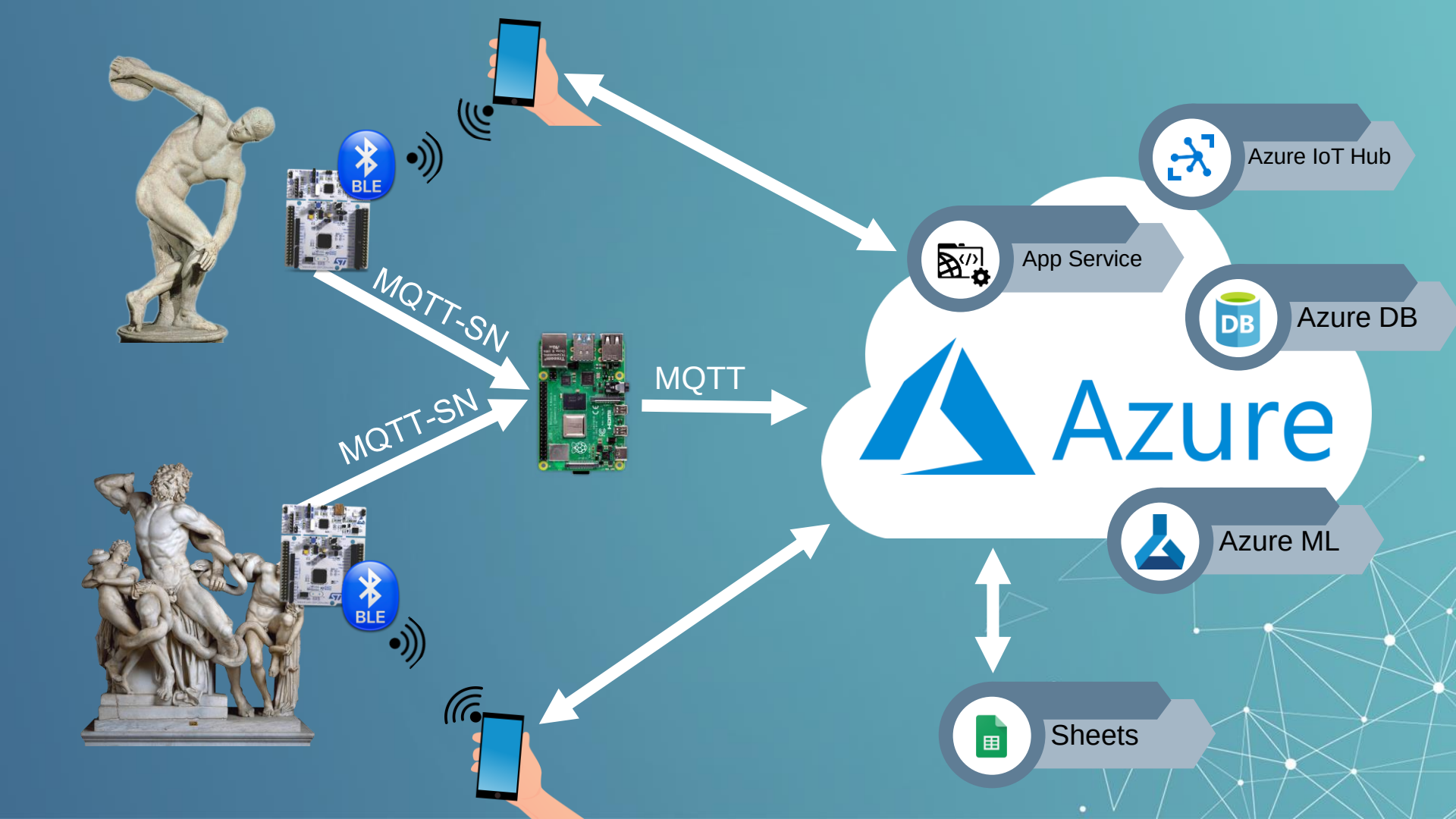
