Experiences in Teaching Tiny ML to Undergraduate and Graduate Students

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Universidad AUTÓNOMA de Occidente

ACREDITACIÓN INSTITUCIONAL DE ALTA CALIDAD NACIONAL E INTERNACIONAL

Who I am

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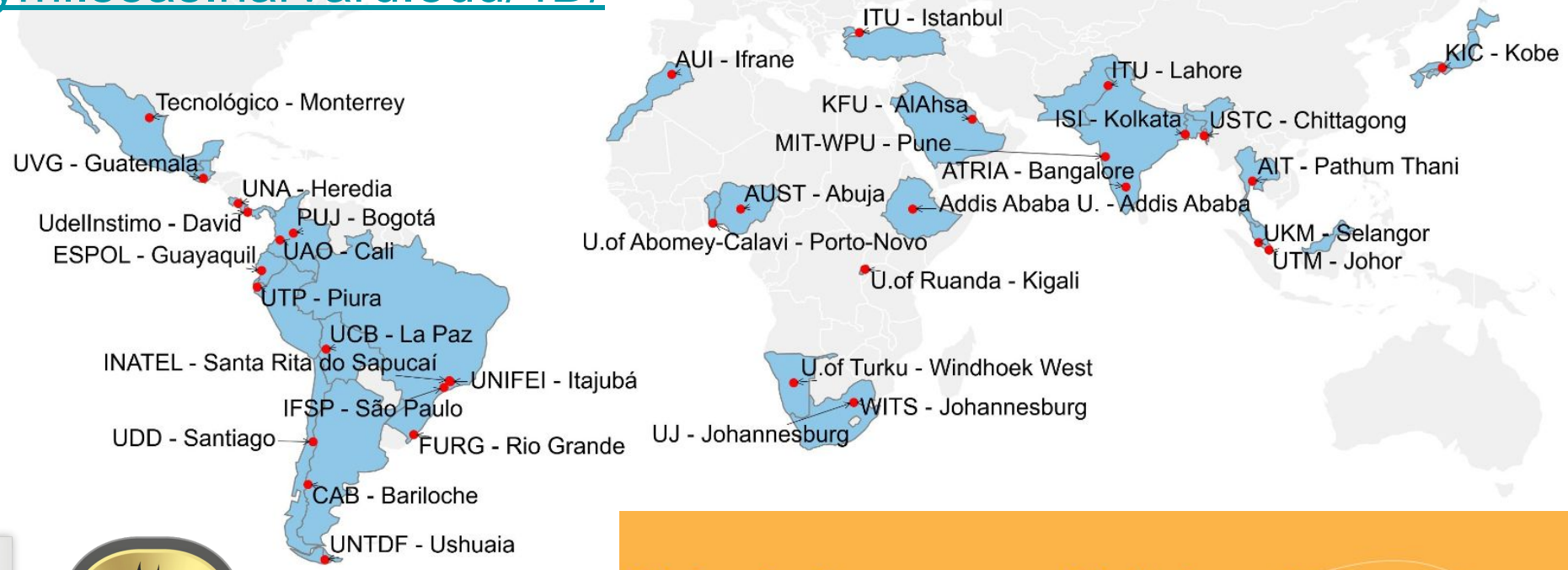
Thanks to TinyML 4D Academic Network!!!

https://tinyml.seas.harvard.edu/4D/



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Workshop on Widening Access to TinyML Network by Establishing Best Practices in Education

