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Abstract

As the world population grows, there is an urgent need to increase food production on a global scale. According to FAO projections, the world population is estimated to increase by 1.15 billion people, reaching around 9.15 billion by the year 2050. Given this scenario, the search for technologies that promote food security, productive increases and results in low environmental impact becomes essential. To achieve this objective, this work aims to implement computing and climate telemetry techniques to collect data that contribute to the planning and management of agricultural crops. To execute the proposal, it was necessary to structure a maintainable, resilient and scalable architecture, subdivided into 4 steps: (1) Data telemetry includes the collection of air humidity and temperature, estimated using a DHT11 sensor, humidity and temperature soil, estimated by the SHT 20 sensor, and rainfall, determined using a tilting rain gauge made with a 3D printer. This data is processed by an ESP32-LoRa module, responsible for sending it to the data processing center (CTD) via wireless communication. (2) Nicknamed "UAI.py", the CTD is a device granted by the Federal Revenue of Brazil that was modified and recycled for use in the project. This device performs "data orchestration", being responsible for receiving, ordering and sending data obtained by IOT devices and their respective sensors, to the back-end execution environment. (3) Upon arriving at the backend, hosted on a remote server, the data is processed, validated, and persisted in a Postgres database, respecting the authenticity of the request and the chronological order in which the data was generated by the devices UAI.py . After this process, all data is accessible through secure routes exposed by the HTTP protocol, and can be consumed by web clients, such as a user interface or machine learning algorithms. (4) However, in order to visualize and analyze stored data in a clear and accessible way, the user interface or "front-end", is the direct interaction between the back-end execution system and the end consumer of the technology, the farmer. (End of steps). The sensors selected and/or manufactured for the project demonstrated the ability to accurately extract climate information, allowing the estimation of crucial parameters for the management of rural properties. The option for 3D modeling and printing proved to be promising in the contexts analyzed, given the growing popularity of this technique and its ability to continuously adapt the model according to the needs of the environment of use. UAI.py has demonstrated effectiveness in orchestrating the collected data, efficiently managing multiple data sets from diverse data sources. Furthermore, when dealing with running a system to maintain data resilience, the developed ecosystem proved to be extremely useful in environments with unstable network connections, a common reality in most rural properties in Brazil. Based on the health indicators of the back-end execution environment, the developed remote server was able to achieve availability rates close to 100% and an average response time of less than 500 milliseconds. Furthermore, the creation of integration tests and unit tests proved to be efficient in ensuring the correct functioning of the application, regardless of the changed code, being a fundamental part of the continuous integration flow. Finally, as a result, the data processed and made available in the user interface, after validation, proved capable of acting in aid of rural management, considering the calculation of evapotranspiration using the Hargreaves method, in addition to highlighting local climatic conditions, allowing the identification of ideal windows for carrying out phytosanitary management.

Keywords (at least three)	Agrometeorology; Internet of Things; Data Science; Distributed Systems; Cloud Computing; Waste of Water; Sustainability; User Experience;

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