



GuardBricks: Building Blocks for Monitoring Secluded Locations with IoT Technologies

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Secluded Locations

- Isolated Area
- Difficult access
- Low Visitation Frequency

Water Infiltration, ...



Pests, ...



Smoke , ...



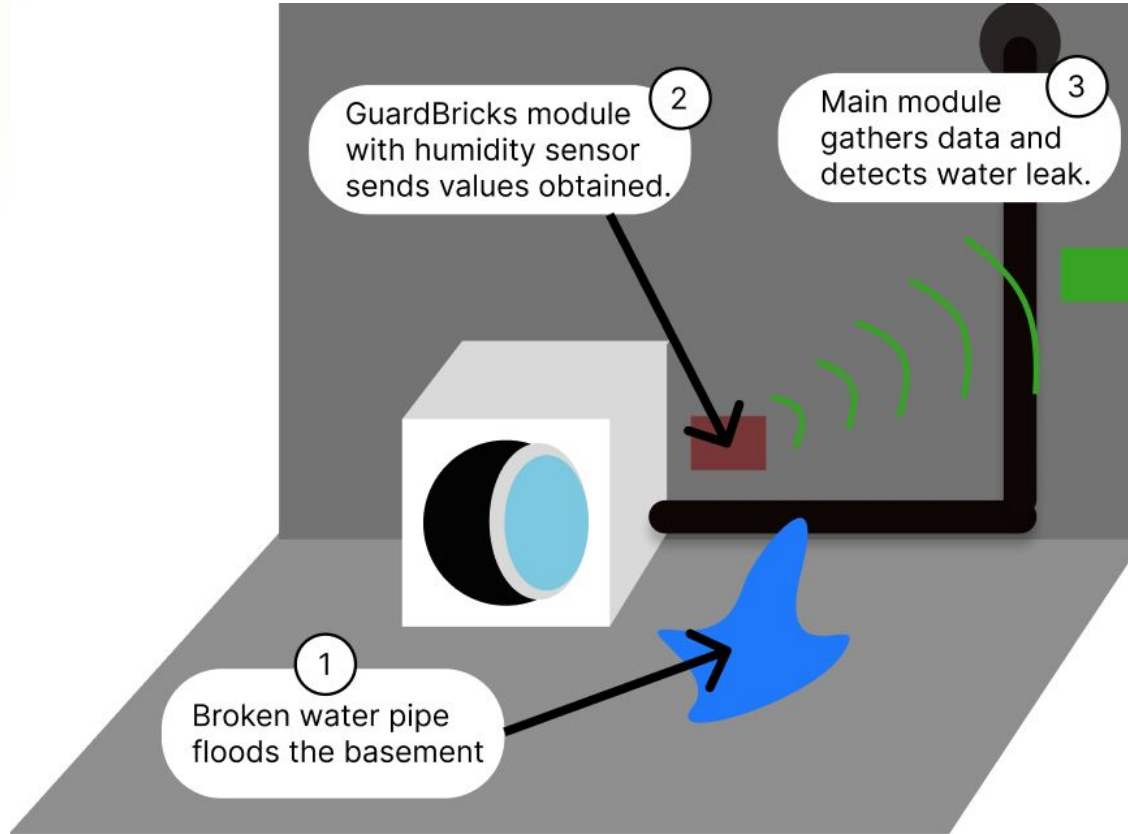
... and Ham?