ICTP

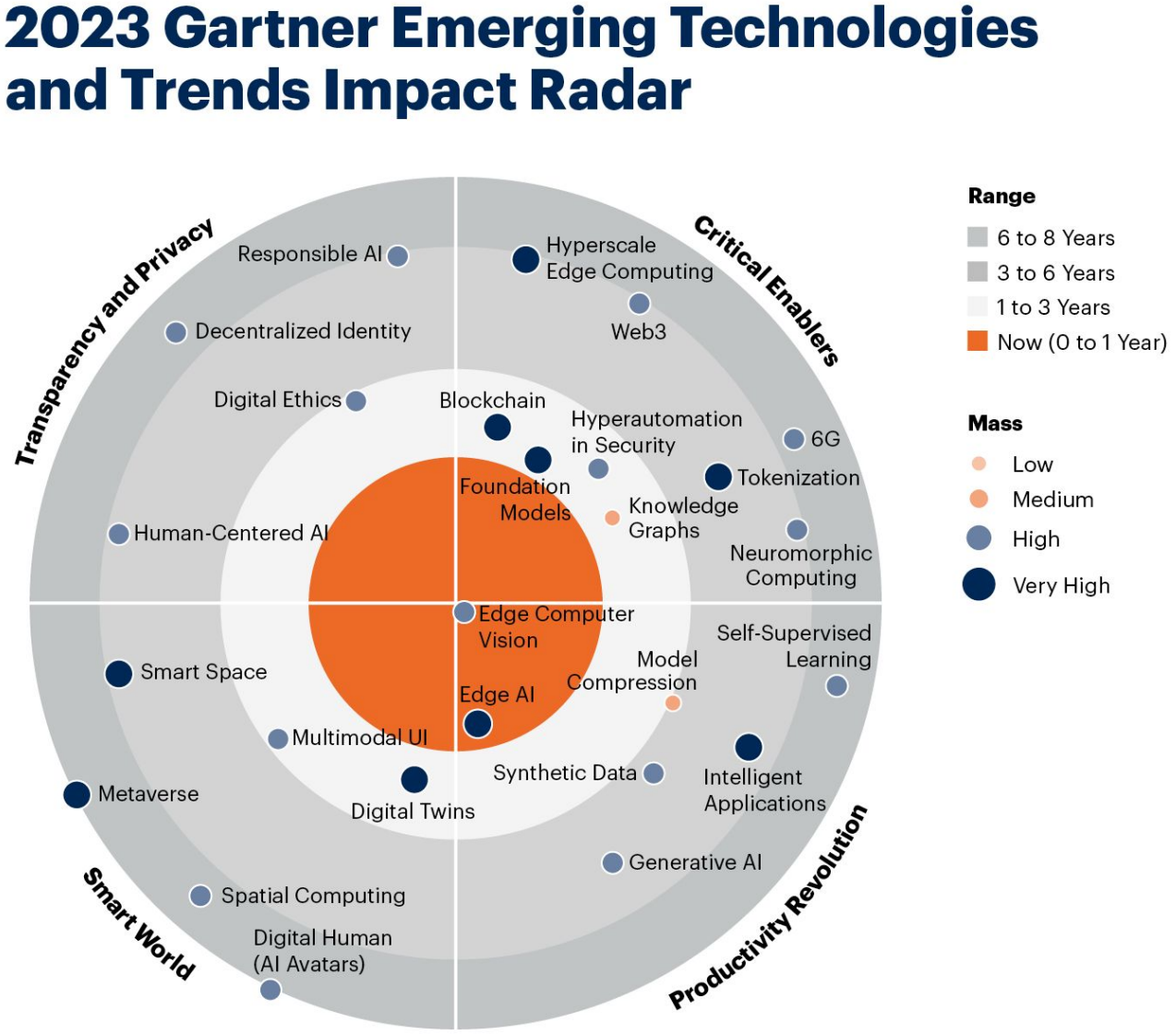
Location

Cali Colombia

Universidad Autónoma de Occidente (UAO)

Why Teach Tiny ML?

- The best way to learn something is to teach it!!!
- Tiny ML has a huge potential to be apply in development countries
- It isn't necessary to have a big infraestructure
- Lack of conectivity in rural zones
- It is possible to solve real problems with low cost solutions
- Teach ML with projects.



https://www.gartner.com/en/articles/4-emerging-technologies-you-need-to-know-about

General Information of the Under Graduate Course

- Artificial Intelligence in Mobile and Embedded Devices
- Two sections at week. 1.5 hour each one
- In person
- Sixteen weeks. Total 48 Hours
- First version 20 students
- Second version 23 students
- Third version 22 students

Course Structure

Software Tools

- Deep Learning (TensorFlow-Keras)
- Google Colab
- Edge Impulse Studio
- IDE Arduino
- APP Inventor