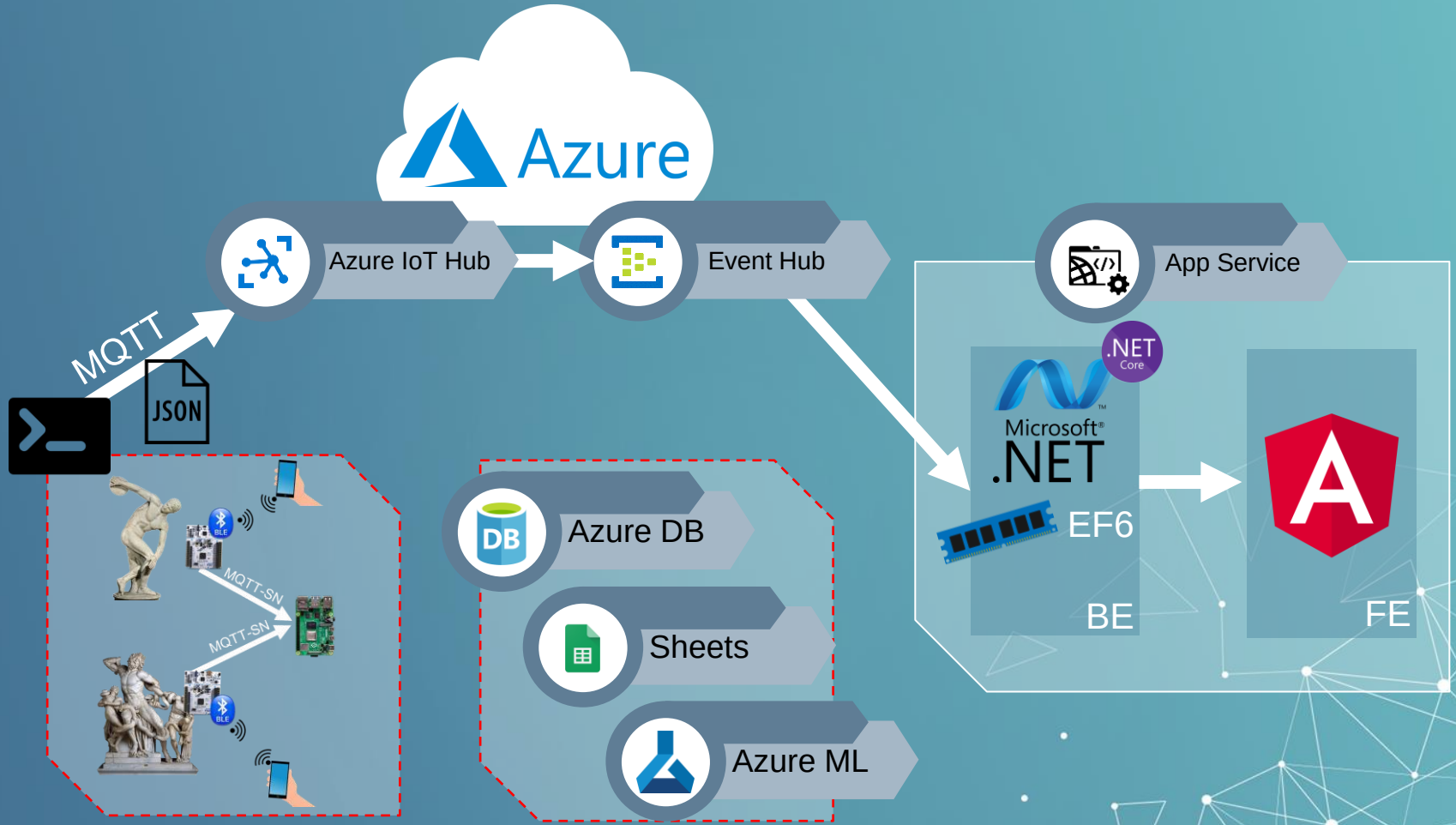
MuSa

