

## Meteorological parameters monitoring system using free hardware and software with data storage and display on Nextion screen

### Sistema de monitoreo de parámetros meteorológicos utilizando hardware y software libre con almacenamiento de datos y visualización en pantalla Nextion

SALINAS-AVILES, Oscar Hilario<sup>1†\*</sup>, BELTRAN-ESCOBAR, Miguel<sup>2</sup>, SÁNCHEZ-LÓPEZ, Verónica<sup>1</sup> and AMADO-SÁNCHEZ, Beatriz<sup>1</sup>

*Universidad Tecnológica Emiliano Zapata del Estado de Morelos/ <sup>1</sup>Academic Division of Information Technologies and Design, <sup>2</sup>Academic Division of Mechanic Industrial*

ID 1<sup>st</sup> Author: *Oscar Hilario, Salinas-Aviles* / ORC ID: 0000-0002-1677-5287, CVU CONAHCYT ID: 35272

ID 1<sup>st</sup> Co-author: *Miguel, Beltran- Escobar* / ORC ID: 0000-0001-9687-0585. CVU CONAHCYT ID: 265509

ID 2<sup>do</sup> Co-author: *Verónica, Sánchez-López*

ID 3<sup>er</sup> Co-author: *Beatriz, Amado-Sánchez*

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#### Abstract

A portable station was designed and built to measure weather conditions using open-source hardware and software, aiming for versatility and low cost. Data acquisition and storage from climate variable measurements are carried out, allowing for interaction through a graphical interface built on an open-source software display. Additionally, there is access and control of the data using an Internet of Things platform that, like the HMI itself, enables real-time monitoring of variable measurements and storage of the monitored data. The designed station, being portable and having internet access, can serve as a support tool for monitoring weather conditions in a photovoltaic systems station, for example. This is highly useful because such conditions interfere with system performance, impacting the energy conversion process. This data collection and storage, for instance, allows for generating forecasts to determine the suitable energy generation type based on the installation location's conditions and foreseeing the potential impact of weather conditions.

**Environmental conditions, Internet of the things, Photovoltaic energy**

#### Resumen

Se diseñó y construyó una estación portátil para medir condiciones climáticas, utilizando hardware y software libre, para hacerla versátil y de bajo costo. Se realiza la adquisición y almacenamiento de los datos, provenientes de la medición de variables climáticas, con la versatilidad de permitir la interacción por medio de una interfaz gráfica construida en una pantalla de software libre. Adicionalmente se cuenta con un acceso y control de los datos utilizando una plataforma de Internet de las cosas que, tal como la misma HMI, permite el monitoreo de las mediciones de las variables en tiempo real, así como el almacenamiento de los datos monitoreados. La estación diseñada, al ser portátil y tener acceso a Internet, puede funcionar como herramienta de apoyo para el monitoreo de las condiciones climáticas, en una estación de sistemas fotovoltaicos, por ejemplo; esto es muy útil debido a que tales condiciones interfieren en el desempeño de los sistemas, impactando en el proceso de conversión de energía. Esta recolección y almacenamiento de datos, permite, por ejemplo, generar pronósticos para conocer qué tipo de generación de energía se adecua a las condiciones del lugar a instalar, así como prever el impacto que se pueden generar las condiciones climáticas.

**Condiciones climáticas, Internet de las cosas, Energía fotovoltaica**

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\* Correspondence to the author (e-mail: oscarsalinas@utez.edu.mx)

† Researcher contributing as first author.

**Introduction**

In times of climate change, or the increase of the planet's temperature, it is important and relevant to monitor weather conditions, not only as a hobby, but as a matter of social responsibility. The increase in the amount of work done in the field of the Internet of Things is due to the availability of the tools to do so; however, this does not mean that it is simple, but it is viable and feasible because it allows or motivates the socialization of knowledge. The use of renewable or "clean" energies is therefore necessary to replace the use of fossil fuels, which employ processes that contribute to high greenhouse gas emissions, contributing to the increase in global temperature. Climatic conditions are important, both for selecting the type of renewable energy to use, as well as for monitoring the conditions, because they impact the performance of power generation.



