

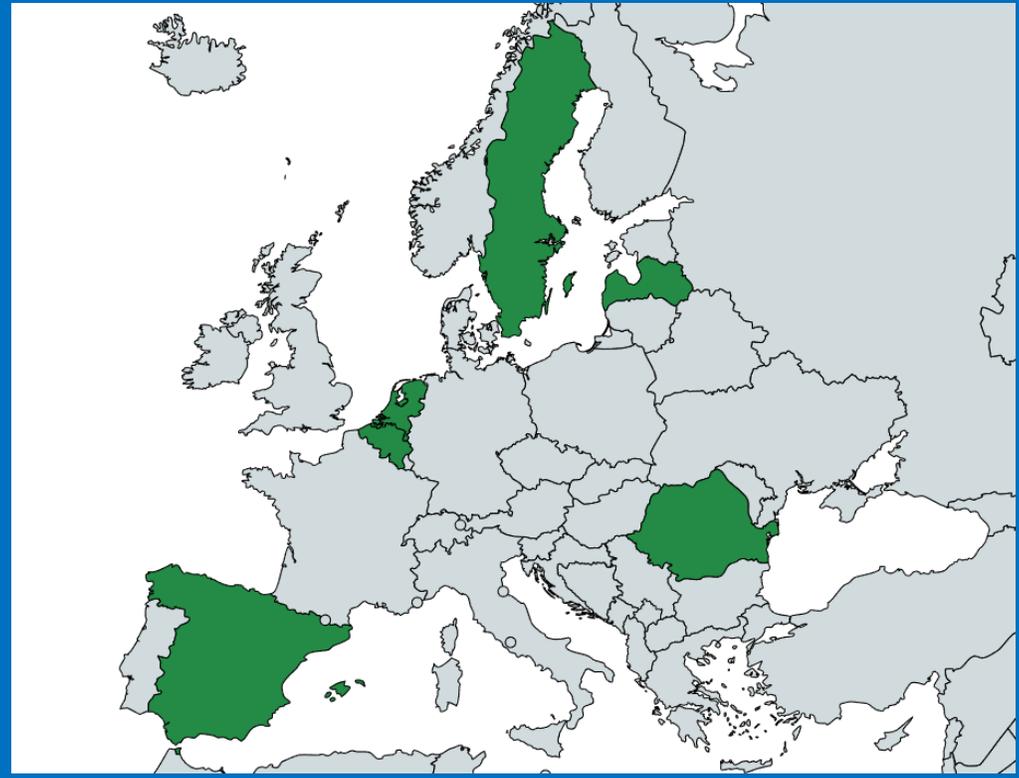
Development of Remote Laboratories: EUBBC-Digital

Omar Ormachea & Alex Villazón
Universidad Privada Boliviana (UPB), Bolivia
13-17 June 2022



Development of Remote Laboratories: EUBBC-Digital

18 Institutions
9 Countries



Europe-Brazil-Bolivia-Cuba Capacity Building Using Globally Available Digital Learning Modules (EUBBC-Digital)

Brazil



UNIVERSIDADE FEDERAL DO RIO DE JANEIRO

Cuba



UNIVERSIDAD DE PINAR DEL RÍO
HERMANOS SAÍZ MONTES DE OCA



Universidad Tecnológica de La Habana
"José Antonio Echeverría"



UNIVERSIDAD DE LA HABANA

Bolivia



UNIVERSIDAD MAYOR DE SAN SIMÓN
Ciencia y Conocimiento desde 1832

Cuba



Remote Labs (LAC)

University: Universidad Pinar del Río, Cuba

Remote Lab name: Thermochemical pyrolysis and gasification processes for the characterization of biomasses for energy use



University: Universidad Central “Marta Abreu” de Las Villas, Cuba,

Remote Lab name: Solar concentration laboratory

Cuba



cujae

Universidad Tecnológica de La Habana
“José Antonio Echeverría”



VNIVERSIDAD
DE LA HABANA

Remote Labs (LAC)

University: Universidad Tecnológica de La Habana José Antonio Echeverría, Cuba

Remote Lab name: Microgrid Lab with use of Renewable Energy Sources

University: University of Habana, Cuba

Remote Lab name: PV-Remote Lab

Remote Labs (LAC)

Bolivia



University: Universidad Privada Boliviana, Bolivia

Remote Lab name: a) Spectroscopy Remote Laboratory
b) PV Solar Efficiency (UVA)



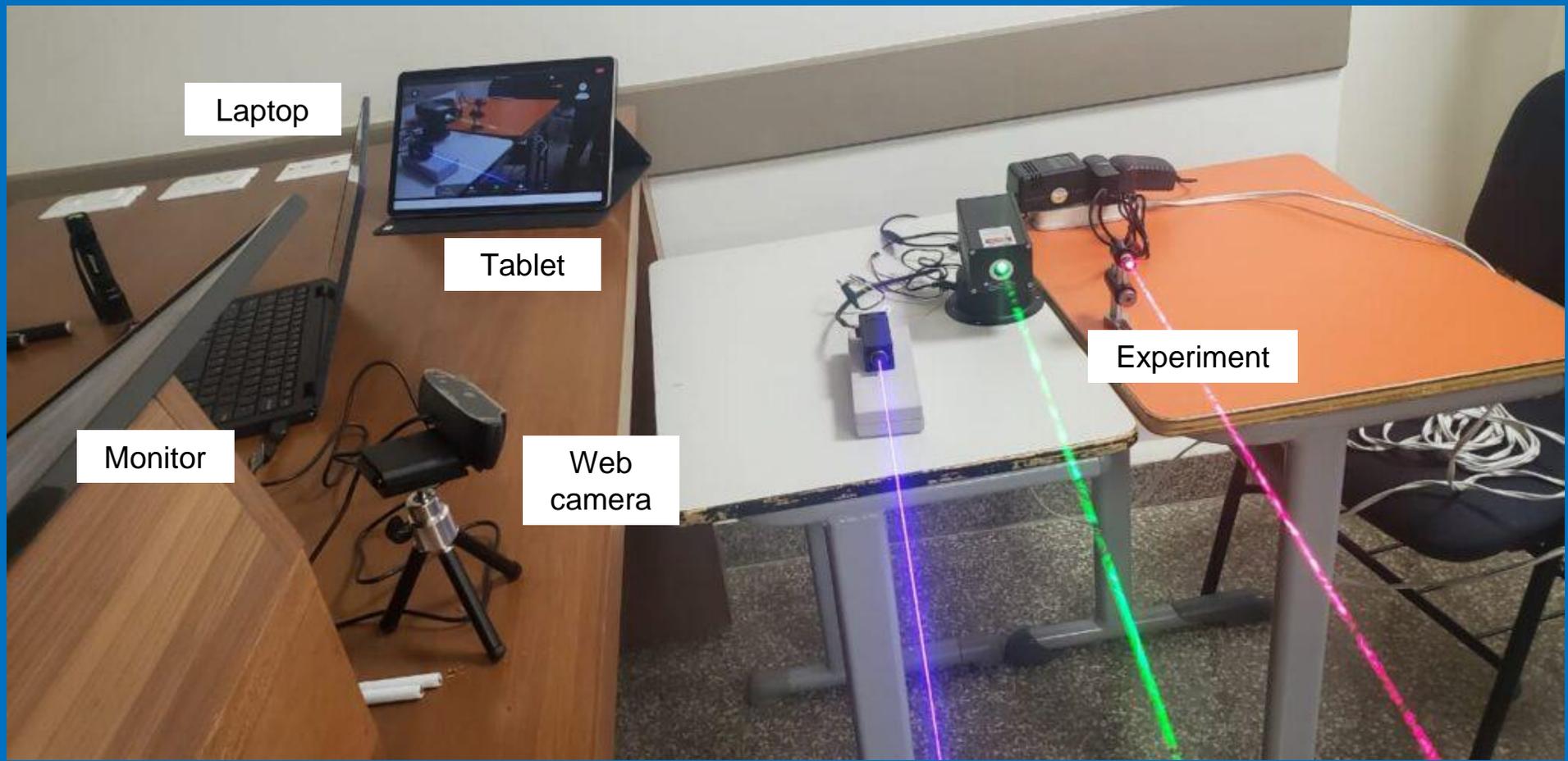
University: Universidad Mayor de San Simón, Bolivia

Remote Lab name: a) Hydraulic Turbine Remote Laboratory
b) Lab facility for testing of biomass cookstoves

Capacity Building



a) EUBBC-Digital “AV Mobile Kits” at UPB



Capacity Building

a) EUBBC-Digital “AV Mobile Kits” at UPB

Presentation of the lab reports made by groups of students with the AV Mobile Kit.