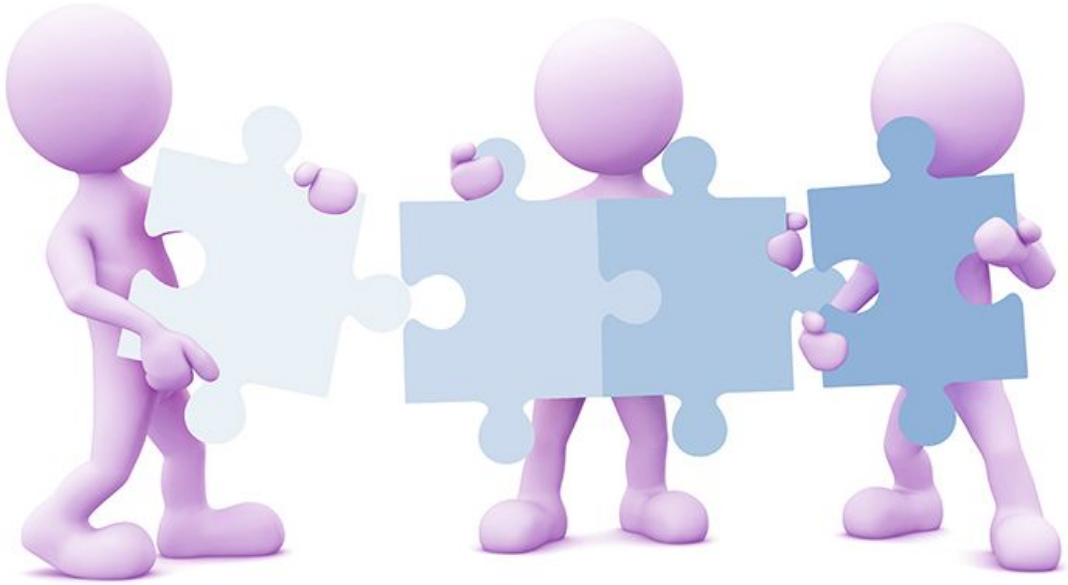
Hardware Tools

- Arduino UNO - MEGA
- Arduino Tiny ML Kit
- Smartphones
- Raspberry Pi

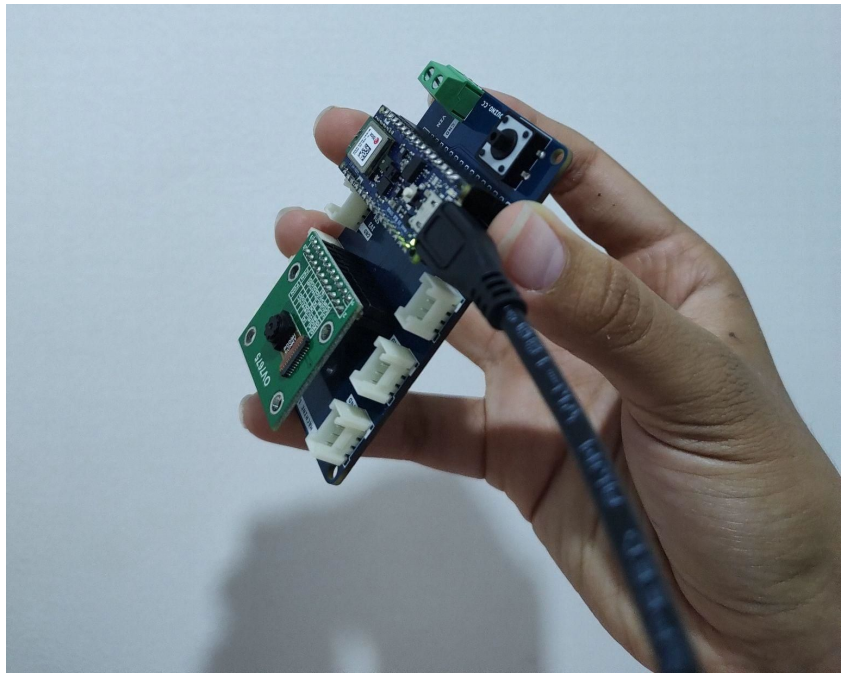
Tiny ML Kit

Course Projects

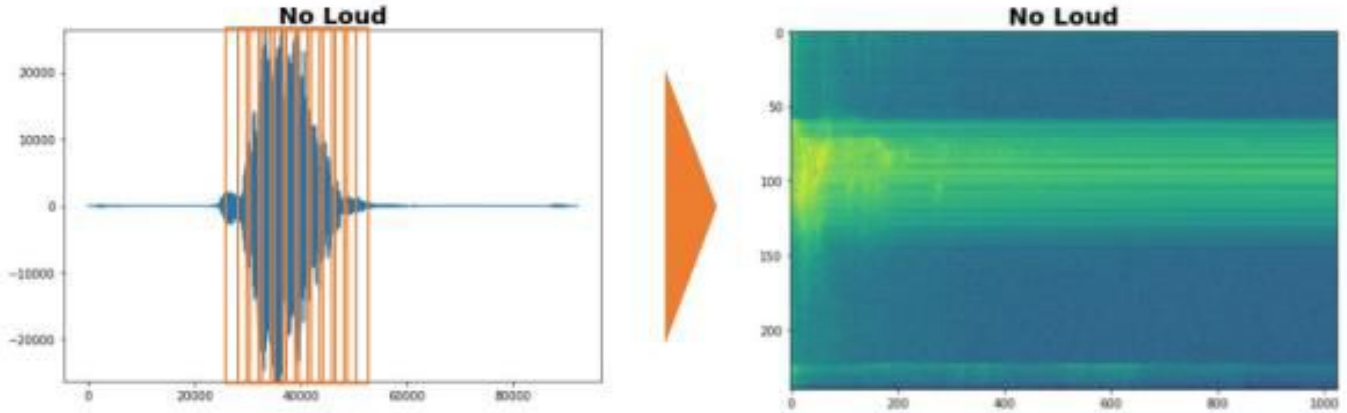
- Image classification using app inventor with hardware interaction
- Motion classification using tiny ml kit with hardware interaction or app interaction
- Sound or image classification using tiny ml kit with hardware or app interaction



