GuardBricks: Building Blocks for Monitoring Secluded Locations with IoT Technologies

Tomás Marques da Silva Coheur

Prof. Miguel Filipe Leitão Pardal
Prof. Alberto Manuel Ramos da Cunha

June 2024

Secluded Locations

- Isolated Area
- Difficult access
- Low Visitation Frequency

Water Infiltration, ...

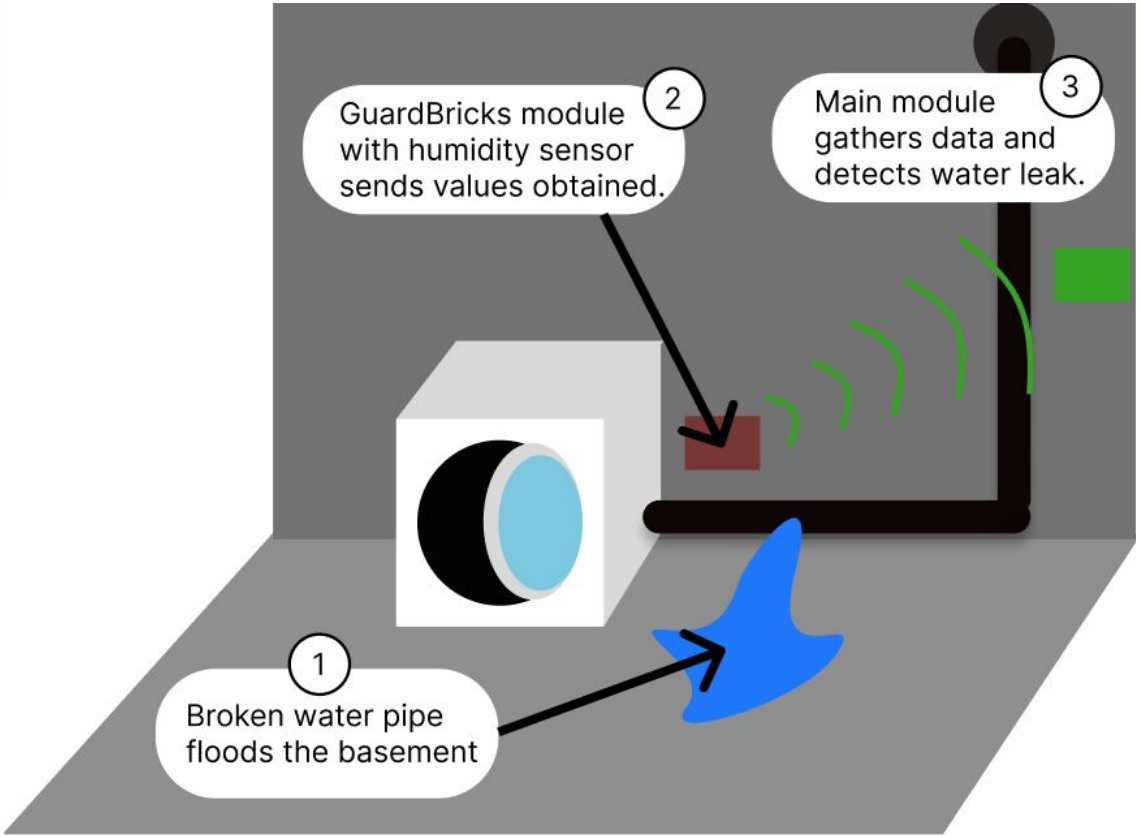
Pests, …

Smoke , …

… and Ham?