The AV Mobile Kit was deployed in a lab with... allowing on-site and on-site students to present...

Capacity Building

FÍSICA CLÁSICA
LABORATORIO 10



The Audio Visual (AV) equipment installed in this laboratory
was financed by the EUBBC-Digital / Erasmus+ Project
(2021-2023)

Project number: 618925-EPP-1-2020-1-BR-EPPKA2-CBHE-JP

Capacity Building

b) AV Equipment installation



Project website

<http://eubbc-digital.upb.edu/>



- HOME
- PARTNERS
- UPB TEAM
- DISSEMINATION ▾
- REMOTE LABS ▾
- REMOTE LAB BOOKING
- MEMBERS ▾

PARTNERS UPB TEAM DISSEMINATION ▾ **REMOTE LABS ▾** REMOTE LAB BOOKING

- Spectrometry Remote Lab
- PV efficiency Remote Lab
- Solar Radiation Measurements
- Solar Radiation Measurements

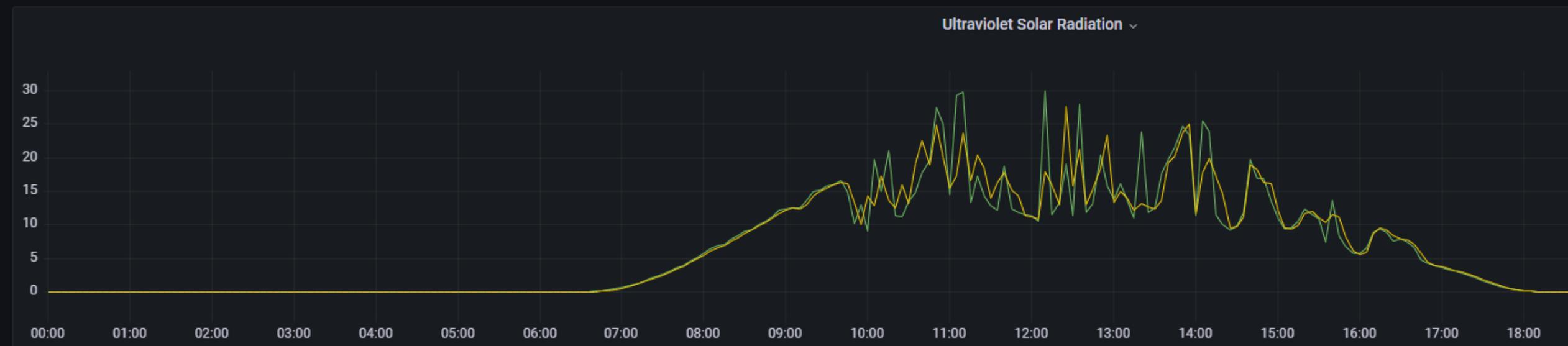
Remote Labs

General / Solar Radiation dashboard

Solar Radiation chart, data since December 2020



Ultraviolet Radiation chart, data since December2020



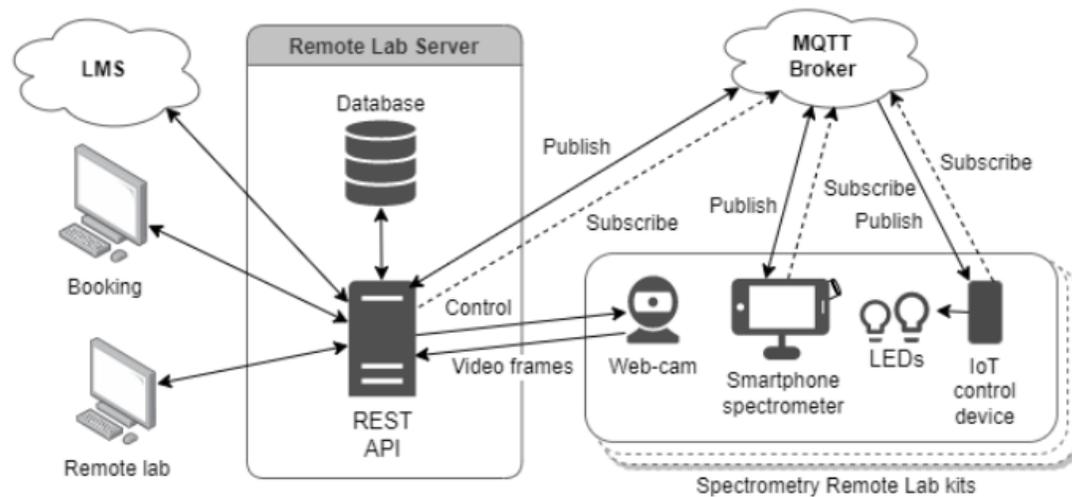
REV2022 Conference: A Low-Cost Spectrometry Remote Laboratory

Abstract: The Covid-19 pandemic has precipitated the digital transformation in education worldwide and has exposed weaknesses and limitations in laboratory and experimental activities, mainly in the field of engineering.