The experience manager
designed by Silvia Del Piano, Stefano Foti and Gianmarco Zizzo


TECHNICAL UPDATE


BLE
MQTT-SN
MQTT-SN
MQTT
BLE
Azure IoT Hub
App Service
Azure DB
Azure
Azure ML
Sheets

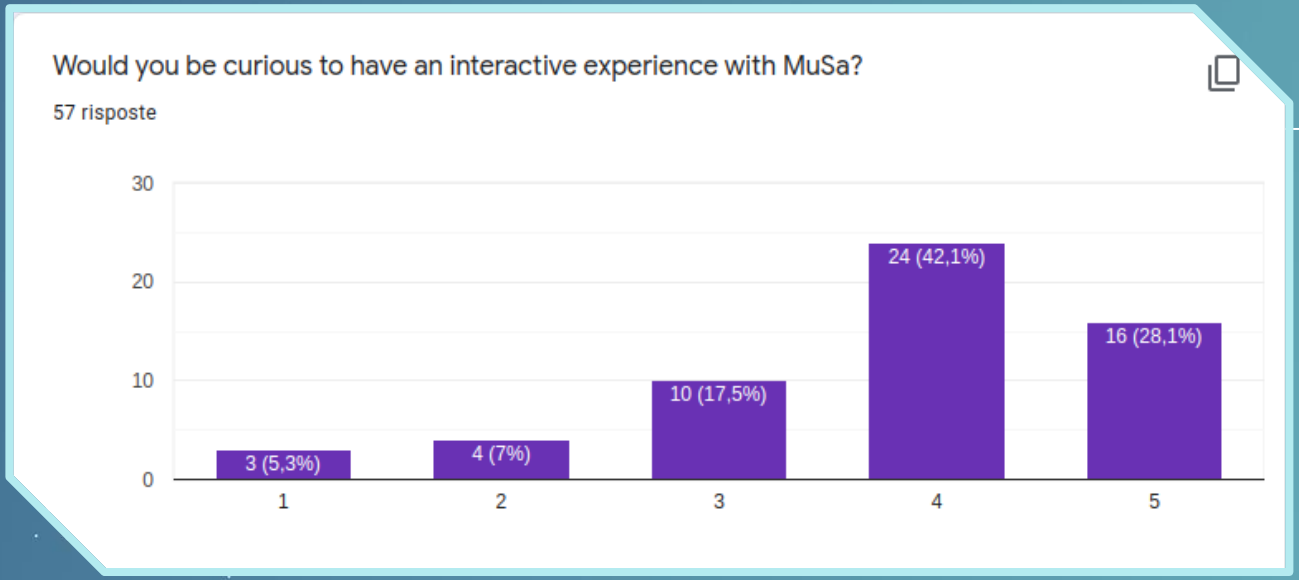

Azure
Azure IoT Hub
Event Hub
App Service
MQTT
JSON
MQTT-SN
MQTT-SN
BLE
BLE
Azure DB
Sheets
Azure ML
.NET Core
Microsoft .NET
EF6
BE
FE

EVALUATION

A presentation about the evaluation done so far

USER'S FEEDBACK

During the development process we're keeping track of the opinions of the users to understand if we're effectively building something of value. In particular, the following results of the surveys we made are quite encouraging.



We can see that the majority of the users would at least be curious to try MuSa.

