IOCAG 2022

The 1st International Online Conference on Agriculture: ADVANCES IN AGRICULTURAL SCIENCE AND TECHNOLOGY

Smart Farming: From Sensor to Artificial Intelligence

Basic integration of artificial intelligence of a plant experimentation chamber with LEDs and sensors through connection to the IoT with node-RED and securing access to data

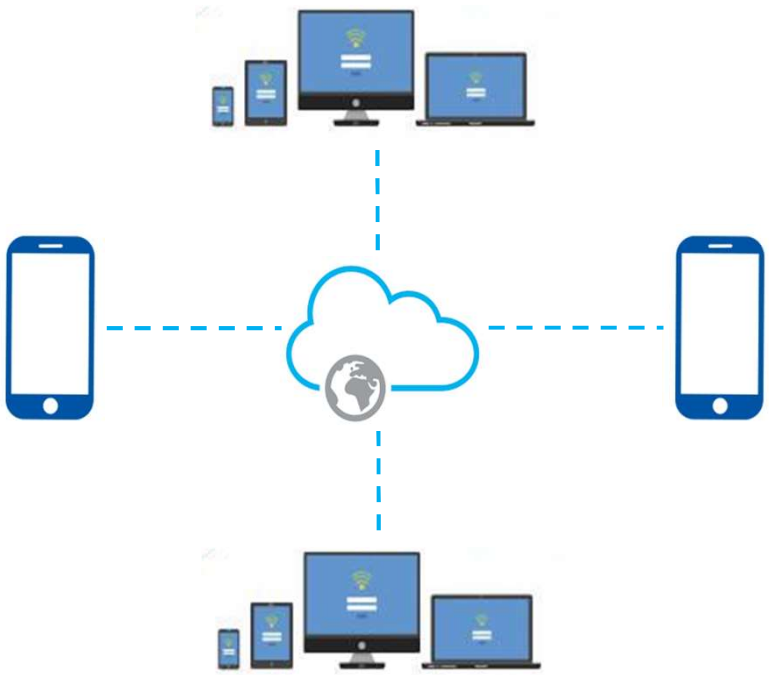
Authors :

Dr. Cristóbal Javier Solano Navarro (UPCT)
Dr. Gregorio Barba-Espín (CEBAS-CSIC)
Dr. Juan Suardíaz Muro (UPCT)
Dr. José Antonio Hernández Cortes (CEBAS-CSIC)

INTRODUCTION

Basic integration of artificial intelligence of a plant experimentation chamber ….

