شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

HANAA ALY

BUILDING ROOFTOPS EXTRACTION FROM SATELLITE IMAGES USING MACHINE LEARNING ALGORITHMS FOR SOLAR PHOTOVOLTAIC POTENTIAL ESTIMATION

By

Eslam Mustafa Mahmoud Muhammed

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Civil Engineering – Public Works

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

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FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Examiners:

Prof. Dr. Adel El-Shazly (Thesis main advisor)
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Prof. Dr. Ahmed Amin (External examiner)

Title of Thesis:

Building Rooftops Extraction from Satellite Images Using Machine Learning Algorithms for Solar Photovoltaic Potential Estimation

Key Words:

Rooftops extraction; Machine learning; Image processing; Solar PV potential; Green energy

Summary:

This research involves the extraction of buildings from satellite images to be used for solar PV potential estimation. Pre-processing algorithms were used to enhance the image of a city in Cairo, Egypt called Madinaty. Then, two machine learning techniques were used to extract the buildings' rooftops. SVM exceeded Naïve Bayes in terms of the detection accuracy with an F1 score of 94.7%. The detected gross areas of the rooftops were used in the second phase of this thesis, which is the PV potential estimation of PV panels mounted over the detected rooftops. Three methods were used for the solar modeling of the study area which are PVWatts calculator, PVGIS, and ArcGIS. The estimated PV potentials were calculated to be 21, 24.9, and 22.3 GWh/year for the three methods respectively. CO2 was reduced by an average of 62% after using solar panels instead of depending on traditional energy sources.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Eslam Mustafa Mahmoud Date: …/…/2021

Signature:

Acknowledgments

I’d like to acknowledge my supervisors **Prof. Dr. Adel El Shazly** and **Dr. Salem Morsy** for their efforts as I would not have been able to complete this work without their continuous patience, advices, and directions. Also, I’d like to thank my family for their continuous support especially my brother **Bassam Mustafa** who offered limitless valuable suggestions throughout my work.

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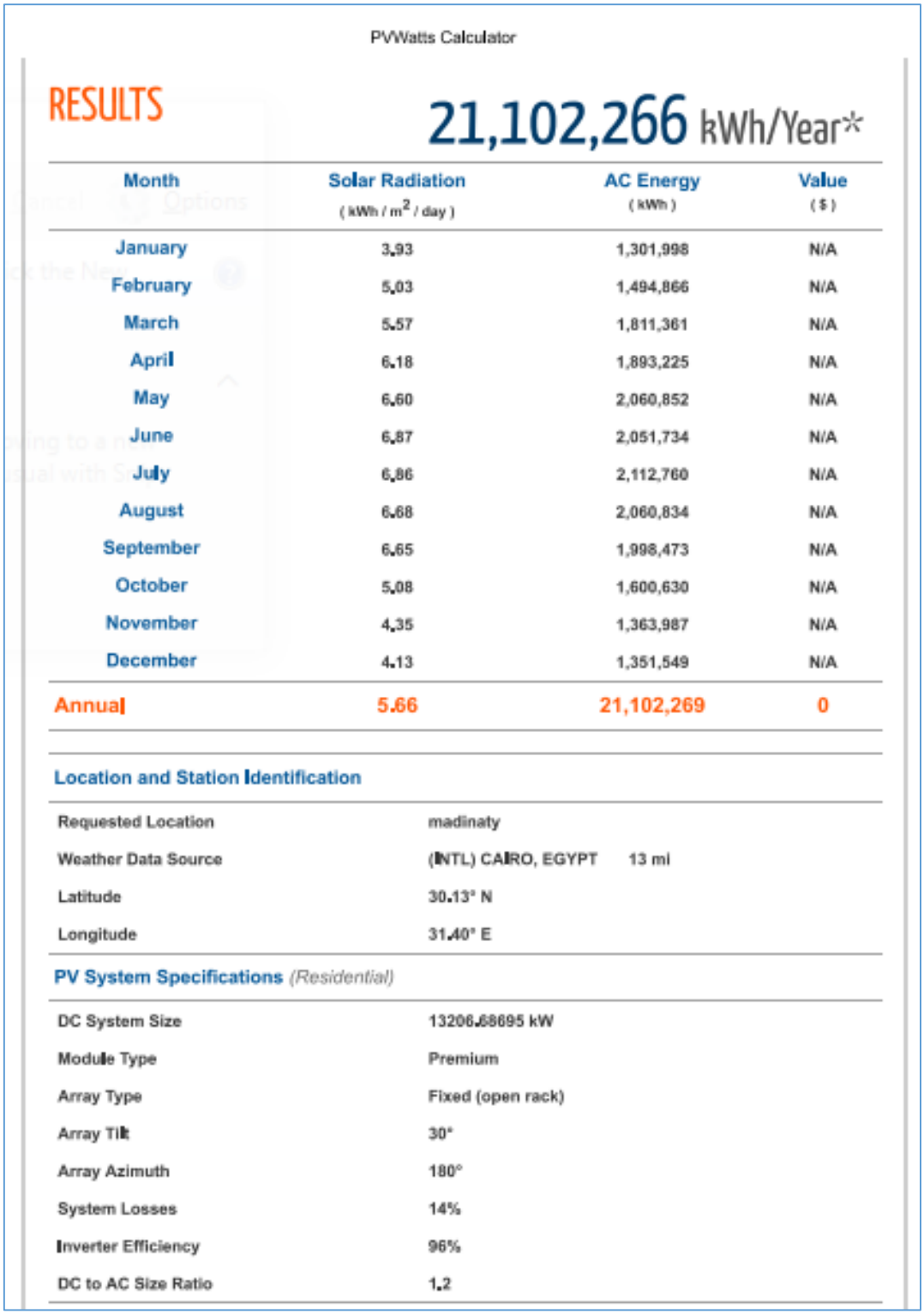

PVWatts Calculator

RESULTS

21,102,266 kWh/Year*

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Value ($)
January	3.93	1,301,998	N/A
February	5.03	1,494,866	N/A
March	5.57	1,811,361	N/A
April	6.18	1,893,225	N/A
May	6.60	2,060,852	N/A
June	6.87	2,051,734	N/A
July	6.86	2,112,760	N/A
August	6.68	2,060,834	N/A
September	6.65	1,998,473	N/A
October	5.08	1,600,630	N/A
November	4.35	1,363,987	N/A
December	4.13	1,351,549	N/A
Annual	5.66	21,102,269	0

Location and Station Identification

Requested Location	madinaty	
Weather Data Source	(INTL) CAIRO, EGYPT	13 mi
Latitude	30.13° N	
Longitude	31.40° E	

PV System Specifications *(Residential)*

DC System Size	13206.68695 kW
Module Type	Premium
Array Type	Fixed (open rack)
Array Tilt	30°
Array Azimuth	180°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.2

List of Tables