Course Projects

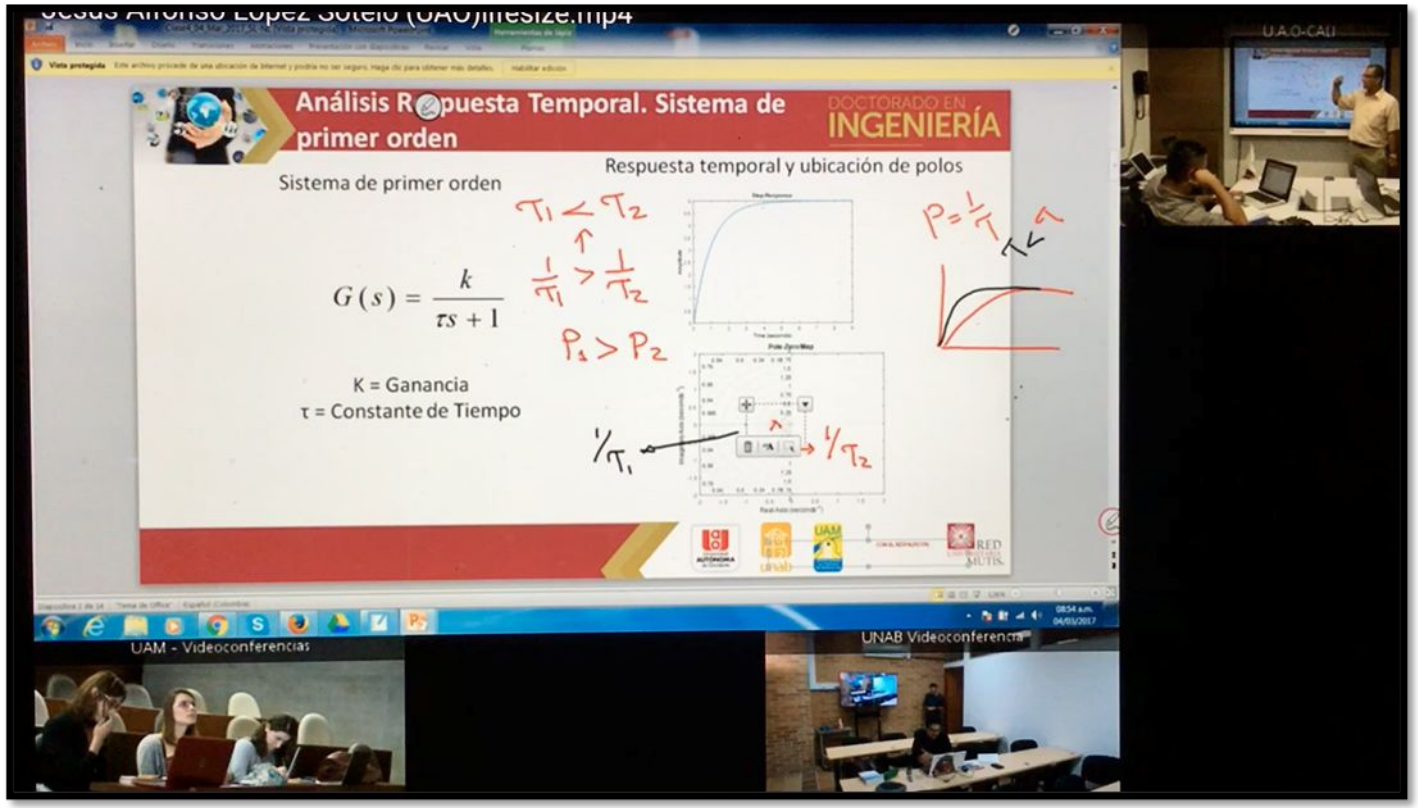


Course Projects



General Information of the Graduate Course

- Artificial Intelligence in Edge AI Devices
- One sections at week. 3 hour each one
- Blended (Hybrid)
- Sixteen weeks. Total 48 Hours
- First version 6 students
- Second version 12 students



Course Structure

Software Tools

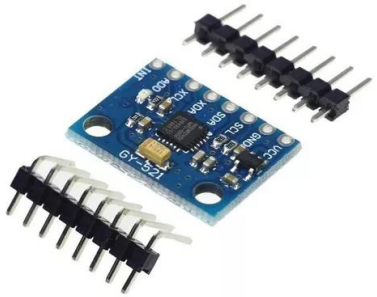
- Deep Learning (TensorFlow-Keras)
- Google Colab
- Edge Impulse Studio