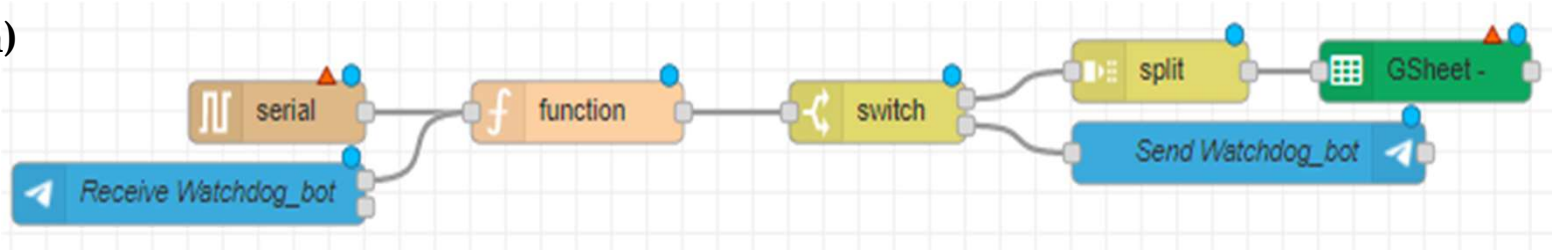
IoT : Internet of Things