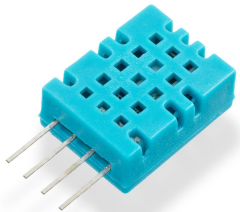
Index

Monitorization

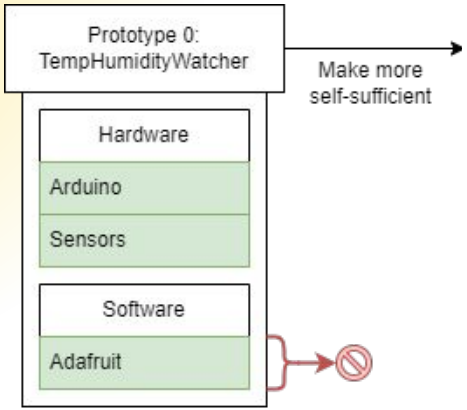


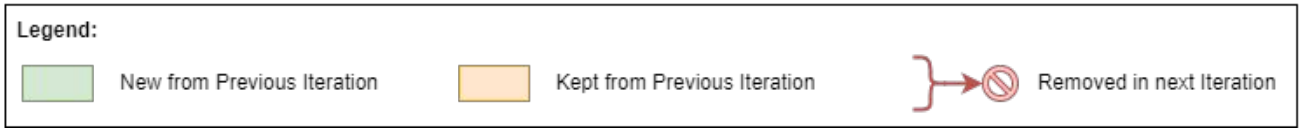
Inspirations

Background

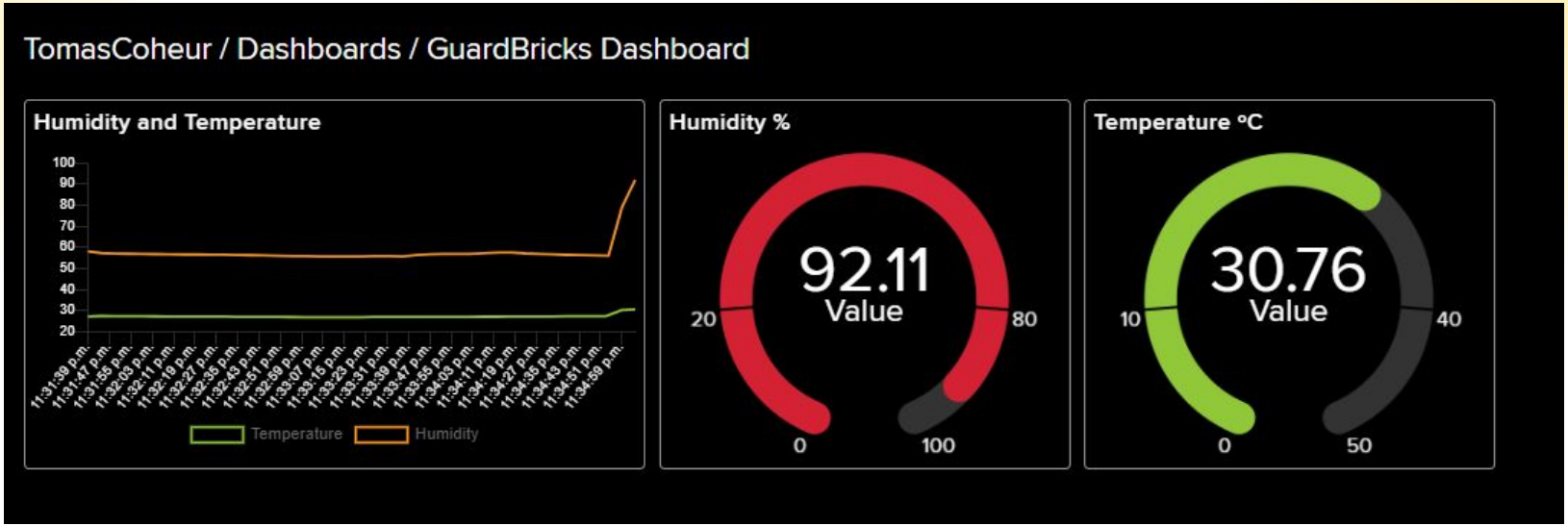


Prototypes


Prototype 0:
TempHumidityWatcher
Make more
self-sufficient
Hardware
Arduino
Sensors
Software
Adafruit