USER'S FEEDBACK

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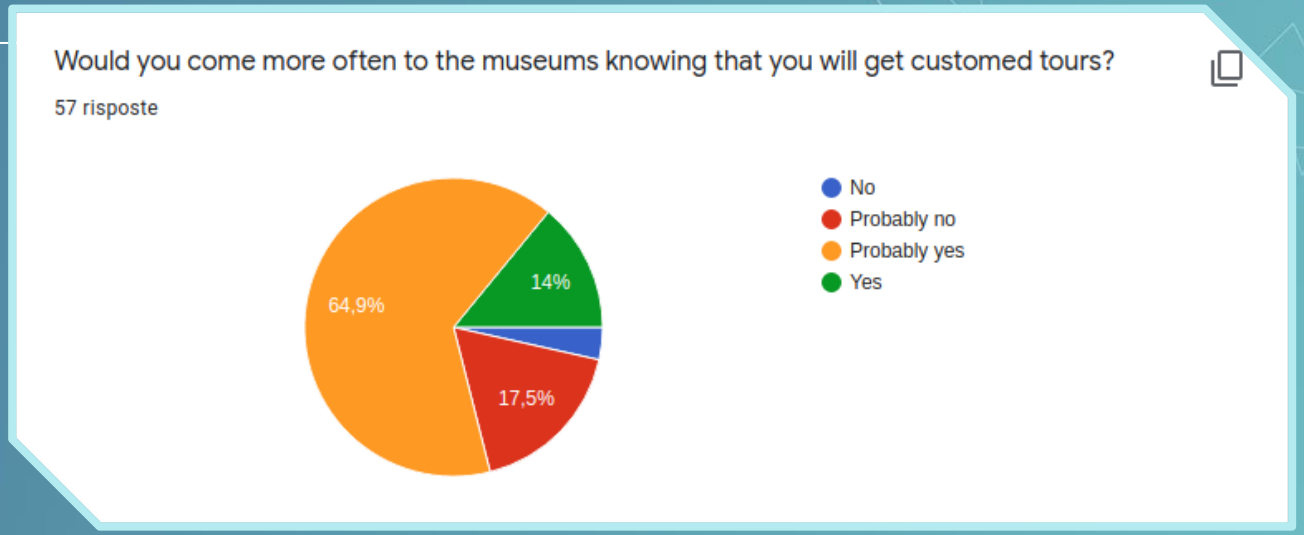
Our application could be useful for the museum to attract more visitors, thanks to making their experiences there more enjoyable.



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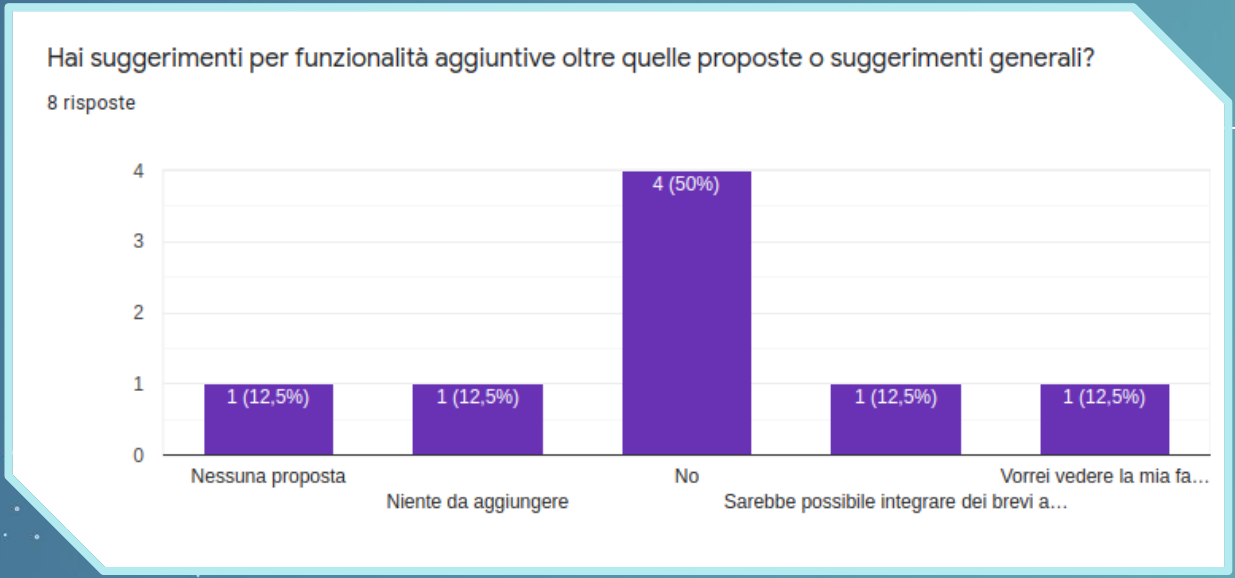