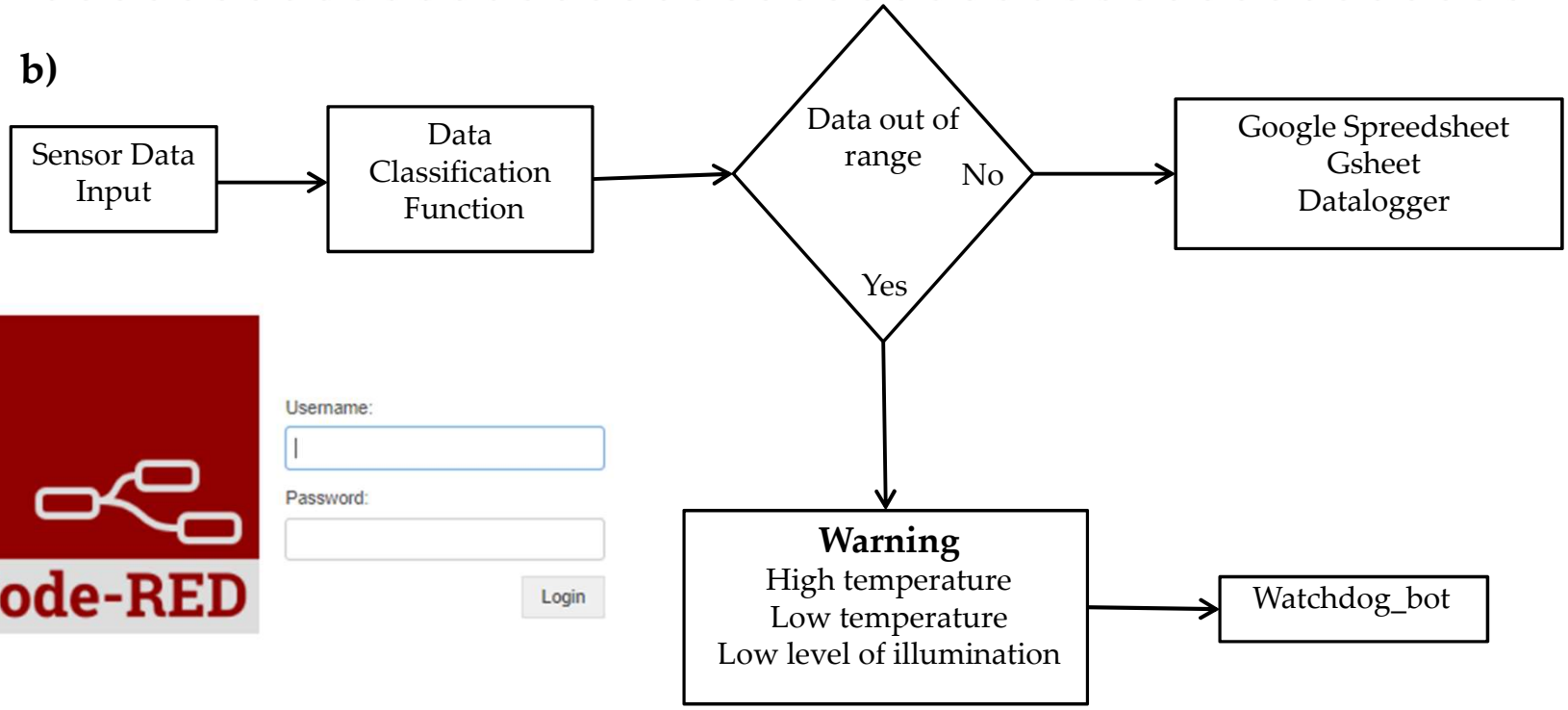
RESULTS

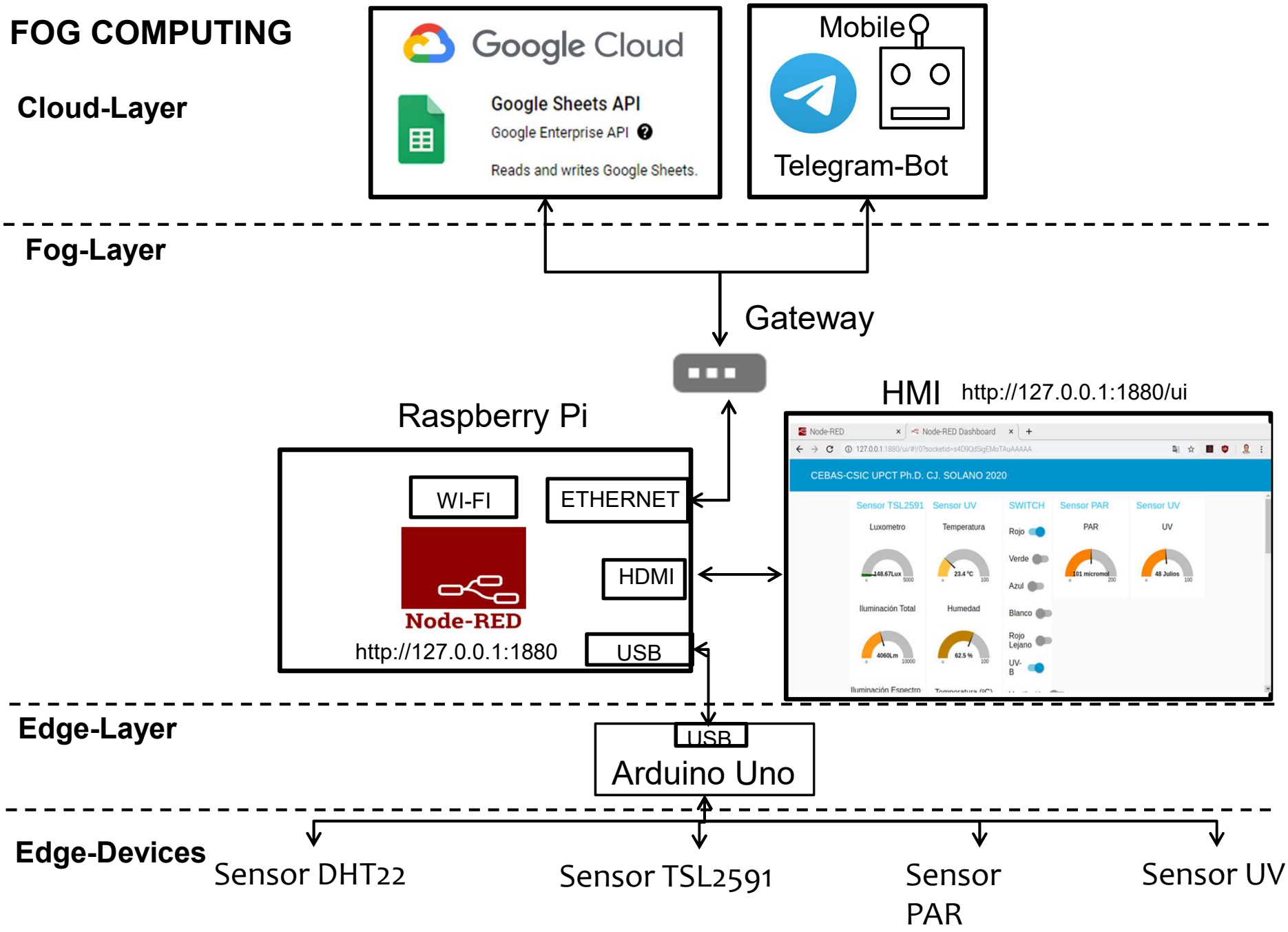
Node-RED

a)