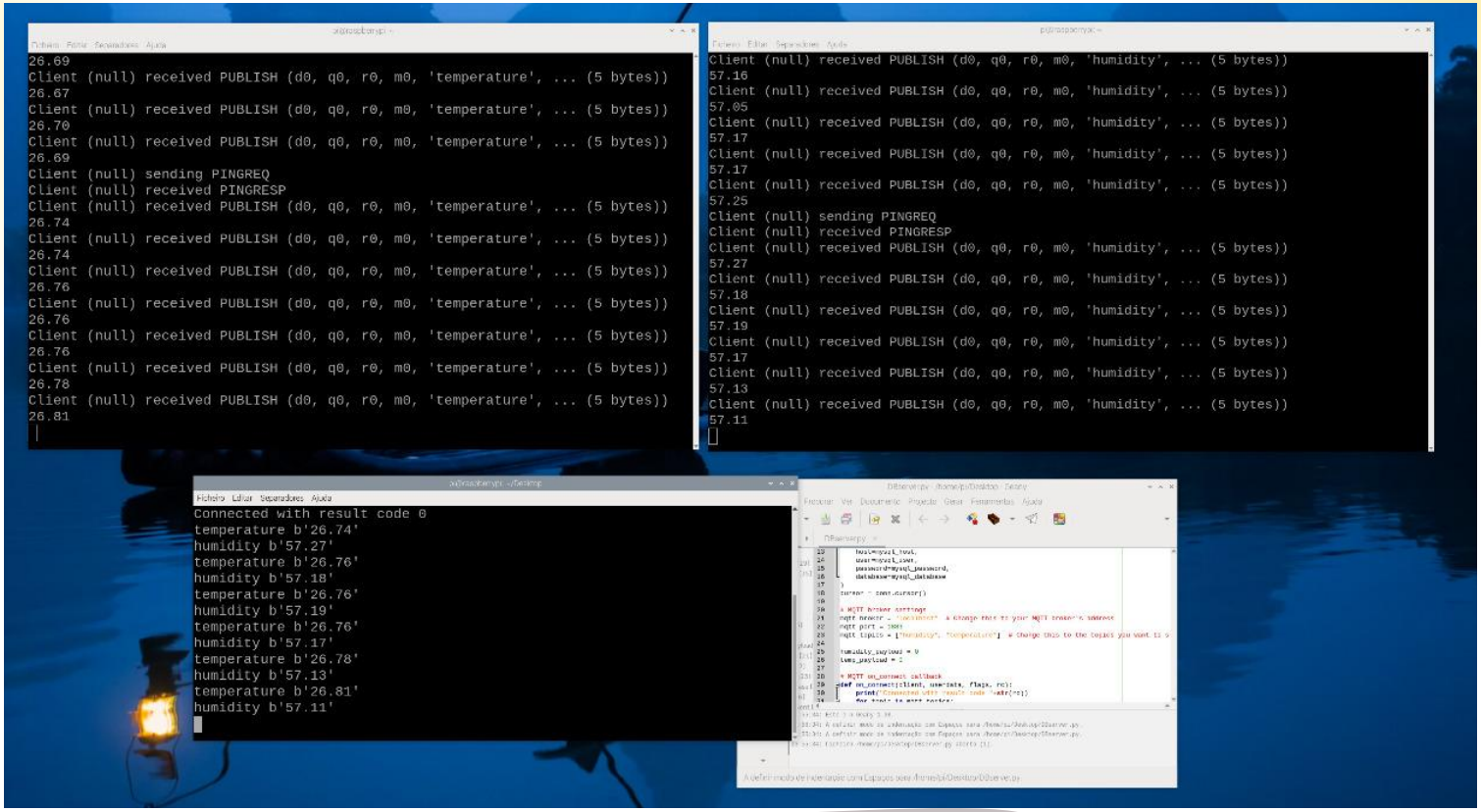

Legend:
New from Previous Iteration
Kept from Previous Iteration
Removed in next Iteration