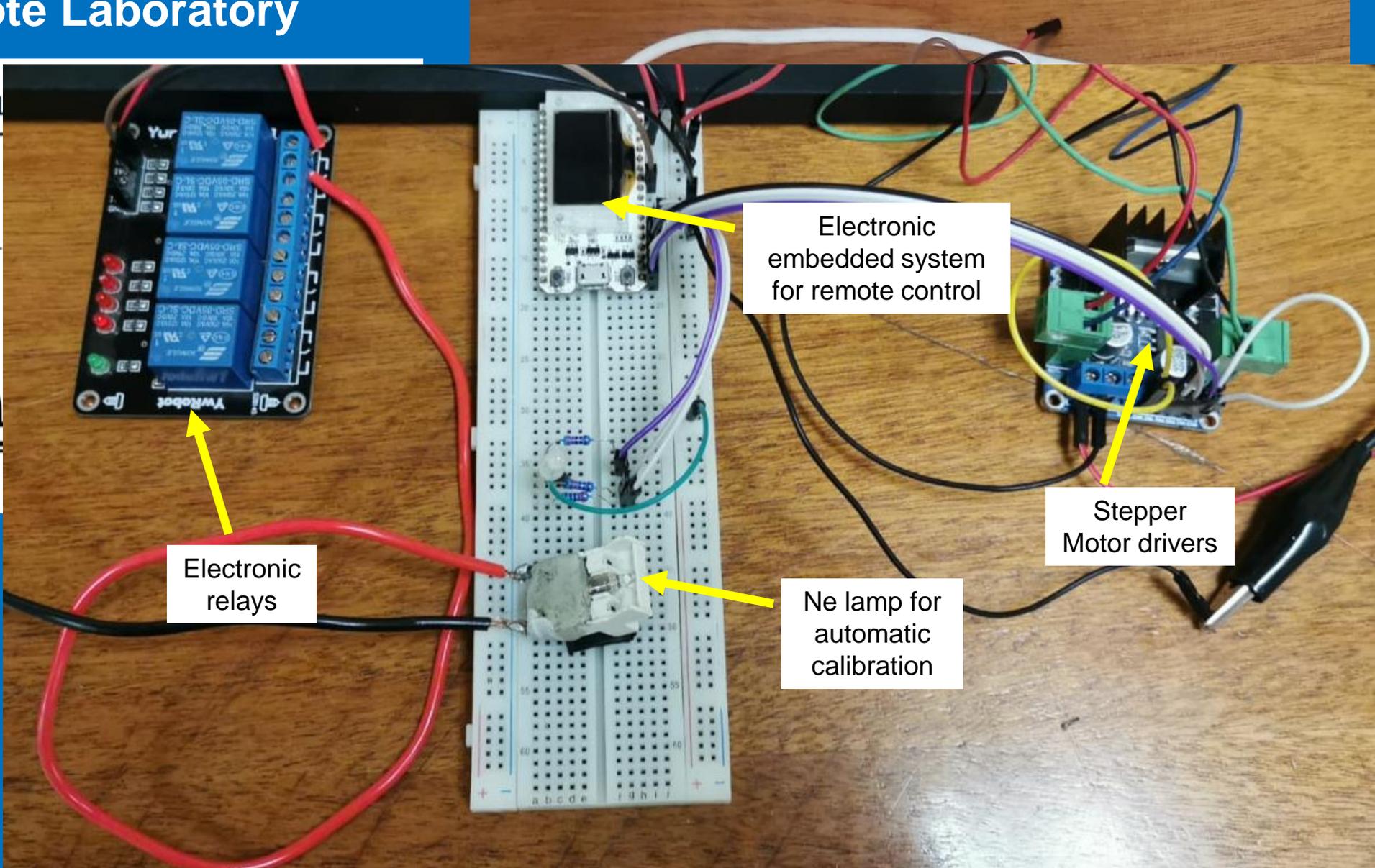
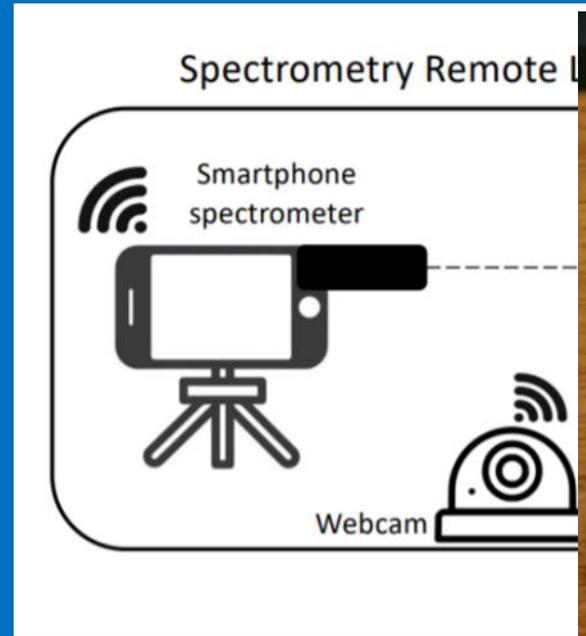
In this paper, we describe how we adapted our low-cost spectrometry technology (which is based on a 3D-printed mini-spectrometer and a smartphone) to deploy a remote laboratory as a rapid solution, due to the impossibility of using conventional and costly spectrometers, which work only for on-campus learning. This adaptation was helpful, not only to have several spectrometers available for a higher number of students but also to allow teachers to prepare asynchronous activities that can be realized without their presence. We applied Internet of Things (IoT) technology for remotely controlling the experiments and used Machine Learning to automatically calibrate our low-cost smartphone spectrometer.