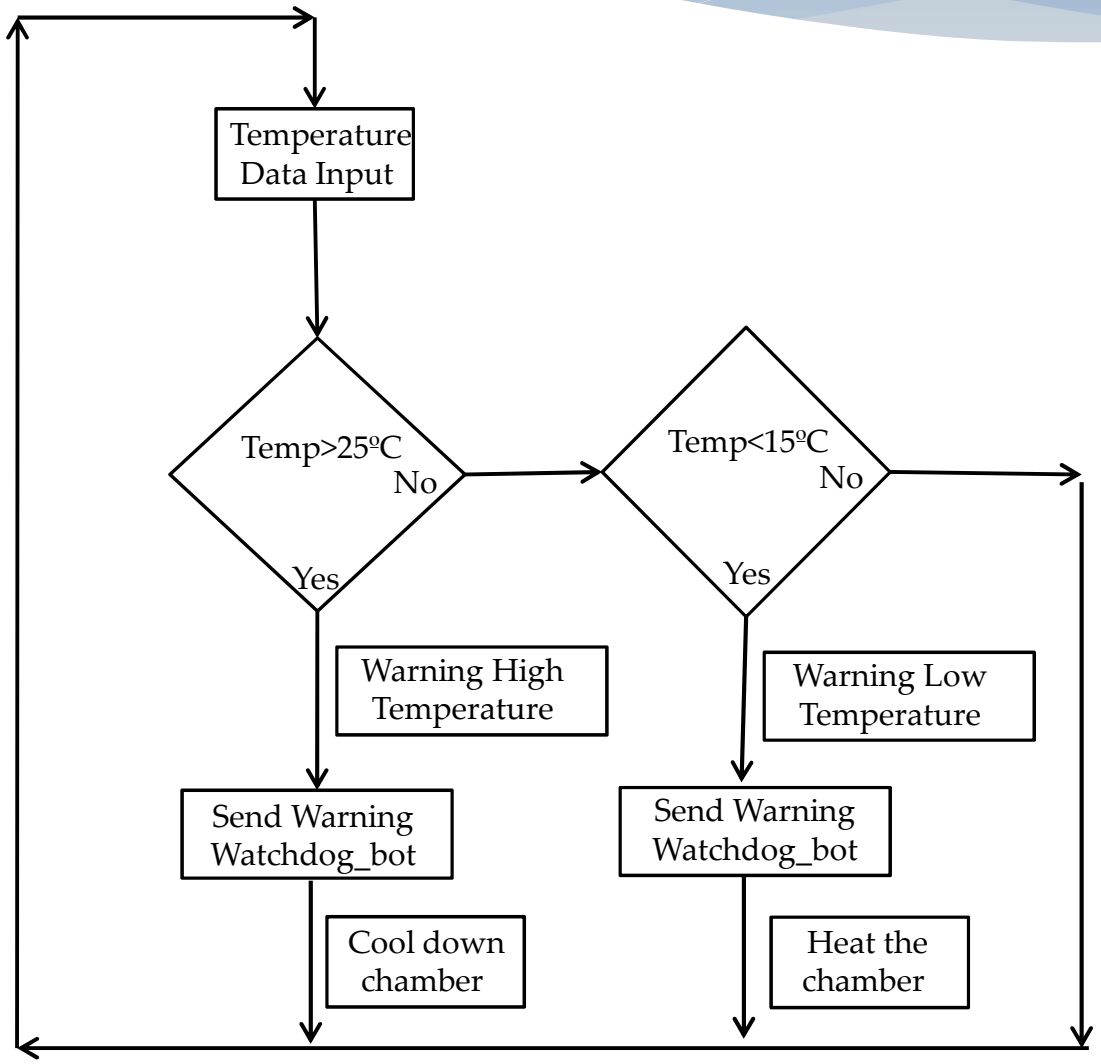

serial
function
switch
split
GSheet -
Receive Watchdog_bot
Send Watchdog_bot

b)


Sensor Data Input
Data Classification Function
Data out of range
No
Yes
Google Spreedsheet
Gsheet
Datalogger
Warning
High temperature
Low temperature
Low level of illumination
Watchdog_bot
Node-RED
Username:
Password:
Login


FOG COMPUTING
Cloud-Layer
Google Cloud
Google Sheets API
Google Enterprise API
Reads and writes Google Sheets.
Mobile
Telegram-Bot
Fog-Layer
Gateway
HMI
http://127.0.0.1:1880/ui
Raspberry Pi
WI-FI
ETHERNET
HDMI
USB
Node-RED
http://127.0.0.1:1880
CEBAS-CSIC UPCT Ph.D. CJ. SOLANO 2020
Edge-Layer
USB
Arduino Uno
Edge-Devices
Sensor DHT22
Sensor TSL2591
Sensor PAR
Sensor UV