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- Objectives
 - Monitorization
- Background and Related Work
- The Prototypes
- The Framework Models
- Evaluation
 - Prototype Evaluation
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- Conclusion

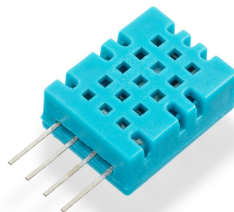
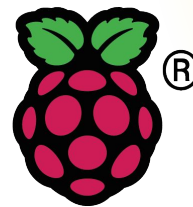
Monitorization



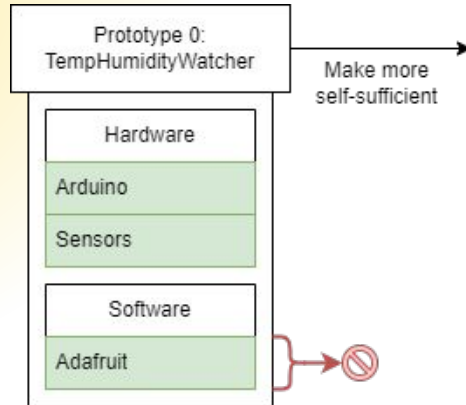
Inspirations



Background



Prototypes



Legend:



New from Previous Iteration



Kept from Previous Iteration

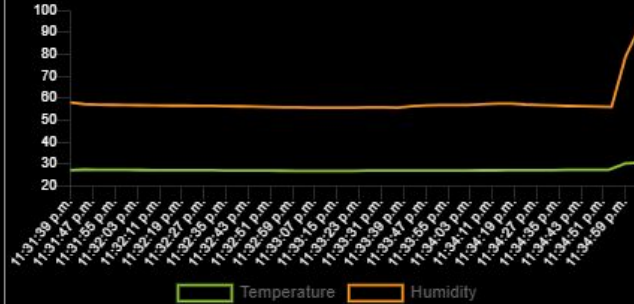