P0: TemphumidityWatcher

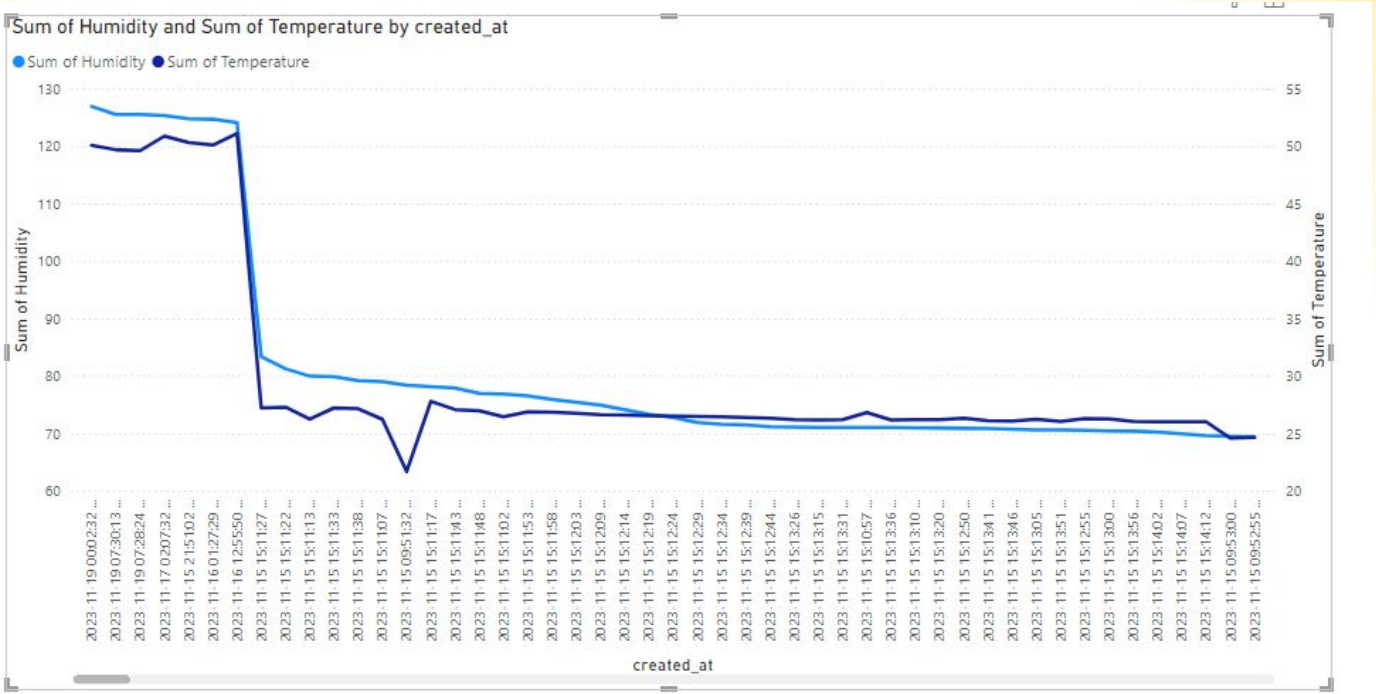


P0: TemphumidityWatcher

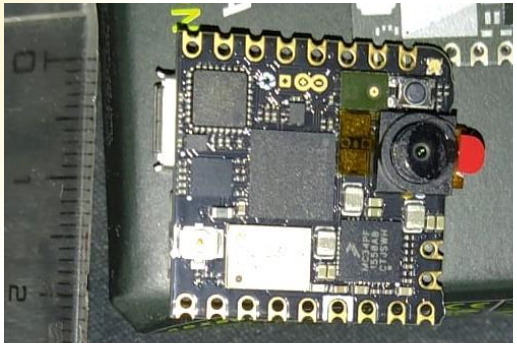
P1: LocalServePi

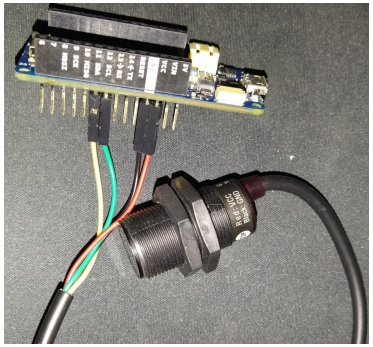


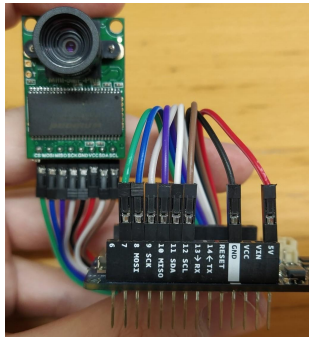
P1: LocalServePi

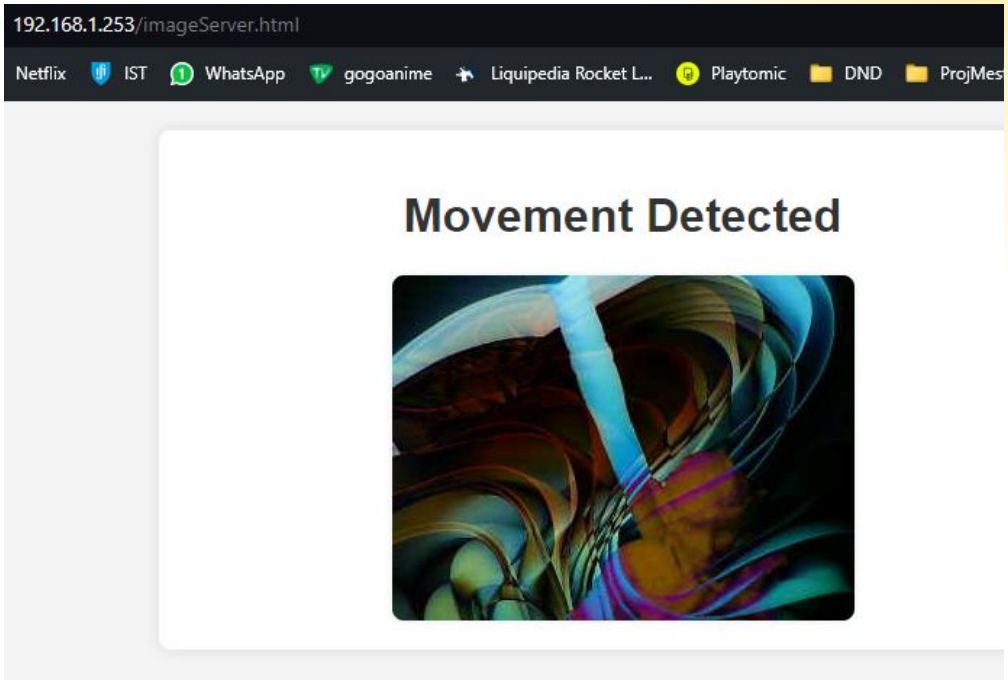


P2-2.5: Vigilantes









Framework Models

Structural Model

- **Hardware**
  - **Controllers**
  - **Sensors**
  - **Power**
- **Software**
  - **IDE**
  - **Code**
  - **Sites**
  - **Tools**
  - **Protocols**

Behavioral Model

- **Data Collection**
- **Data Transmission**
- **Data Processing**
- **Data Storage**
- **Data Visualization**

Prototypes Evaluation

Dashboard Comparison

Feature	Arduino IoT Cloud	Adafruit IO	IFTTT
Free Tier	2 Things Unlimited Dashboards 1 day Data Retention 100Mb for sketches	10 Feeds 30 Days Data Storage 5 User Dashboard	2 Applets Standard Applets Speed
Paid Tier 1	Maker Plan: $5,99/month 25 Things 25 days Data Retention Unlimited storage for sketches	IO+ Plan: $10/month Unlimited Feeds 60 Days of Data Storage Unlimited User Dashboards	Pro Plan: $2,58/month Unlimited Applets Exclusive Triggers and Actions

Prototypes Evaluation

Battery Testing

Data Transmission Interval	Battery Life (Days)
Every Second	0.8
Every 5 Seconds	3.98
Every Minute (estimated)	47.75

Evaluation Structural and Behavioral Model

```
{"data_collection": [
        {"id": "gb.data.collection.arduino",
            "description": "Arduino MKR 1010 for data collection",
            "sensors": "Various IoT sensors",
            "sampling_rate": "1 sample per second"},