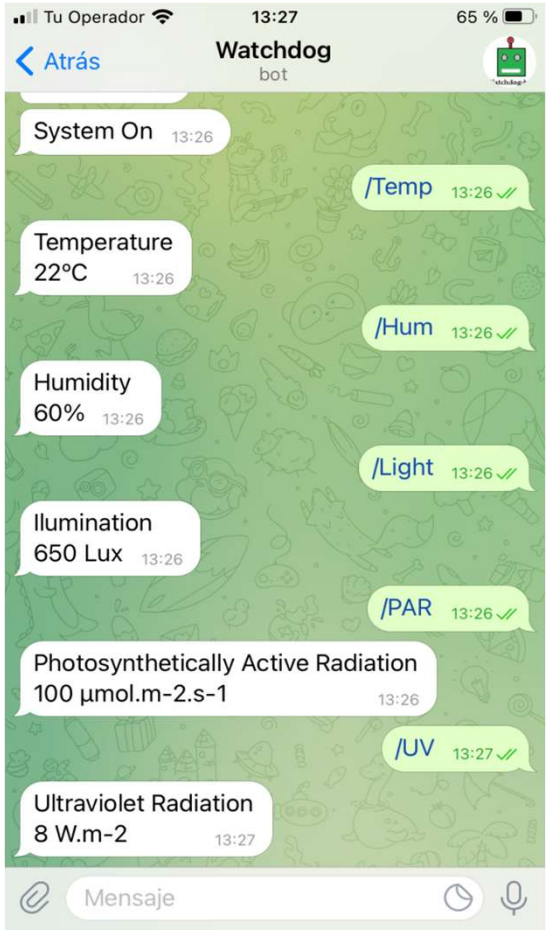
System flow diagram



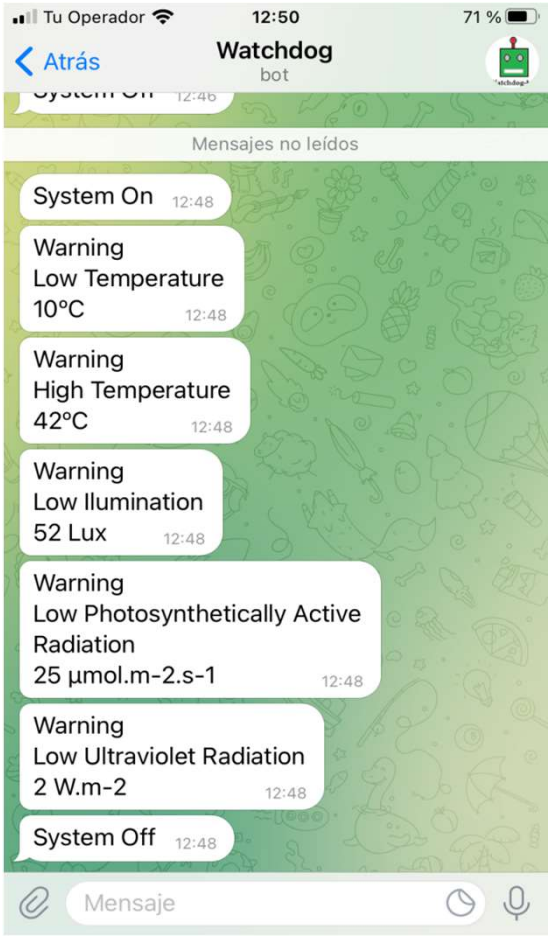
Basic integration of artificial intelligence of a plant experimentation chamber ….

Telegram

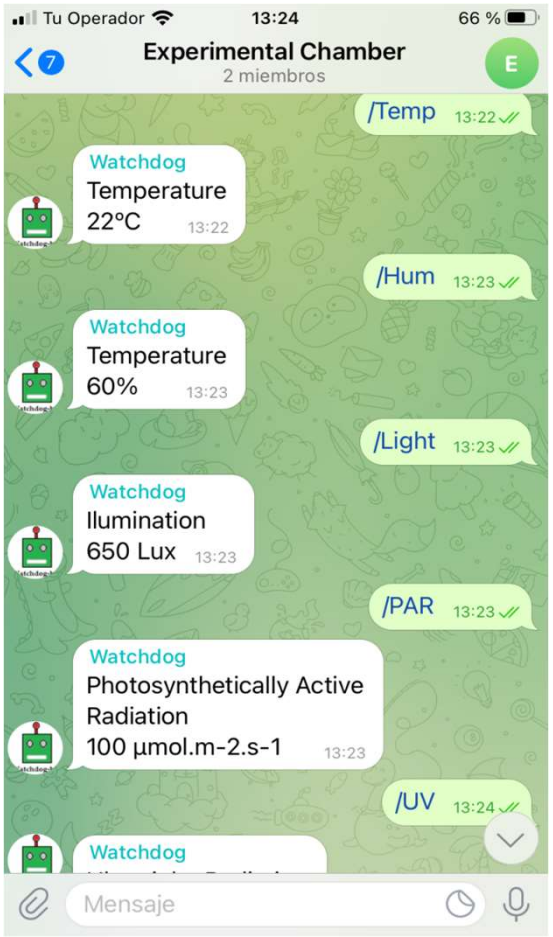
a)