We can be reassured on the fact that we're catching the main needs of the users, since, a part from some peculiar suggestions, the majority of them doesn't feel the need to point out more functionalities to add with respect to the ones already presented.

USER'S FEEDBACK

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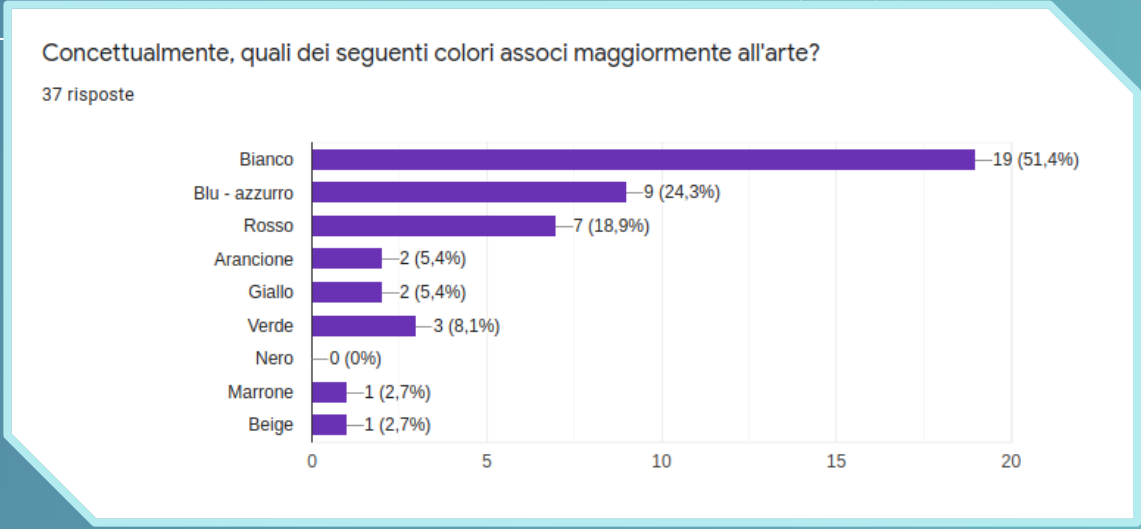
We're also taking into account our user's opinion to build an interface which can be to their liking.



COMPLEXITY & RESPONSIVENESS

We need our system to be **responsive** to follow the user in real-time during his visit, but at the same time we also don't want to flood our network with messages, keeping the **complexity low**, also to save the board's power.

This also affects the cost: we want to **push the limits of our free plan** to exploit it to the fullest (the limit of messages we can send to Azure is 8000 per day), so that we can pay as less as possible.

This can be achieved by taking advantage of **edge computing**: we do data pre-processing in the gateway to aggregate messages of different boards and send to Azure a single report.

COMPLEXITY & RESPONSIVENESS

Let's do a **short evaluation** in terms of complexity and responsiveness of this system, let's consider the following scenario:

- we have 30 STM-Nucleo boards that send 1 message per second

- **raw data is sent to Azure**: this means that there are around 30 messages * 60 s = 1800 messages each minute, which means that in 8000 / 1800 **= 4,4 minutes** the **free plan would expire**.