        {"id": "gb.data.collection.arduino_carrier",
            "description": "Arduino IoT Carrier for extended sensor capabilities",
            "sensors": "Built-in temperature, humidity, pressure, light, and gesture sensors",
            "sampling_rate": "Adjustable sampling rate"}],
    "data_transmission": [
        {"id": "gb.data.transmission.wifi",
            "description": "Wi-Fi module for data transmission",
            "protocol": "Wi-Fi"}],
    "data_processing": [
        {"id": "gb.data.processing.raspberrypi",
            "description": "Raspberry Pi 4 for data processing",
            "algorithms": "Data filtering and aggregation"}],
    "data_storage": [
        {"id": "gb.data.storage.mysql",
            "description": "MySQL database for data storage",
            "type": "Relational database"}],
    "data_visualization": [
        {"id": "gb.data.visualization.powerbi",
            "description": "PowerBI for data visualization",
            "platform": "PowerBI"}]
}
```

Evaluation Final Assessment

Extensive Testing

- Arduino’s battery consumption: efficient operation with 20000mAh battery.

Component and Cloud Services Analysis

- Many cloud services require subscriptions for complex IoT systems.
- Pricier components have better documentation and are more user-friendly.

Challenges

- Diverse components and potential remote location issues complicate creating a generalized system with affordable parts.

Framework Models

- **Structural Model**: Comprehensive component catalog.
- **Behavioral Model**: Insights into prototype construction and functionality.