- IDE Arduino
- APP Inventor

Hardware Tools

- ESP 32 - ESP CAM
- Sensors: MPU 6050
- Raspberry Pi

ESP 32

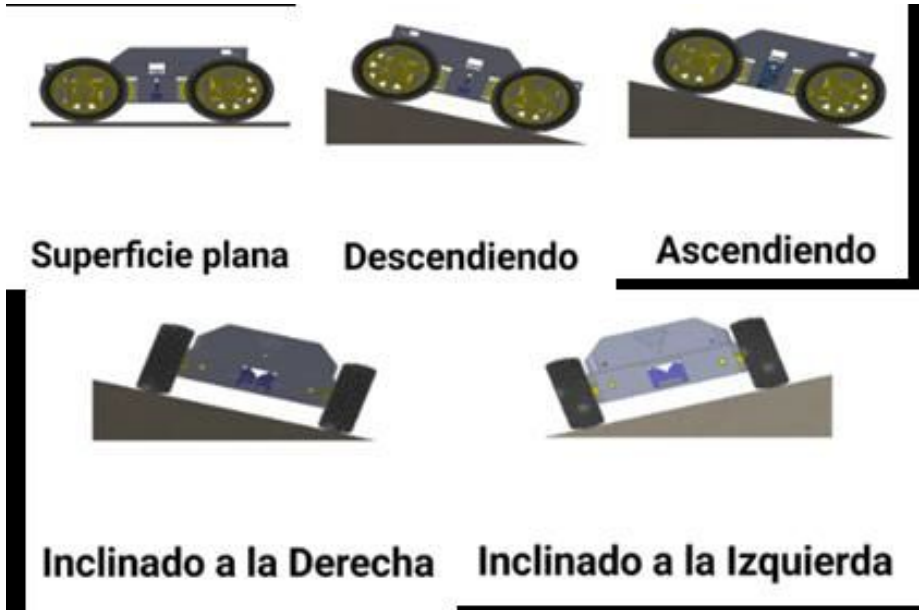
ESP CAM



Course Projects

- Motion classification using ESP 32 and MPU 6050 with hardware interaction or app interaction
- Sound classification using ESP 32 and microphone sensor with hardware interaction or app interaction
- Image classification using ESP CAM with hardware or app interaction