Removed in next Iteration

P0: TempHumidityWatcher

TomasCoheur / Dashboards / GuardBricks Dashboard

Humidity and Temperature



Humidity %



Temperature °C



P0: TempHumidityWatcher

Adafruit IO Action: Humidity feed has a new value: 92.108429 Σ Inbox x

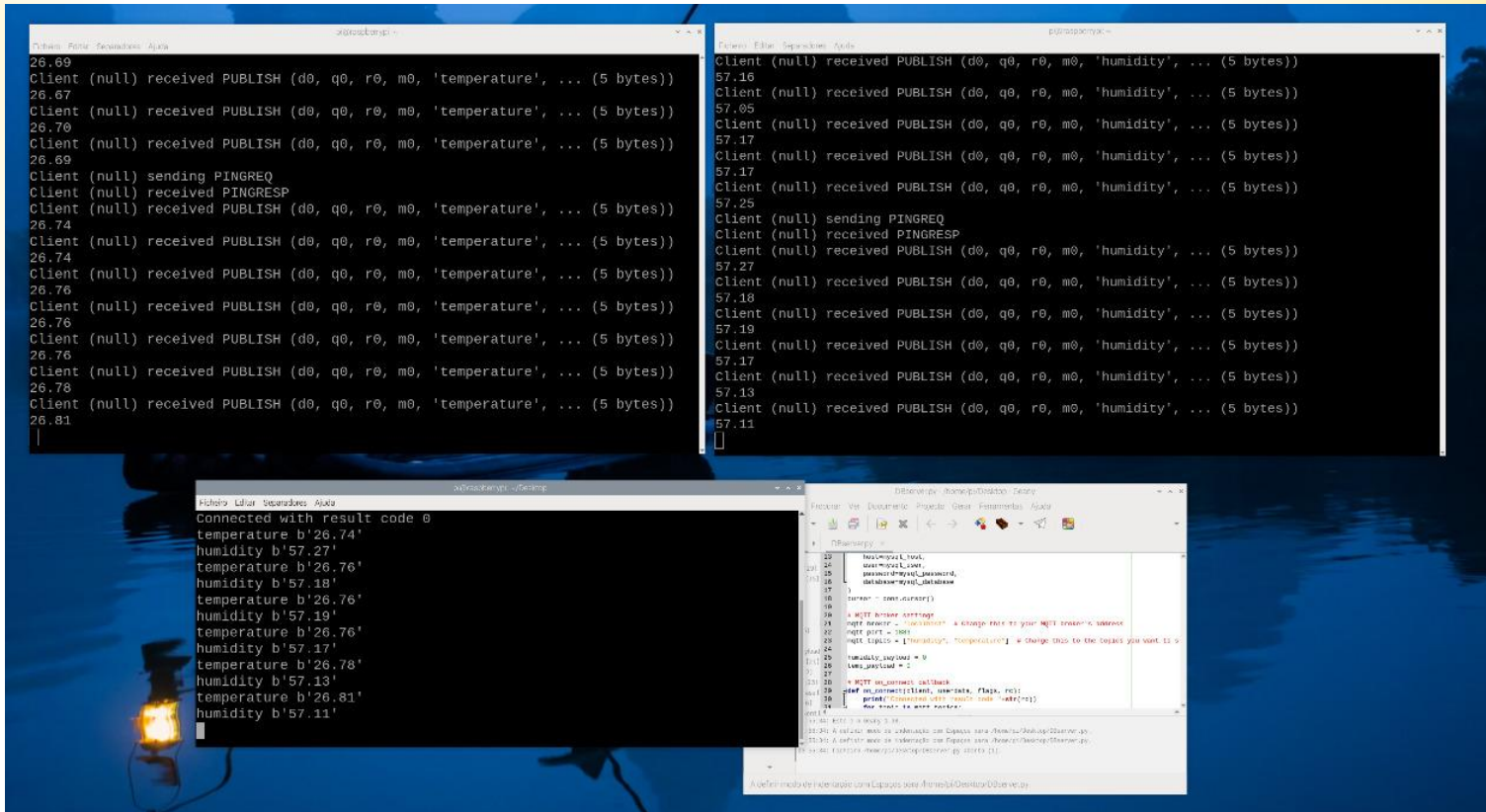


Adafruit IO ✓ [<notify@io.adafruit.com>](mailto:notify@io.adafruit.com)
to me ▼

The Humidity feed has a new value: 92.108429 at 2024-06-11T22:35:04Z

This email was templated by TomasCoheur and generated automatically by [Adafruit IO](#) in response to [a user defined action](#).

