

UNIVERSIDADE DE SÃO PAULO  
FACULDADE DE FILOSOFIA, CIÊNCIAS E LETRAS DE RIBEIRÃO PRETO  
DEPARTAMENTO DE COMPUTAÇÃO E MATEMÁTICA

GABRIEL CARVALHO SILVA

# **An IoT Smart Scale Proof of Concept for Smart Homes**

Ribeirão Preto–SP

2025



GABRIEL CARVALHO SILVA

## **An IoT Smart Scale Proof of Concept for Smart Homes**

Versão Original

Dissertação apresentada à Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto (FFCLRP) da Universidade de São Paulo (USP), como parte das exigências para a obtenção do título de Mestre em Ciências.

Área de Concentração: Computação Aplicada.

Orientador: Cléver Ricardo Guareis de Farias

Ribeirão Preto–SP

2025



Gabriel Carvalho Silva

An IoT Smart Scale Proof of Concept for Smart Homes. Ribeirão Preto–SP, 2025.  
45p. : il.; 30 cm.

Final Paper submitted to the Faculdade de Filosofia, Ciências e Letras  
de Ribeirão Preto da USP, as part of the requirements for obtaining a Bachelor's  
degree in Computer Science.

Supervisor: Cléver Ricardo Guareis de Farias

1. IoT. 2. Embedded Systems. 3. Event-driven Architecture.



*A minha avó, Maria Daria Rocha.*





# Acknowledgements

Agradeço ...



*“RAAAWR // (Totoro)*



# Abstract

This is the english abstract.

**Keywords:** iot. smart home. event driven. face recognition. smart scale.



# List of figures





# List of tables



# List of abbreviations and acronyms

TODO

TODO



# List of symbols

$\Gamma$

TODO



# Summary

	<b>Introduction . . . . .</b>	<b>25</b>
<b>0.1</b>	<b>Theoretical Background . . . . .</b>	<b>25</b>
0.1.1	The Internet of Things and Smart Homes . . . . .	25
0.1.2	Smart Scales . . . . .	25
<b>0.2</b>	<b>The Smart Scale project as an architectural and technical Proof of Concept . . . . .</b>	<b>25</b>
<b>0.3</b>	<b>Objectives . . . . .</b>	<b>25</b>
<b>1</b>	<b>METHOD . . . . .</b>	<b>27</b>
<b>1.1</b>	<b>Project definition . . . . .</b>	<b>27</b>
1.1.1	Functional Requirements . . . . .	27
1.1.2	Nonfunctional Requirements . . . . .	27
1.1.3	Overall Design . . . . .	27
1.1.3.1	Infrastructure . . . . .	27
1.1.3.2	Architectural Patterns . . . . .	27
1.1.4	Design of the edge layer . . . . .	27
1.1.5	Design of the fog layer . . . . .	27
1.1.6	Design of the cloud/hub layer . . . . .	27
<b>1.2</b>	<b>Tests and Demos . . . . .</b>	<b>27</b>
<b>2</b>	<b>RESULTS . . . . .</b>	<b>29</b>
<b>2.1</b>	<b>Smart Scale Measurements . . . . .</b>	<b>29</b>
2.1.1	Data Serialization . . . . .	29
<b>2.2</b>	<b>Smart Scale Face Recognition . . . . .</b>	<b>29</b>
2.2.1	Method comparison . . . . .	29
2.2.2	Handling Privacy . . . . .	29
<b>2.3</b>	<b>Dashboard data visualization . . . . .</b>	<b>29</b>
<b>2.4</b>	<b>System integration . . . . .</b>	<b>29</b>
<b>3</b>	<b>DISCUSSION AND FUTURE WORK . . . . .</b>	<b>31</b>
<b>3.1</b>	<b>Extensions to the PoC . . . . .</b>	<b>31</b>
<b>3.2</b>	<b>Applications to the Internet of Medical Things . . . . .</b>	<b>31</b>
<b>3.3</b>	<b>Applications to Husbandry . . . . .</b>	<b>31</b>
<b>4</b>	<b>CONCLUSION . . . . .</b>	<b>33</b>

**APPENDIX** **35**

**APPENDIX A – QUISQUE LIBERO JUSTO . . . . . 37**

**APPENDIX B – NULLAM ELEMENTUM . . . . . 39**

**ANNEX** **41**

**ANNEX A – MORBI ULTRICES RUTRUM LOREM. . . . . 43**

**ANNEX B – FUSCE FACILISIS LACINIA DUI . . . . . 45**



---

# Introduction

## 0.1 Theoretical Background

### 0.1.1 The Internet of Things and Smart Homes

### 0.1.2 Smart Scales

## 0.2 The Smart Scale project as an architectural and technical Proof of Concept

## 0.3 Objectives



---

# Method

## 1.1 Project definition

### 1.1.1 Functional Requirements

### 1.1.2 Nonfunctional Requirements

### 1.1.3 Overall Design

#### 1.1.3.1 Infrastructure

ESP32 and equipment raspberry pi placeholded by laptop (docker)

#### 1.1.3.2 Architectural Patterns

DDD and event driven

**1.1.4 Design of the edge layer**

**1.1.5 Design of the fog layer**

**1.1.6 Design of the cloud/hub layer**

## **1.2 Tests and Performance Analysis**

**1.2.1 Processing Performance**

**1.2.2 Usability Performance**

---

## Results

### 2.1 Smart Scale Measurements

#### 2.1.1 Data Serialization

### 2.2 Smart Scale Face Recognition

#### 2.2.1 Method comparison

Euclidian distance X cosine & neural net vs basic moment calculation

#### 2.2.2 Handling Privacy

### 2.3 Dashboard data visualization

### 2.4 System integration



---

## Discussion and Future Work

### 3.1 Extensions to the PoC

### 3.2 Applications to the Internet of Medical Things

### 3.3 Applications to Husbandry





---

## Conclusion



# Appendix



A

---

Quisque libero justo



B

---

**Nullam elementum**





# Annex



A

---

Morbi ultrices rutrum lorem.



B

---

Fusce facilisis lacinia dui