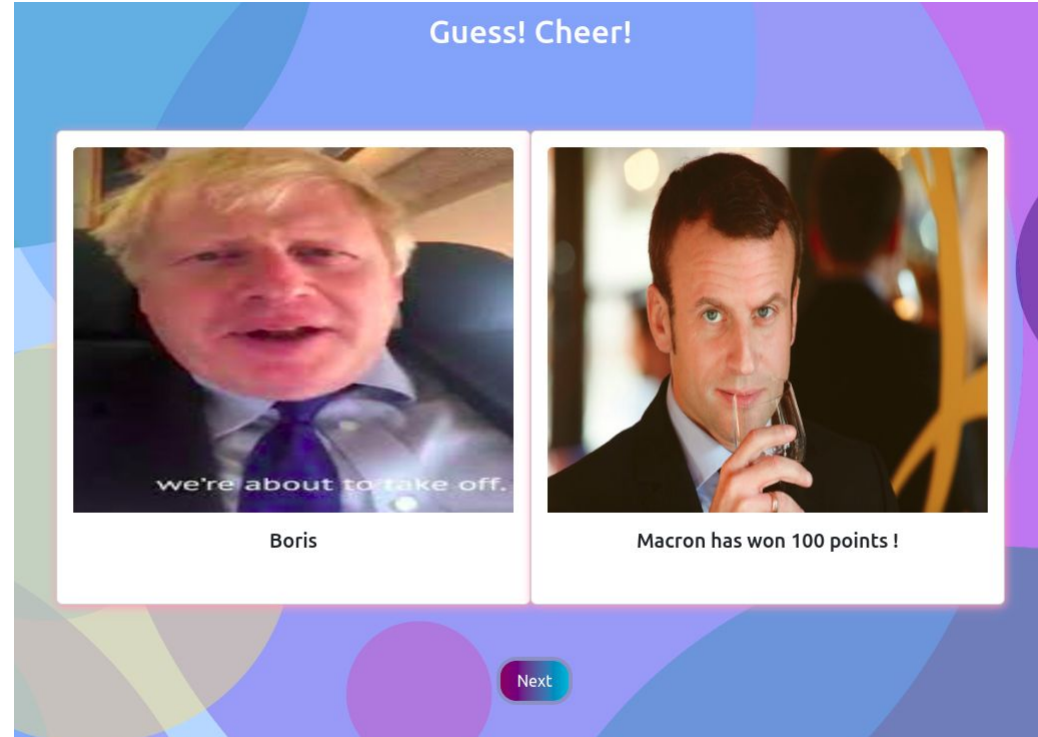


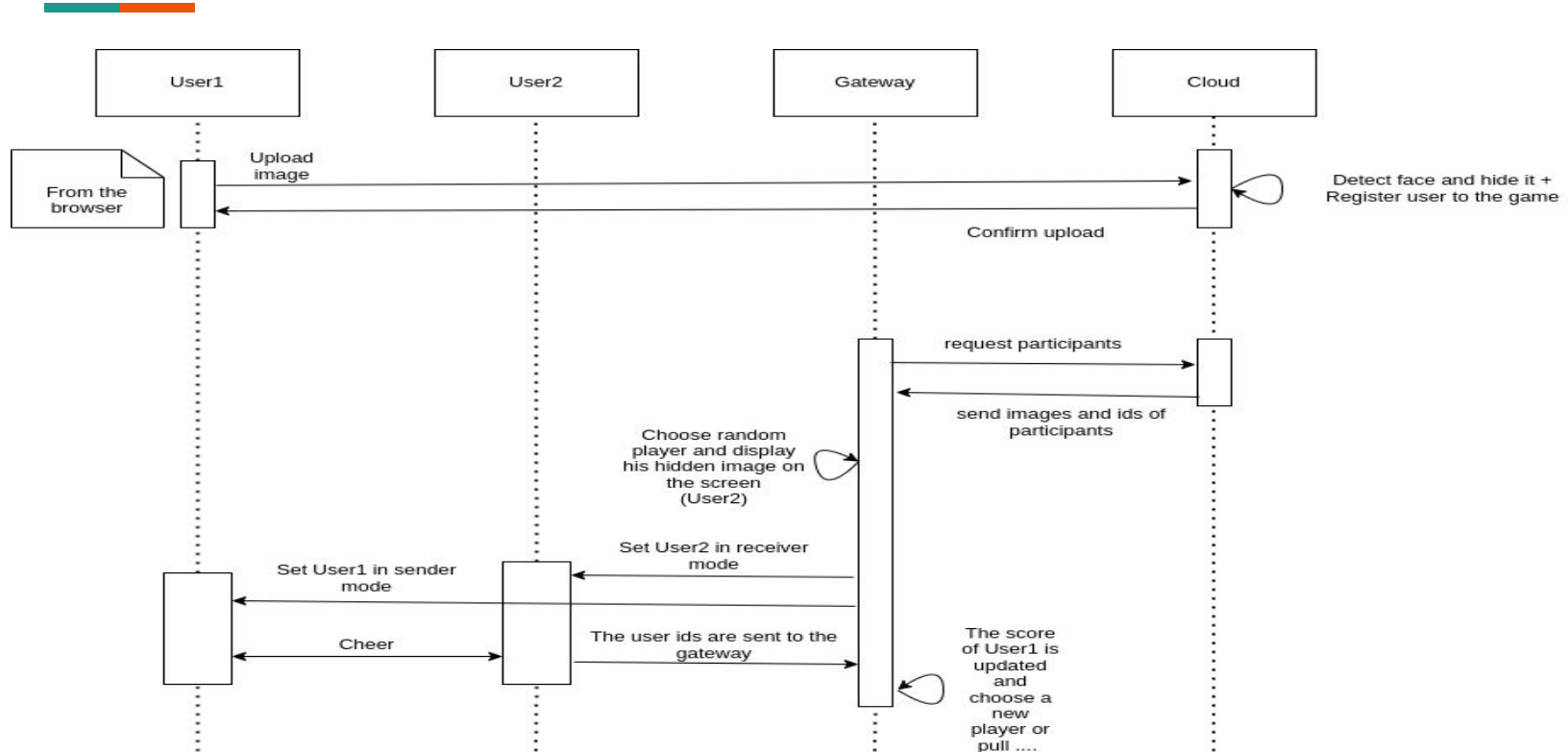
Next

Gateway:

Guess Who

- Combining cup, gateway and cloud functionalities
- To participate, a user has to upload an image of him
- The cloud detects faces and blurs them
- The gateway pulls all the images and displays them
- The first player to cheer with the target wins





Evaluation Power Consumption

- ZigBee would be roughly consume $\frac{1}{4}$ of WIFI.
- 600 mA for the LED ring
- up to 150mA for the NFC

	WiFi	ZigBee
IEEE standard	802.11.x	802.15.4
Age: as of	1985-1997	1999-2004
Frequency	2.4/5/60 Ghz	868/915 Mhz, 2.4 Ghz
Channel Bandwidth	0.3/0.6/2 MHz	1 Mhz
Range	30-100m	10-30m; new: <= 100m
network type	PAN & WLAN	WPAN
speed	802.11a,bc: 11-54 mbps; ac: ~7 Gbps	250kbps
Power consumption	0.87 watts (24h test)	1/4% WiFi power consumption 0.39 watts (24h test) ~10-100 mW Tuya: sleep mode avg.: 1.4 μ A sleep mode max: 3 μ A constant receiving: 8 mA
Power consumption (our devices' datasheet)	ESP32: ~80-108mA	TI CC2530: connected: 13uA(Min) ~ 3mA(max) disconnected: 13uA(Min) ~ 36mA(max) switch & perform new operation ~20mA Operation 1*: ~101mAs over ~6.6ms Operation 2**: ~388mAs over ~23.9ms
Bit time	0.00185 micro sec	4 micro sec
Other	Router works as a hub -> found in most homes	No strain on WiFi network & less prone to interference No cloud & LTS manufacturer dependency Offline operateability open protocol (pros and cons) Does require a smart hub (but almost limitless # of devices)

Evaluation Wireshark

- Standard packages that were expected:
 - DHCP
 - TCP Handshake
 - MQTT Connect
- Update GW <-> Cup