Presenter: Alex Villazon

Conference: [REV2022](#) – 19th International Conference on Remote



Spectroscopy Remote Laboratory



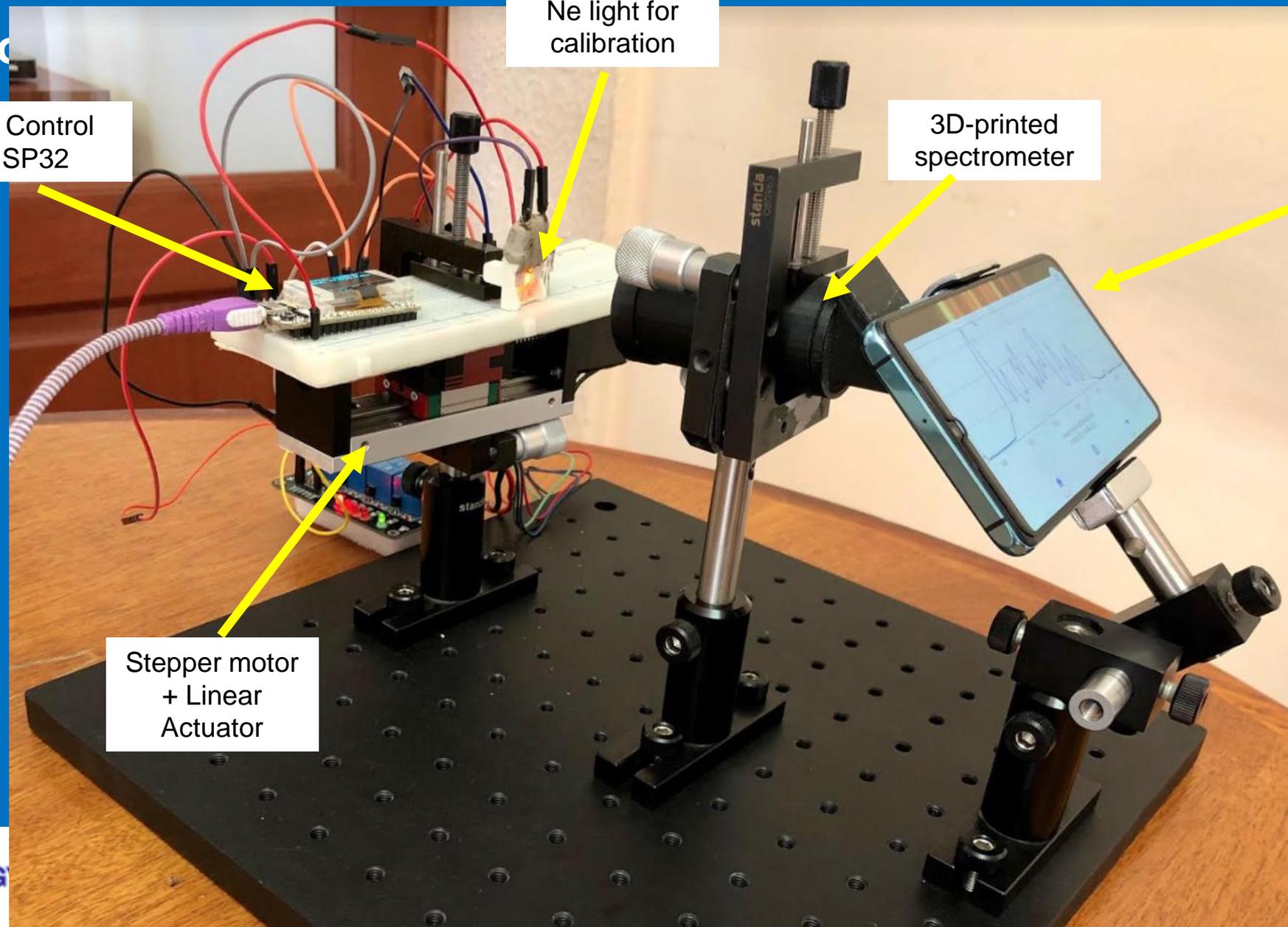
Electronic relays

Electronic embedded system for remote control

Stepper Motor drivers

Ne lamp for automatic calibration

Spectroscopy



IoT Control
ESP32

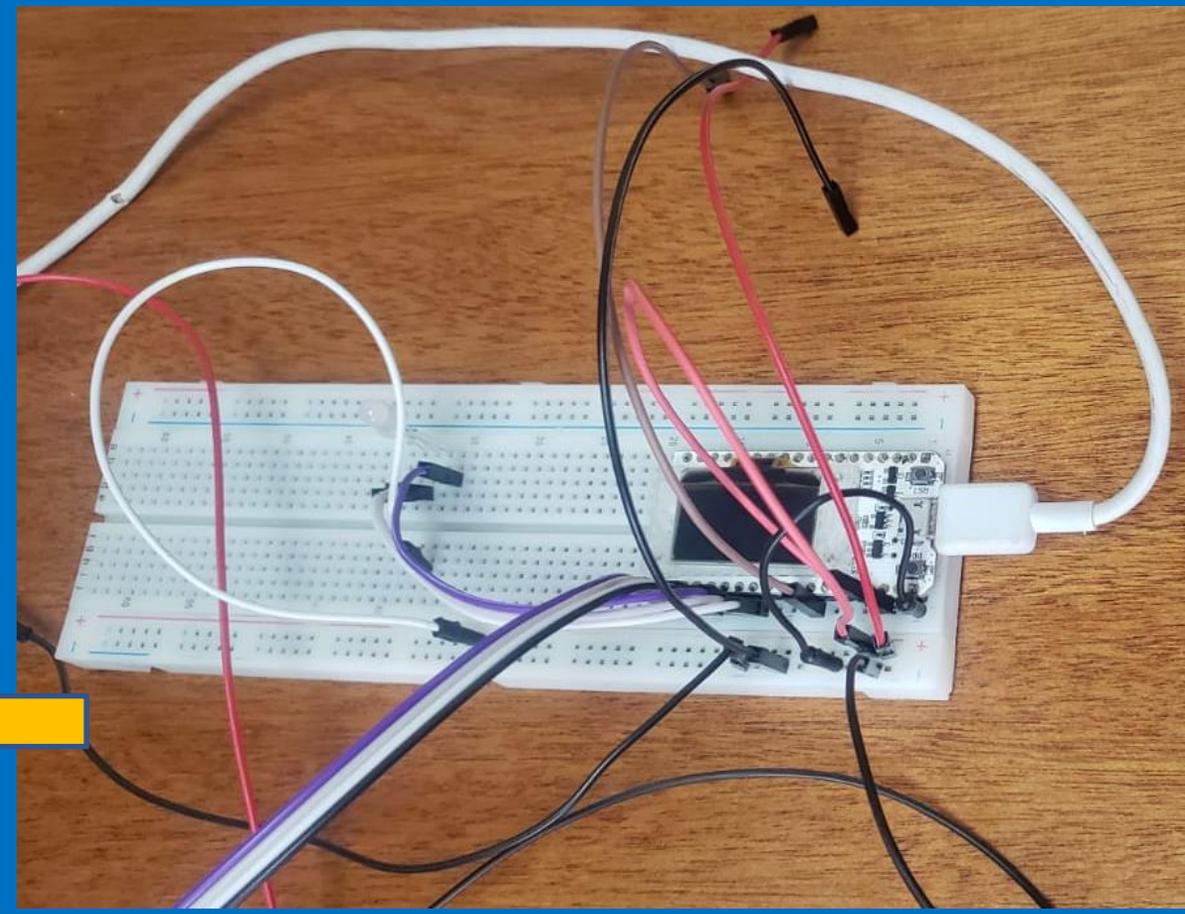
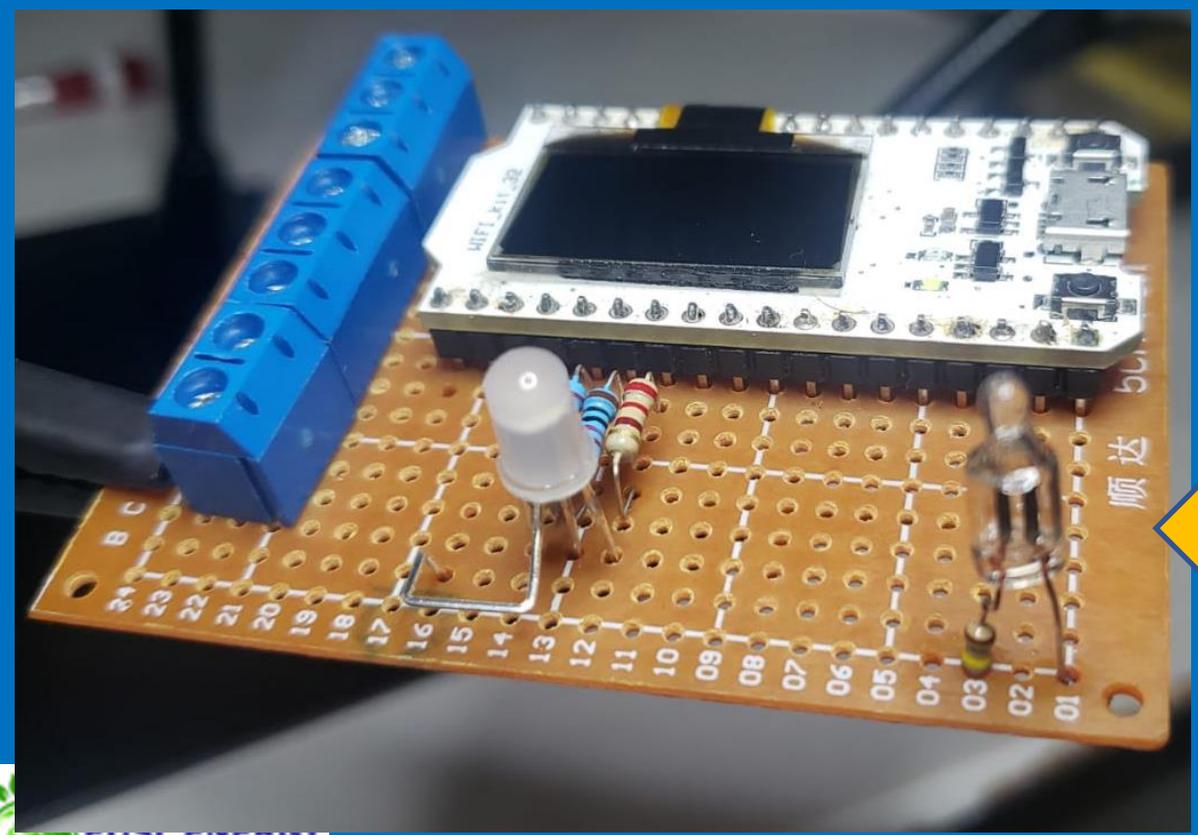
Ne light for
calibration