P1: LocalServePi



```
26.69 Client (null) received PUBLISH (d0, q0, r0, m0, 'temperature', ... (5 bytes))
26.67 Client (null) received PUBLISH (d0, q0, r0, m0, 'temperature', ... (5 bytes))
26.70 Client (null) received PUBLISH (d0, q0, r0, m0, 'temperature', ... (5 bytes))
26.69 Client (null) sending PINGREQ
26.74 Client (null) received PINGRESP
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|

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57.05 Client (null) received PUBLISH (d0, q0, r0, m0, 'humidity', ... (5 bytes))
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57.13 Client (null) received PUBLISH (d0, q0, r0, m0, 'humidity', ... (5 bytes))
57.11 |

Connected with result code 0
temperature b'26.74'
humidity b'57.27'
temperature b'26.76'
humidity b'57.18'
temperature b'26.76'
humidity b'57.19'
temperature b'26.76'
humidity b'57.17'
temperature b'26.78'
humidity b'57.13'
temperature b'26.81'
humidity b'57.11'

23 #!/usr/bin/env python3
24 """
25 This script is a simple MQTT client that publishes data to a broker.
26 It uses the paho-mqtt library to connect to the broker and publish data.
27 """
28 import sys
29 import time
30 import random
31 from paho.mqtt.client import Client
32
33 # MQTT broker settings
34 broker = "mqtt://localhost:1883"
35 topic = "test/topic"
36
37 # MQTT client settings
38 client_id = "test-client"
39 user = "test-user"
40 password = "test-password"
41
42 # MQTT client object
43 client = Client(client_id)
44 client.username_pw_set(user, password)
45
46 # MQTT client callback functions
47 def on_connect(client, userdata, flags, rc):
48     """
49     Called when the client successfully connects to the broker.
50     """
51     print("Connected with result code " + str(rc))
52
53     # Subscribe to the topic
54     client.subscribe(topic)
55
56 def on_publish(client, userdata, mid):
57     """
58     Called when the client successfully publishes a message to the broker.
59     """
60     print("Published " + str(mid))
61
62 # MQTT client loop
63 client.loop_start()
64
65 # Main loop
66 while True:
67     # Generate random data
68     temperature = random.uniform(20, 30)
69     humidity = random.uniform(40, 60)
70
71     # Publish data to the broker
72     client.publish(topic, str(temperature) + " " + str(humidity))
73
74     # Wait for 1 second
75     time.sleep(1)
76
77 # MQTT client loop
78 client.loop_stop()
79
80 # End of script
```

```

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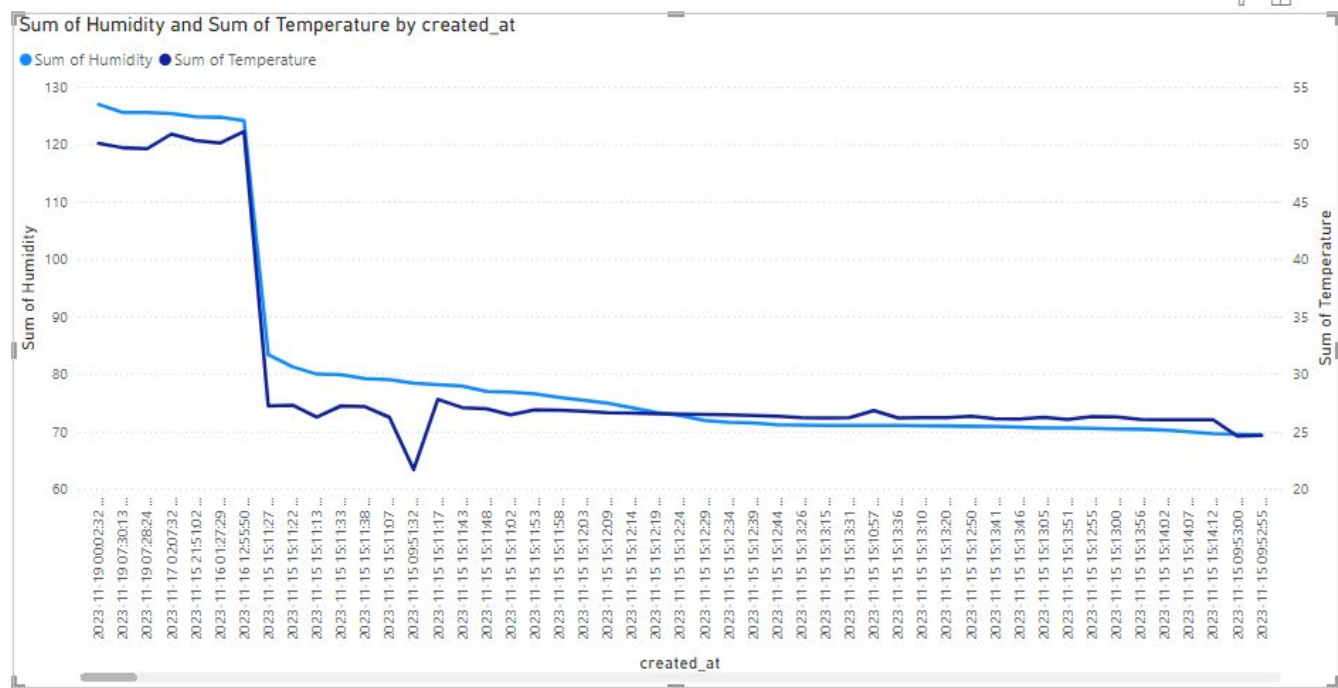
```