 - 123 Byte Frame
- every 15 sec MQTT ping packets.
 - deactivate keepalive

ip.addr == 192.168.137.39						
No.	Time	Source	Destination	Protocol	Length	Info
10	2.642431	192.168.137.1	192.168.137.39	TCP	123	10003 → 65307 [PSH, ACK] Seq=1 Ack=1 Win=64478 Len=69
11	2.713468	192.168.137.39	192.168.137.1	TCP	54	65307 → 10003 [ACK] Seq=1 Ack=70 Win=5586 Len=0

> Frame 10: 123 bytes on wire (984 bits), 123 bytes captured (984 bits) on interface \Device\NPF_{9469459E-ABE9-44AF-B8F0-463EC29E4CC9}, id 0	
▼ Ethernet II, Src: 4a:45:20:90:c2:66 (4a:45:20:90:c2:66), Dst: Espressi_e8:16:40 (24:0a:c4:e8:16:40)	
> Destination: Espressi_e8:16:40 (24:0a:c4:e8:16:40)	
> Source: 4a:45:20:90:c2:66 (4a:45:20:90:c2:66)	
Type: IPv4 (0x0800)	
> Internet Protocol Version 4, Src: 192.168.137.1, Dst: 192.168.137.39	
> Transmission Control Protocol, Src Port: 10003, Dst Port: 65307, Seq: 1, Ack: 1, Len: 69	
▼ Data (69 bytes)	
Data: 304300156375702f32343a30413a43343a45383a31363a34307b0a202022636f6c6f7222...	
[length: 69]	

0000	24 0a c4 e8 16 40 4a 45 20 90 c2 66 08 00 45 00	\$...@JE ..f..E-
0010	00 6d 40 0f 40 00 00 06 27 02 c0 a8 01 c0 a8	n@.@... '.....
0020	89 27 27 13 ff 1b 43 49 87 32 d7 17 5b fd 50 18	..*...CI :2..[P-
0030	fb de ab 9d 00 00 30 43 00 15 63 75 70 2f 32 340C ..cup/24
0040	3a 30 41 3a 43 34 3a 45 38 3a 31 36 3a 34 30 7b	:0A:C4:E 8:16:40{
0050	0a 20 20 22 63 6f 6c 6f 72 22 3a 20 22 72 67 62	- "colo r": "rgb
0060	28 32 35 35 2c 30 2c 30 29 22 2c 0a 20 20 22 6d	(255,0,0 }",- "m
0070	6f 64 65 22 3a 20 22 31 22 0a 7d	ode": "1 "-}



Plans for the future / final documentation

- Evaluate more:
 - Power Consumption
 - Traffic