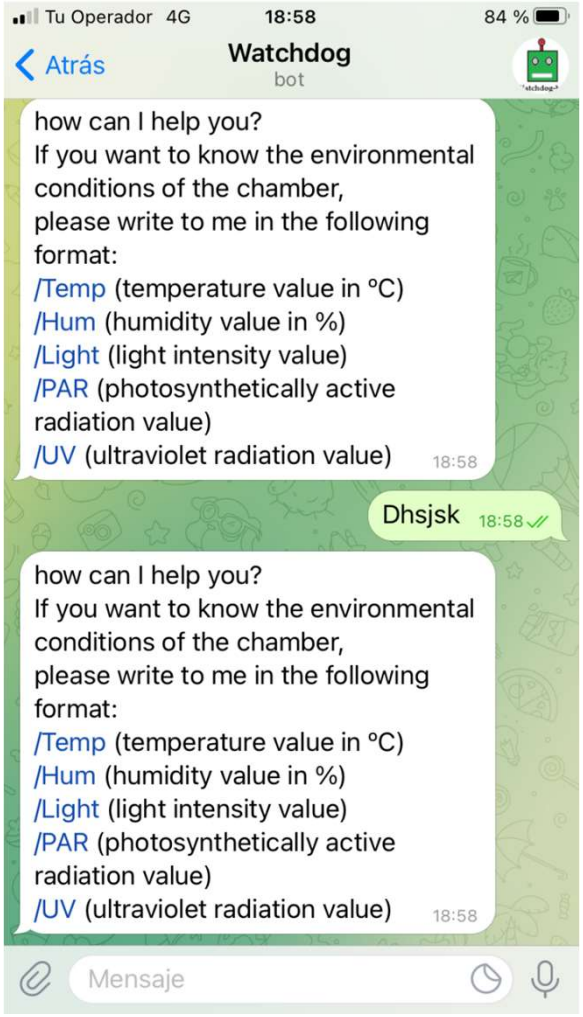
b)

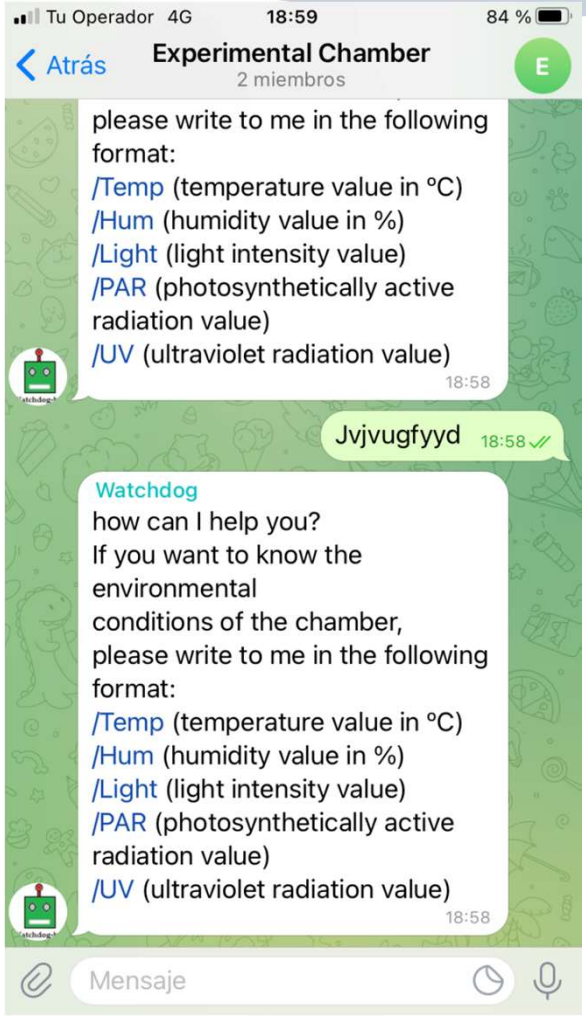


c)



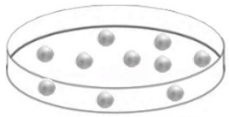
Basic integration of artificial intelligence of a plant experimentation chamber ….