3D-printed
spectrometer

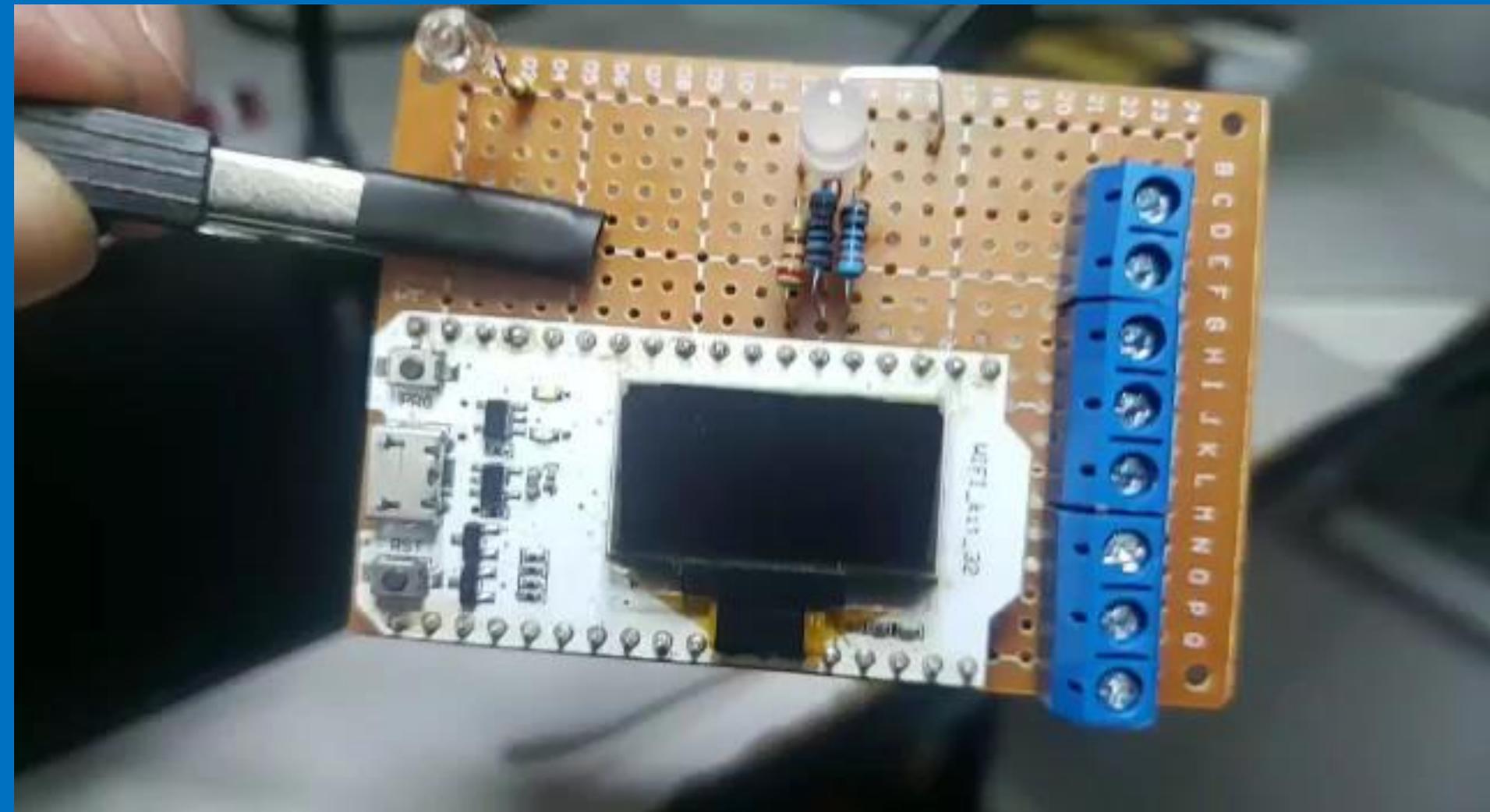
Smartphone

Stepper motor
+ Linear
Actuator

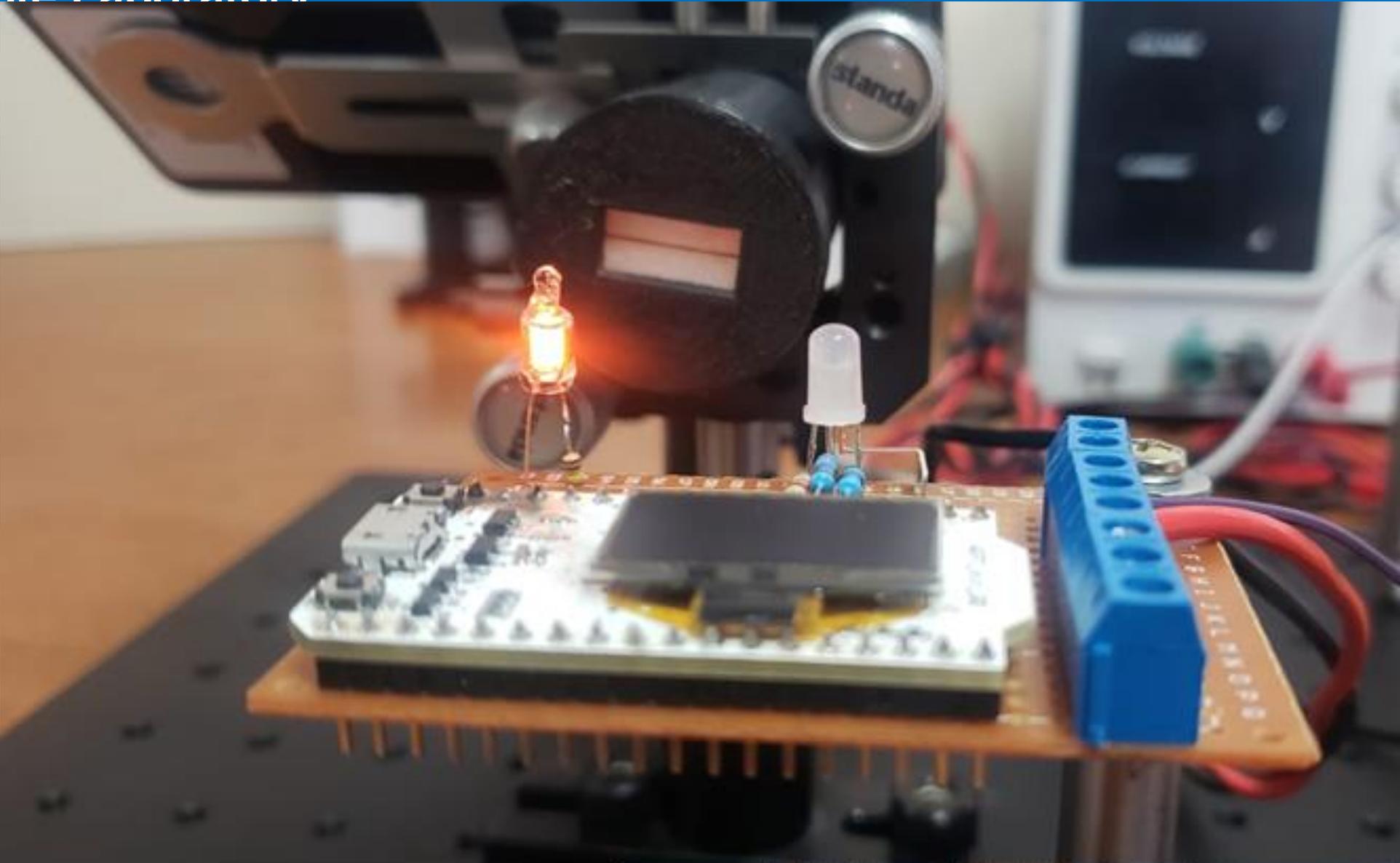
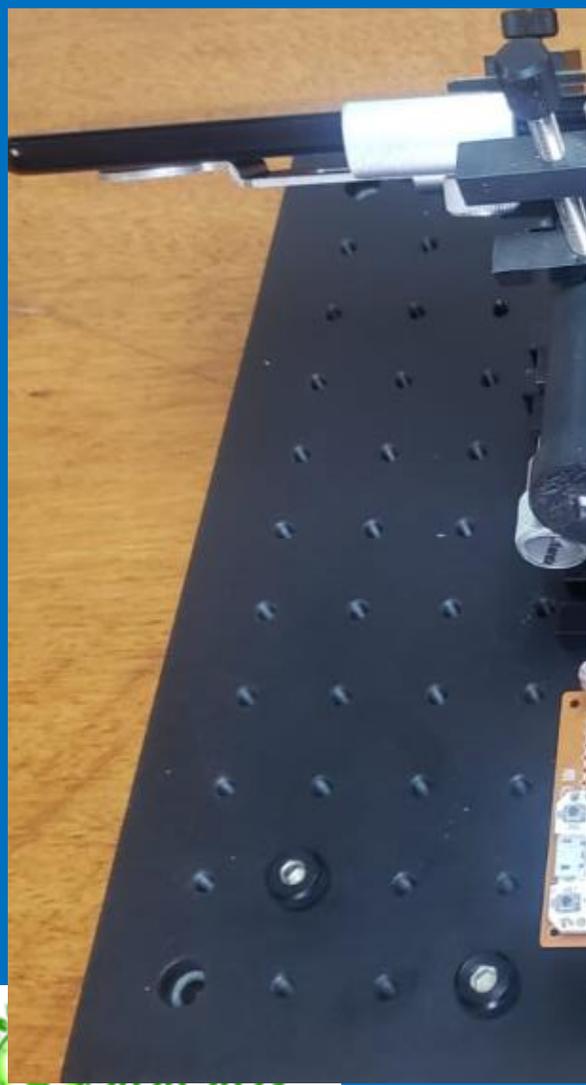
Spectroscopy Remote Laboratory