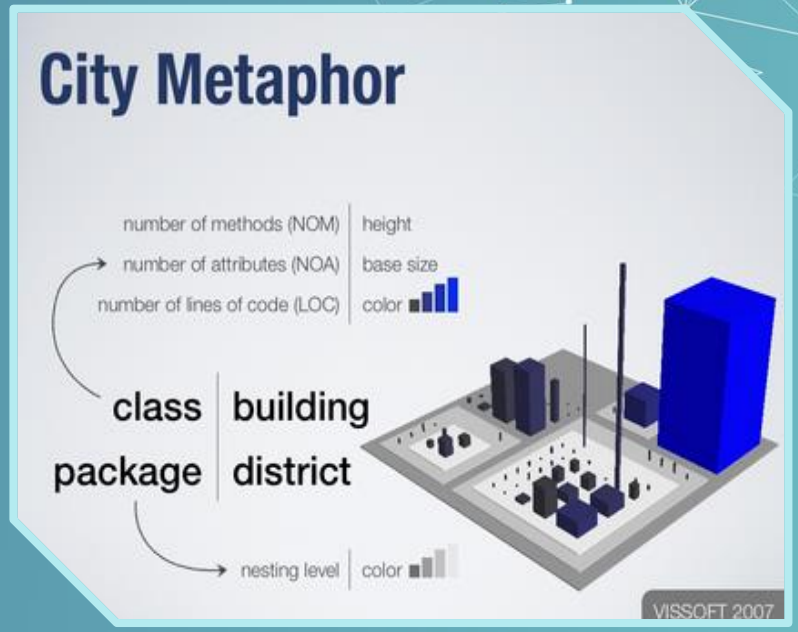
- **edge computing**: instead of sending the messages directly to Azure, they are collected by the gateway, which instead sends to the cloud a report every 5 seconds. So we have 60 / 5 = 12 messages per minute, which means that the free plan would last for 8000 / 12 = 666,66 minutes, which is **11,11 hours**.

So we have **5 minutes vs 11 hours a day**, the advantages of the edge computing architecture are immense! We could have a museum with 30 boards use our system for free each day (unless it stays open for more than 11 hours).

CODE CITY AND THE BACKEND

CodeCity Tool

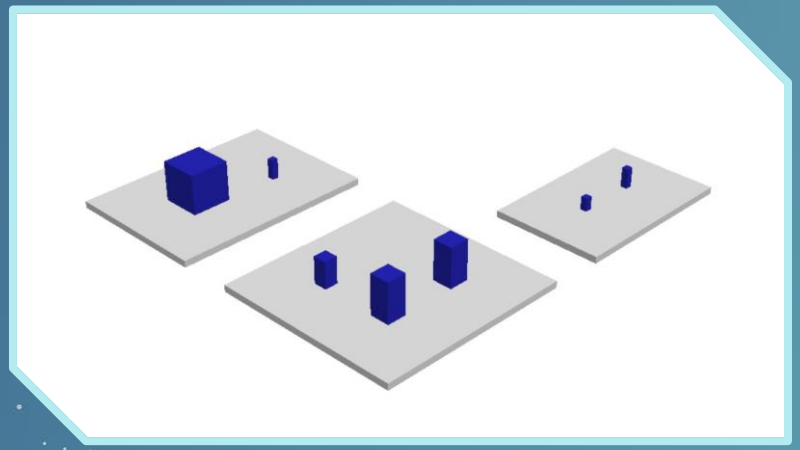
Our backend code quality will be tested with CodeCity. It is a very simple tool that allows to check **the most common software metrics** in a new way in which software systems **are visualized as interactive, navigable 3D cities**. The classes are represented as buildings in the city, while the packages are depicted as the districts in which the buildings reside. The more the city is well structured, the higher the code quality is.