Conclusion

GuardBricks as Building Blocks for Monitoring Secluded Locations with IoT technologies

GuardBricks, as a proactive Maintenance of Secluded Locations with Internet of Things technologies

Future Work

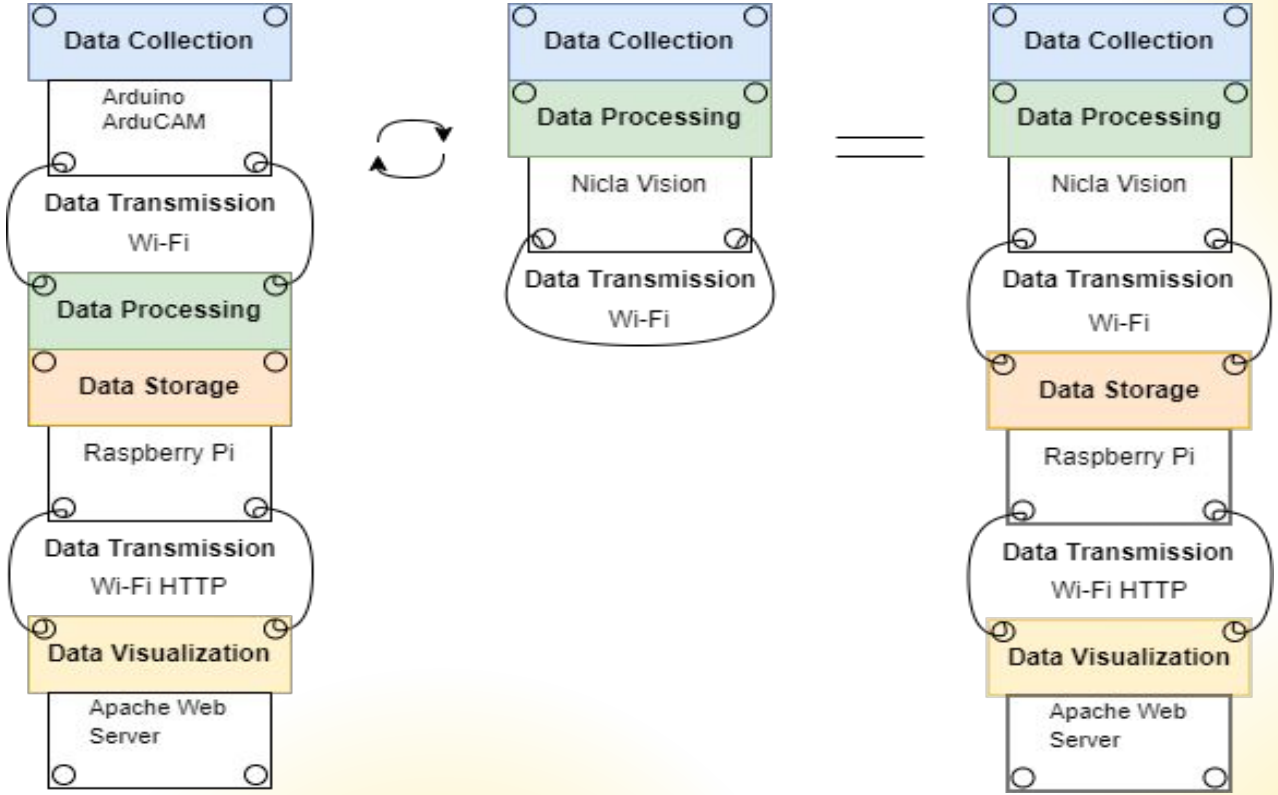
- User-friendly Building Application
- Auto Generated Instructions
- Easy Deployment
- New Framework Models

Thank You!

GuardBricks: Building Blocks for Monitoring Secluded Locations with IoT Technologies

Email: tomas.coheur@tecnico.ulisboa.pt

June 2024


Data Collection
Arduino
ArduCAM
Data Transmission
Wi-Fi
Data Processing
Data Storage
Raspberry Pi
Data Transmission
Wi-Fi HTTP
Data Visualization
Apache Web
Server
Data Collection
Data Processing
Nicla Vision
Data Transmission
Wi-Fi
Data Collection
Data Processing
Nicla Vision
Data Transmission
Wi-Fi
Data Storage
Raspberry Pi
Data Transmission
Wi-Fi HTTP
Data Visualization
Apache Web
Server