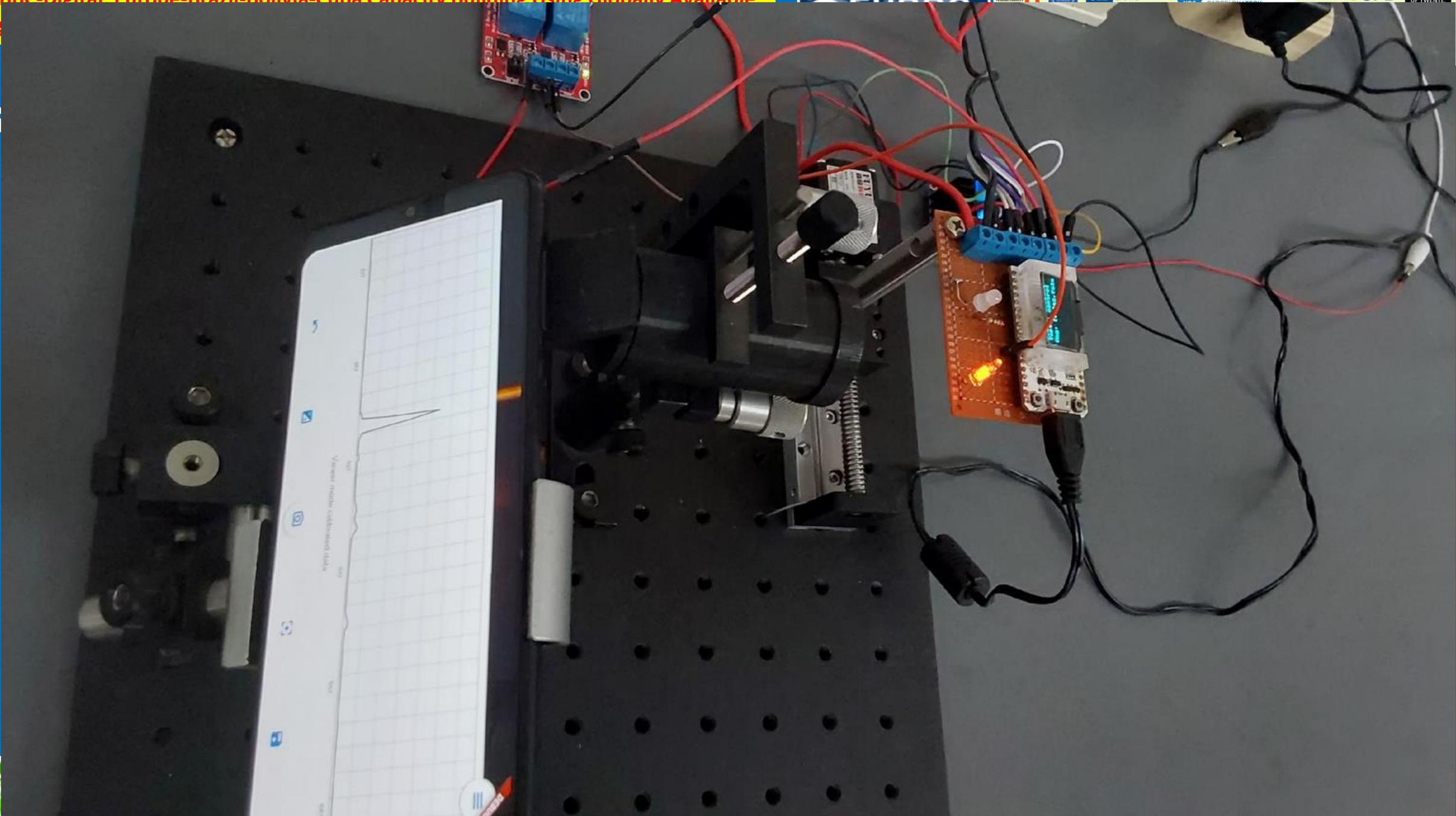


Spectroscopy Remote Laboratory



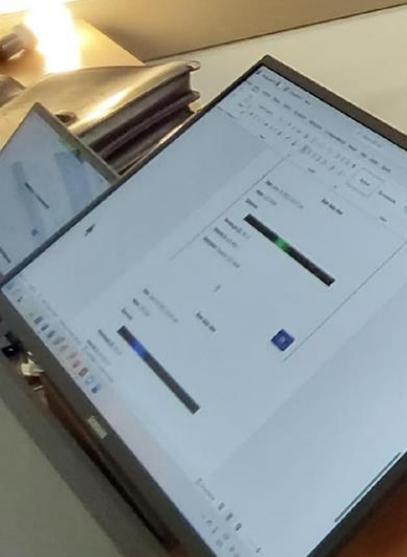
Spectroscopy Remote Laboratory





Spectroscopy

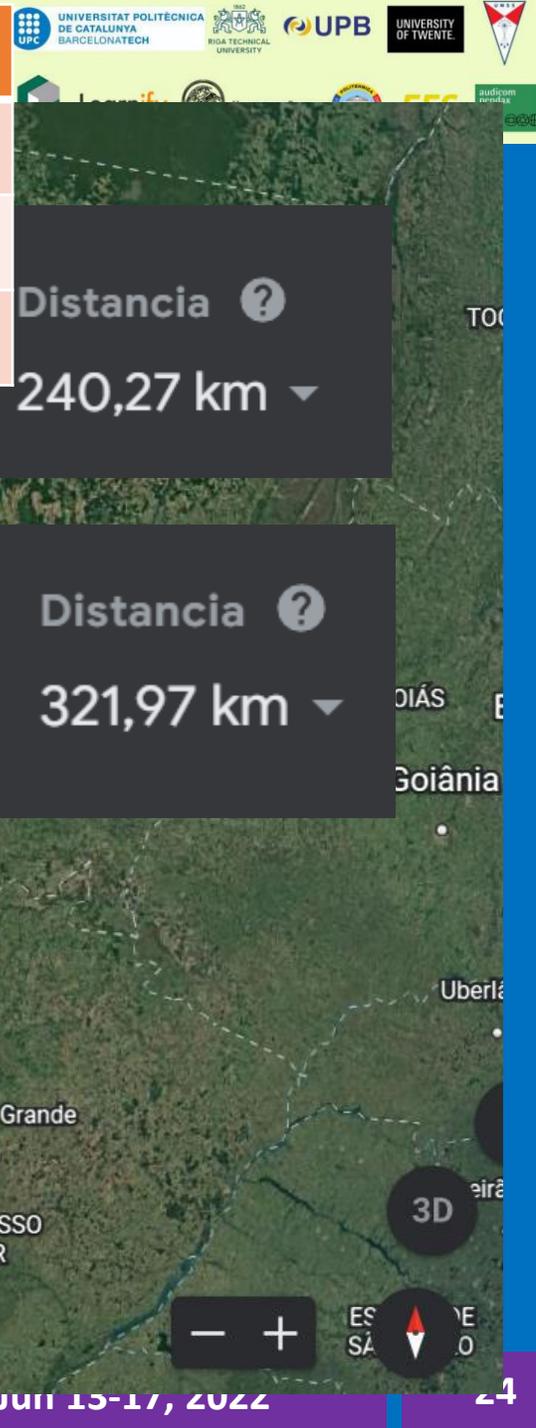
Implementation in real context



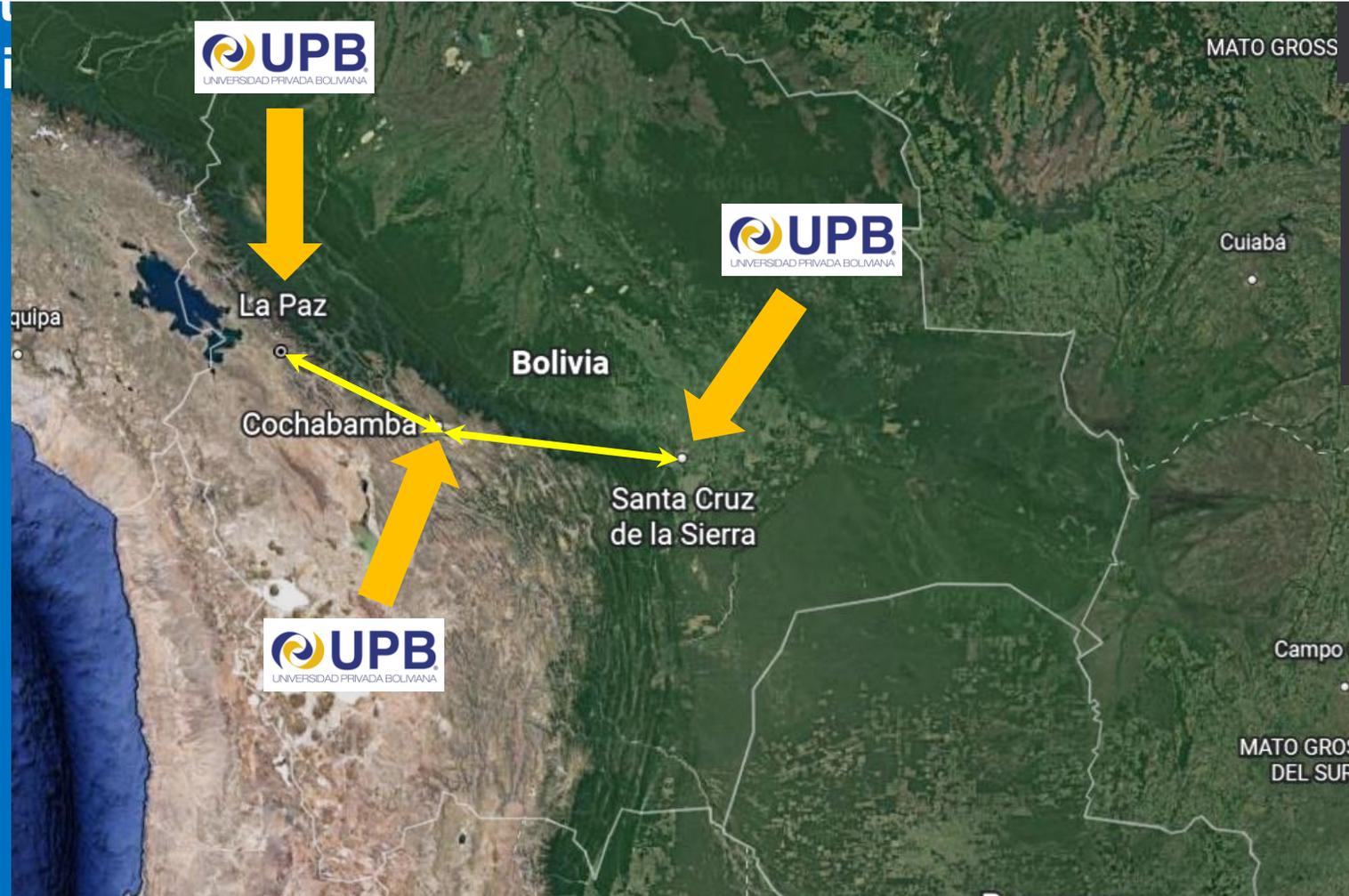
Sp



Number of students	Location	Report successfully
9	Cochabamba	Yes
3	La Paz	Yes
1	Santa Cruz	Yes



Implementat
in real condi



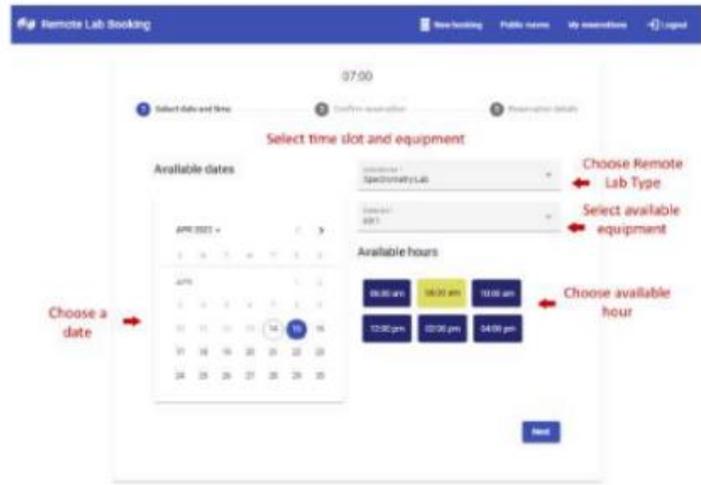


Figura 35. Interacción con la interfaz del laboratorio de espectrometría remoto

Primeramente, se procedió a realizar la calibración del equipo usando la lámpara de Neón; conjuntamente, se hizo el moviendo el protoboard remotamente cambiando la posición del LED RGB. Este proceso fue bastante sencillo simplemente por medio de la interacción del usuario con los diferentes botones y herramientas de fácil uso y manejo.

