Revitalizing Solar Insights: A Dashboard for West Tennessee Solar Farm

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ABSTRACT

This project we constructed aims to be an interactive dashboard for displaying solar irradiance data collected at a photovoltaic power station. Given a recent push by the University of Tennessee Research Foundation toward revitalizing its use, the West Tennessee Solar Farm will serve as a template. This location is of particular interest due to its proximity to Blue Oval City (the site of the new Ford manufacturing plant, near Stanton, TN). With the farm's existing dashboard being non-functional, there is a demand for a solution, which we will achieve through MySQL, Python, Google Drive API, R-Shiny, Shinyapps.io, and Google Cloud Console. MySQL serves as our data hub, efficiently organizing solar energy data by sensor location. Python, coupled with the Google Drive API, simulates real-time data collection.

The core of the project is an R-Shiny dashboard offering real-time data visualization, interactive maps, detailed sensor information, and access to historical data and analysis. Users can select their desired time frames. Shinyapps.io hosts the dashboard, ensuring accessibility across diverse platforms, such as web browsers and various operating systems. This approach allows users from all major operating systems to access the dashboard, promoting widespread accessibility. To further fortify data security and enhance user convenience, Google Cloud Console safeguards our API information. Our dashboard incorporates an export function, enabling users to extract data. In addition, we constructed an easy-to-use webpage that is accessible across various major operating systems. This approach ensures that our project is widely available and caters to a diverse audience; thus, making valuable solar irradiance data easily accessible to all. This project aims to provide researchers, policymakers, and the public with real-time insights into solar irradiance data at the West Tennessee Solar Farm, supporting sustainable energy solutions.

1. INTRODUCTION

In the pursuit of sustainable energy solutions, our project ventures to unlock the vast potential of solar irradiance data. Our focus is on the West Tennessee Solar Farm, situated near Stanton, TN. Its strategic proximity to Blue Oval City adds notable importance. The critical challenge we address is the current, non-functional existing dashboard for the solar farm, which has left vital solar irradiance data inaccessible for potential users. The West Tennessee Solar Farm offers the potential for abundant clean energy, but its potential remains unrealized in part due to the limitations of the existing dashboard. In this project, we aspire to bridge this data accessibility gap while opening up opportunities to inform and educate the general public about the farm's renewable energy potential.

In response to this need, our project emerges as a symbol of innovation and accessibility, seamlessly integrating an array of cutting-edge technologies. With MySQL as our data hub, we thoroughly organize solar energy data by sensor location. Python, in collaboration with the Google Drive API, takes on the role of capturing and decoding real-time data with unwavering precision. However, the importance of our project lies in R-Shiny dashboard, an interactive interface that goes beyond the typical data visualization. It not only brings solar irradiance data to life in real-time but also empowers users with interactive maps, intricate sensor insights, information that is relatable to the lay-person, and a comprehensive historical archive.

2. TECHNOLOGIES USED

The integrated project described is designed to collect, manage, and visualize real-time sensor data from a solar farm. MySQL is used to store and manage the sensor data, which includes various parameters such as solar irradiance levels from ten different sensors. This data is then retrieved by a Python program, which periodically updates a CSV file stored in Google Drive. This CSV file acts as a remote server, securing the data and making it accessible to both Python and R for analysis and visualization. The R-Shiny web application serves as the core of the project, offering a user-friendly and responsive dashboard for real-time data visualization. It includes interactive maps with clickable sensor markers, providing detailed information and enabling users to explore daily, weekly, and monthly trends in solar irradiance. The dashboard also facilitates historical data analysis and export options while being hosted on shinyapps.io for universal accessibility. The Google Cloud Console stores API information for data security, ensuring the integrity and privacy of the sensor data throughout the entire system.

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