Holo: Editor: Superdroid: Aloka
Connected with result code 0
temperature b'26.74'
humidity b'57.27'
temperature b'26.76'
humidity b'57.18'
temperature b'26.76'
humidity b'57.19'
temperature b'26.76'
humidity b'57.17'
temperature b'26.78'
humidity b'57.13'
temperature b'26.81'
humidity b'57.11'

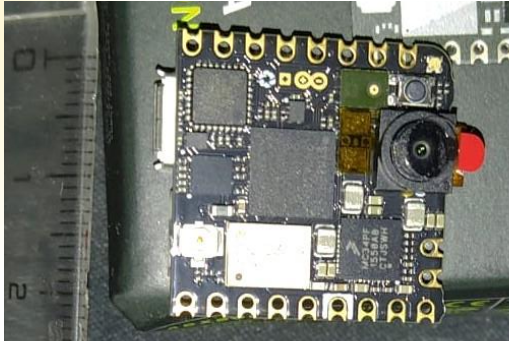
```

[illegible]

P1: LocalServePi



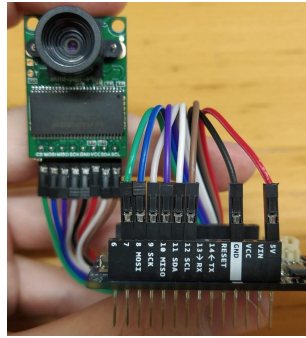
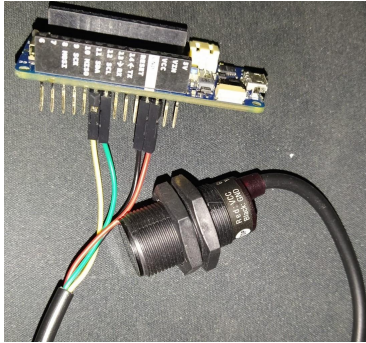
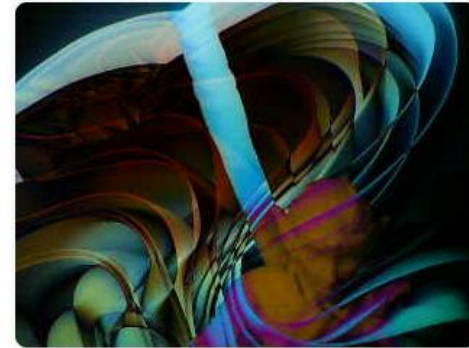
P2-2.5: Vigilantes



192.168.1.253/imageServer.html

Netflix IST WhatsApp gogoanime Liquipedia Rocket L... Playtomic DND ProjMes

Movement Detected



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

```
{
  "hardware": [
    {
      "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"
        }
      ]
    },
    {
      "transmission": [
        {
          "id": "gb.data.transmission.wifi",
          "description": "Wi-Fi module for data transmission",
          "protocol": "Wi-Fi"
        }
      ]
    },
    {
      "processing": [
        {
          "id": "gb.data.processing.raspberrypi",
          "description": "Raspberry Pi 4 for data processing",
          "algorithms": "Data filtering and aggregation"
        }
      ]
    },
    {
      "storage": [
        {
          "id": "gb.data.storage.mysql",
          "description": "MySQL database for data storage",
          "type": "Relational database"
        }
      ]
    },
    {
      "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

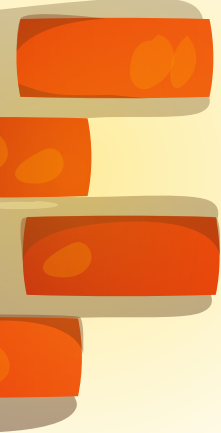

- **Structural Model:** Comprehensive component catalog.
- **Behavioral Model:** Insights into prototype construction and functionality.

Conclusion

GuardBricks as Building
Blocks for Monitoring
Proactive Maintenance
Scheduled Locations with
Sensor Locations with
with IoT technologies
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

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