Luego, utilizando los botones de la página web, se encendió el led rojo, el azul y el verde, respectivamente. En dicho paso, para la medición de la longitud de onda de cada led, se dejó únicamente encendido el led de neón conjuntamente con el led a ser evaluado. Esto quiere decir que se realizó una evaluación individual de cada led.

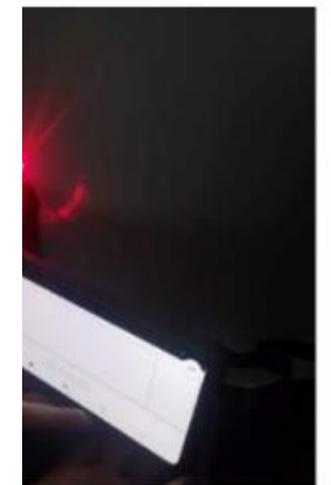
De este modo, al iniciar con las mediciones del led rojo se obtuvieron los siguientes datos.



Figura 37. Longitud del Led Azul (Laboratorio remoto de espectrometría)



Figura 38. Longitud del Led Verde (Laboratorio remoto de espectrometría)



del espectro de un láser rojo

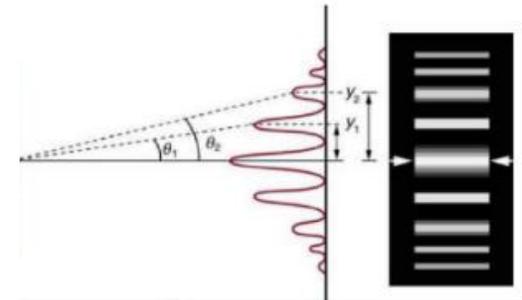


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aperturas en el rango de 10 a 100 μm producen
difracción de fácil resolución.

lugar de una sola rendija, dos rendijas están
por un frente de onda plano, una serie de franjas
encia paralelas a las rendijas aparecerán en una
jana, como se muestra en la imagen a
n.