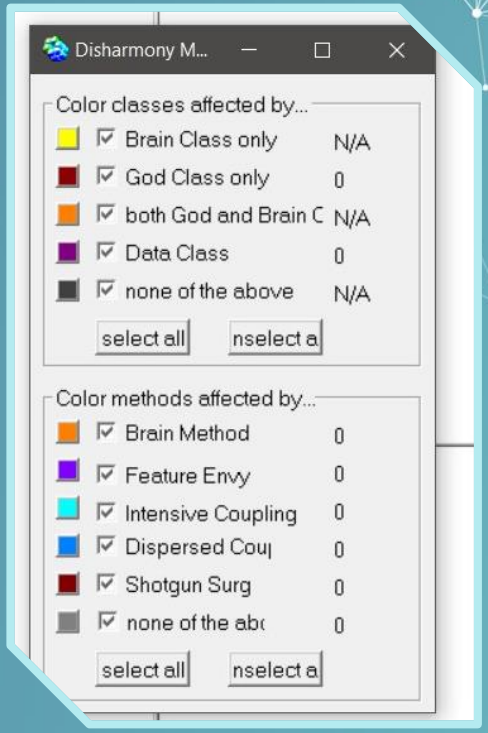


CodeCity better performs with huge projects

CODE CITY AND THE BACKEND

MuSa City





Specific metrics

SENSOR NETWORK RELIABILITY

Having a board that acts as a gateway is a **single point of failure**!

Redundancy approach: we have a second Raspberry Pi in hot standby.
Every time the gateway sends the report to Azure via MQTT, also the second Raspberry receives it. If the second board doesn't receive any message for a certain amount of time, it will assume that the main gateway has suffered a failure, and therefore replaces the faulty board taking its place as the gateway.

UPDATED COST EVALUATION

Azure IoT Hub

Free until
8000 messages/day

Azure Database

Free for
the previous Azure
Database generation
(the 4th),
few GB of space

Major drawback:
you can not have any
backup possibility

Azure App Service Plan

Free
complete solution to
deploy a full-stack
application with both FE
and BE.
1GB of storage
1GB of RAM
shared CPU

Please note that in such
a way you can not keep
your application always
running.

Azure Machine Learning

Does not offer any free
plan It starts at about
4 USD/month.

Raspberry Pi

> 20 €

STM-Nucleo

10 – 15 €
+
20 – 30 € for Wi-Fi and
BLE expansions

PRICE

For further details, please have a look at Microsoft Pricing Calculator.

FUTURE PLANS

for technical development and evaluation until the final delivery

TECHNICAL DEVELOPMENT

Deploy on Azure

Since that part of the demo is simulated or runs in local.
A great part of MuSa lives in the Cloud and we will need Azure IoT Hub, Azure ML, Azure DB and Azure App Service

Providing the personalized tours to the visitors

One of MuSa's main features is to provide personalized tours and we want to realize a profiling questionnaire that makes MuSa able to serve something that matches perfectly with visitor's interests, also using the information that we got with our online survey

TECHNICAL DEVELOPMENT

Data collection

For both visitors types: the one who uses MuSa and the one that only wants to help the improving with the data collecting

The interaction

The "interaction" with the artwork, understood as when a visitor is near an artwork, through his smartphone he can ask for some extra information or curiosities

FUTURE EVALUATION

The user experience

We care a lot about our visitors: our main goal is to make them happy!
We will evaluate the user experience with a Moment method and an Episode method: we expect to do this through the tools PrEmo and AttrakDiff

Overall system

It is very important to provide a system qualitatively good and we will analyze it through the guidelines by ISO/IEC 9126-1. We used a criteria-based evaluation which gives a measurement of quality in several areas, including understandability, documentation and portability

FUTURE EVALUATION

Power consumption, communication complexity and scalability…

… of the sensor network because we want to build a maintainable and consistent system

Price considerations

We will do a revision about the expected price of the whole system because we want to make MuSa easily accessible and doable. This will include the price of the hardware and the price of the Azure plan needed, computable with Microsoft Pricing Calculator.

THANKS FOR YOUR ATTENTION