Figure 3 Parameters displayed on NEXTION screen.



Figura 3.16 Dashboard de Ubidots

Figure 4 Working whiteboard in ubidots

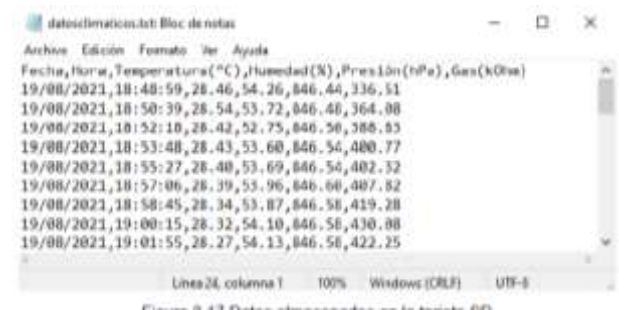


Figure 5 Data stored on micro SD

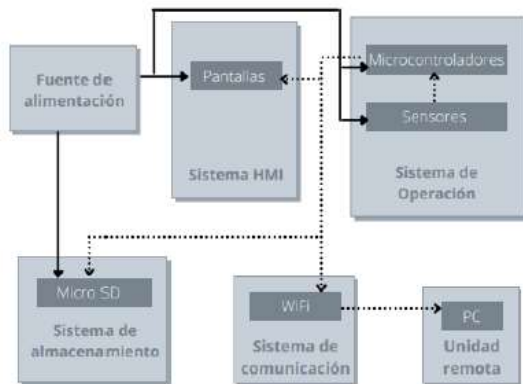


Figure 1 Proposed system architecture.

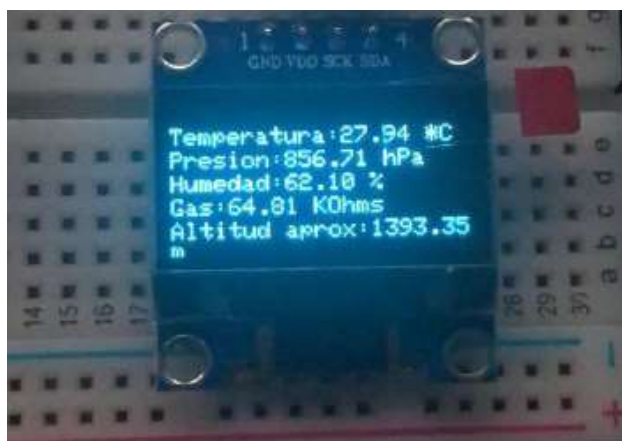


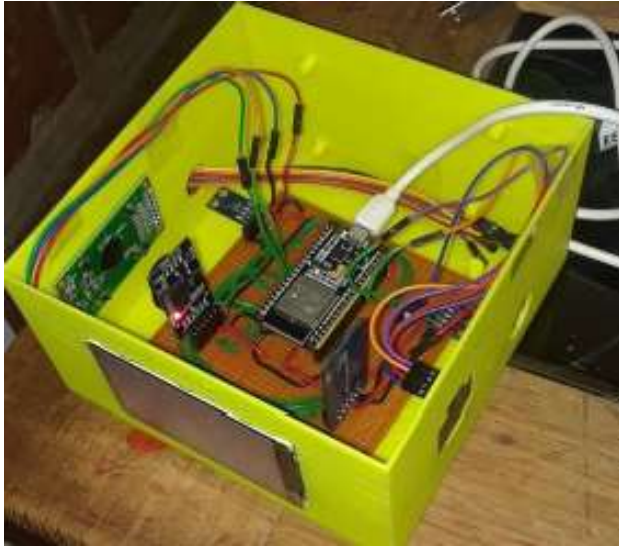
Figure 2 Parameters displayed on OLED screen



Figure 6 Message on OLED display.

## Results

The portable station was completely built, with connection to the Internet through the use of a low-cost electronic card called ESP32, Figure 5.



**Figure 5** Low-cost portable station.

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## Conclusions

The performance of the weather data acquisition station was successfully tested.

It is feasible to build low-cost monitoring tools with open source hardware and software.