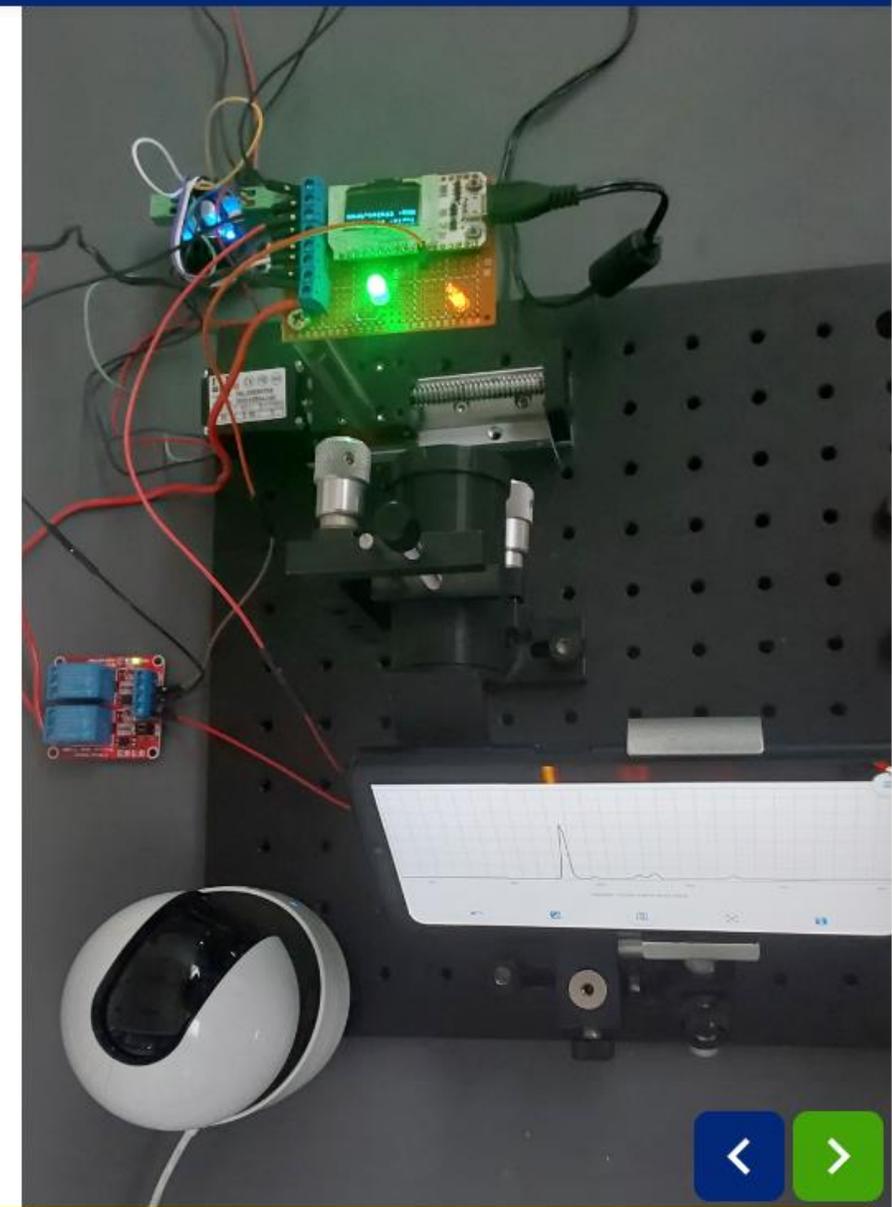
Learnify module Spectrometry

Activity 1: Introduction

Dear Learner [welcome](#),

The Spectrometry Remote Laboratory at Universidad Privada Boliviana (UPB), offers the ability to engineering students and teachers to remotely conduct experiments with **xx** equipment and under real **xx** conditions, from anywhere on the planet, helping the student to become capable of putting the theory into practice. **Also, a web camera provides a live view of the experimentation setup.**

The following activities, which include reading some chapters, some questions and a video, will help significantly in conducting and understanding the experiment that will follow. The video gives detailed instructions for operating the **booking system in order to choose the kit and the time for operation. Also the video gives the instructions for control the laboratory remotely by watching it, it will be very easy to start the experiment, while the knowledge from the suggested chapters will help to fully understand the subject of the experimental exercise. It is worth mentioning that the video gives instructions only to learn how to operate the remote lab and nothing else. The knowledge will be acquired from the conduct of the experiment, after having read of course before, the respective suggested chapters. The prerequisite theoretical knowledge is briefly mentioned in the "Synopsis" file (Activity 2). It is strongly recommended that you start by reading this file to determine if you need to read the suggested chapters. This module should be considered absolutely necessary and can be described as something like a pillar for the next experimental exercises.**



Spectral data

Intensity [a. u.]

Wavelength [Å]

Selected data:

Wavelength [Å]	Intensity [a. u.]
0	0

06-02-2022 Thu 04:06:02

Experiment view

Light source control

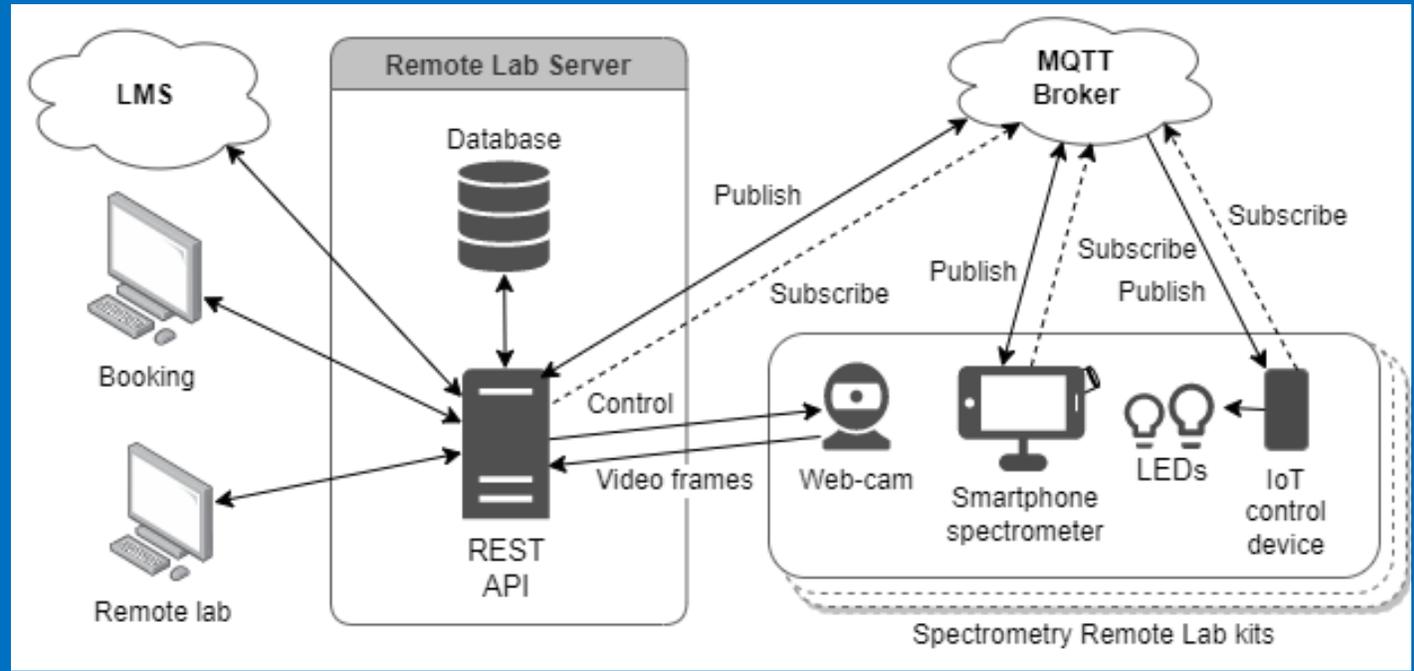
Red Green Blue Neon

Actuator control

Camera controller

DEMO

Architecture of the Remote Laboratory & Booking System



Tuesday 14	WORKSHOP 2.2	
Time in CET	University	Remote Lab Name
16:00-16:10	Universidad Privada Boliviana, Bolivia	Spectroscopy Remote Lab Booking System



THANK YOU

Q&A

Contact: avillazon@upb.edu
<http://eubbc-digital.upb.edu/>

SPECTRA UPB 

Software for low-cost smartphone spectrometer