Course Projects

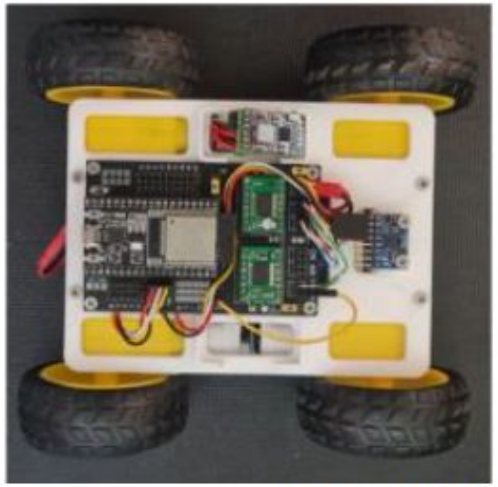


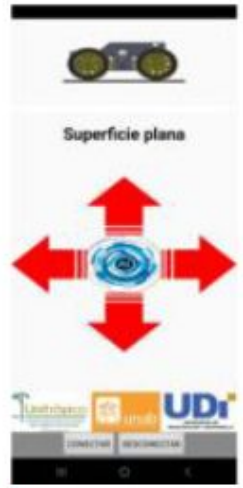
Robot con sensor Inercial → Comunicación inalámbrica a través de ESPNOW → ESP32 conectado a EDGE IMPULSE

ESPNOW

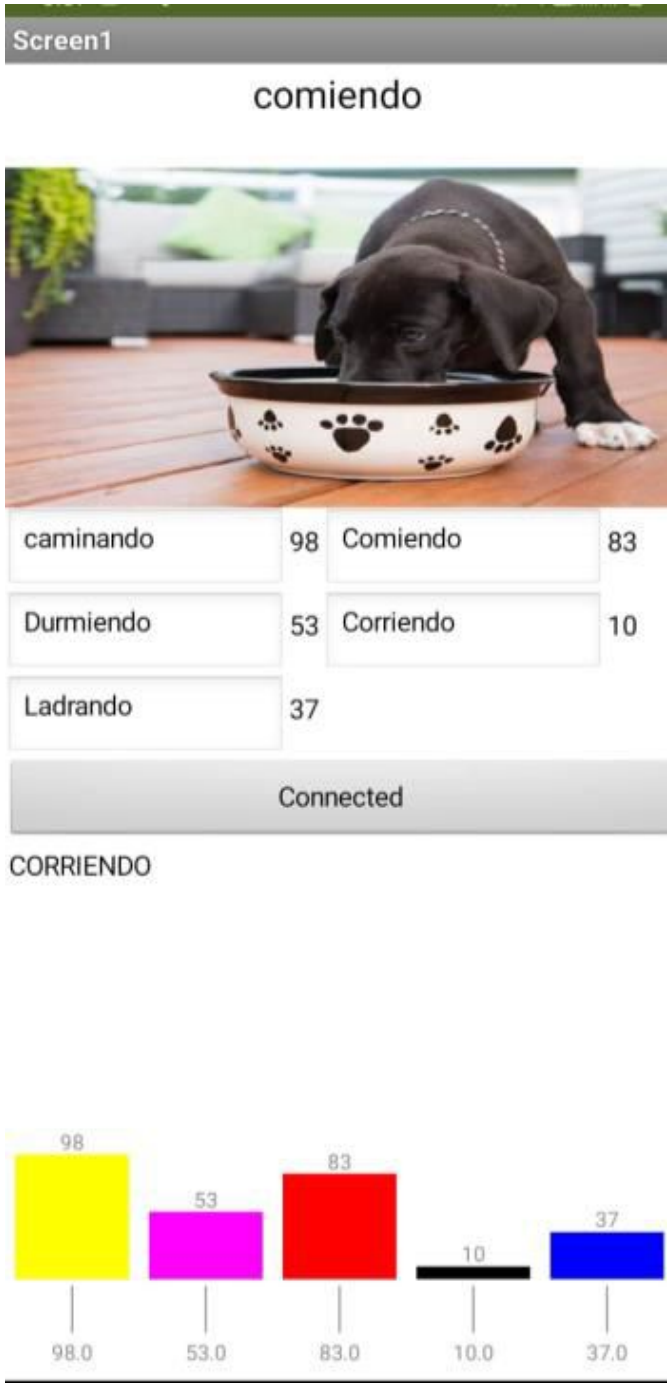
EDGE IMPULSE

Robot con sensor Inercial → Comunicación inalámbrica a través de Bluetooth → Aplicación móvil para control y monitoreo del Robot