Biological validation : pea seed treatment

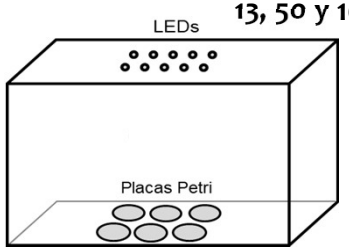
Preparation of plant material



Pea seeds(after 12h imbibition)

Treatment in the chamber

LEDs - Red
13, 50 y 100 µmol s^{-1} m^{-2}



Treatment times :
0', 5', 10', 15', 30', 60'

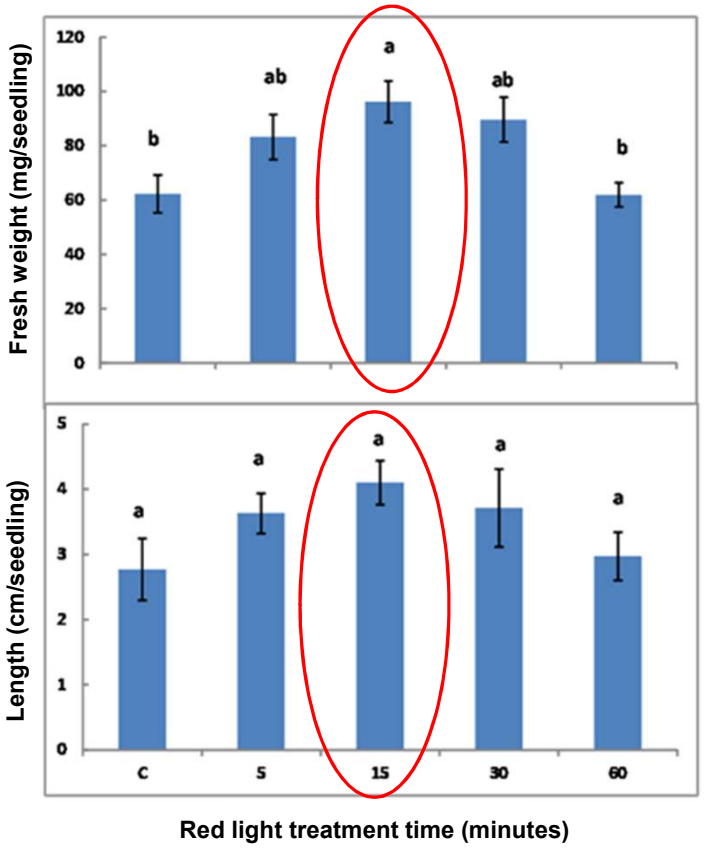
Incubation

25 °C, darkness

2 a 5 days

Sampling and analysis

Photo shooting
Fresh weight
Seedling length
Measure enzymatic activities



CONCLUSIONS

Conclusions

- **The proposed system has a low cost, low energy consumption, is compact and highly accurate to monitor the environment with the dedicated sensors remotely from anywhere in the world.**

- **A perfect balance between accuracy and cost is achieved through the use of free, cost-effective, and open source resources.**

- **Researchers are in an excellent position to take advantage of these tools to revolutionize plant science and improve reproducibility in experimentation with little impact on their budgets.**

IOCAG 2022

The 1st International Online Conference on Agriculture: ADVANCES IN AGRICULTURAL SCIENCE AND TECHNOLOGY

Smart Farming: From Sensor to Artificial Intelligence

Basic integration of artificial intelligence of a plant experimentation chamber with LEDs and sensors through connection to the IoT with node-RED and securing access to data

Acknowledgments:

Funded by Fundación Séneca (Project 21632/PDC/21)

Authors :

Dr. Cristóbal Javier Solano Navarro (UPCT)

Dr. Gregorio Barba-Espín (CEBAS-CSIC)

Dr. Juan Suardíaz Muro (UPCT)

Dr. José Antonio Hernández Cortes (CEBAS-CSIC)