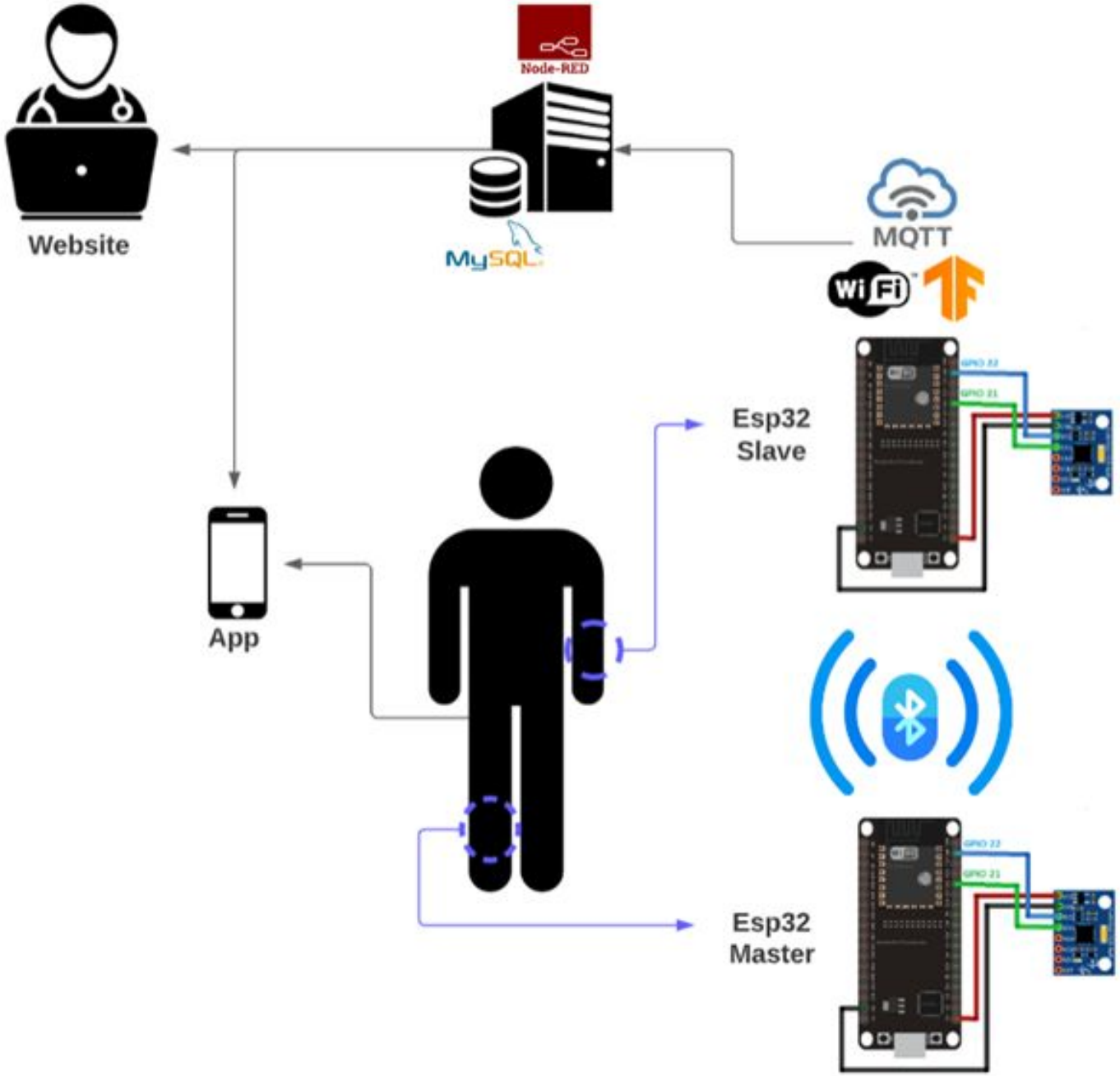




Course Projects



Course Projects



Some Final Thoughts

- The topic is very attractive for the students.
- The course is a good complement to others AI courses that we have at UAO.
- Different background of the student that is a little challenging for them and the professor.
- Arduino kits are very useful for the course.
- Include different hardware platform is challenging but necessary.
- The background of the students matters.