Review of Solar Photovoltaic Android-Based Applications for Smartphone and Tablet

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***Abstract*—Simulation techniques are commonly conducted in designing a solar system prior to building the real installation. Nowadays, there are various software tools that are available both online and offline based, either using desktop or smartphone hardware. This work reviews five photovoltaics (PV) applications Android-based software for smartphones and tablets. The features and advantages of the reviewed application are discussed. Simulations were carried out to compare the results. It was found different small results among the applications. However, the deviation was about 0.21 with accuracy of about 95%, means that the results from all the applications are relatively similar.**

Keywords—photovoltaic, android, smartphone, tablet, application

I. INTRODUCTION

Energy supply and demand have been one of the most important issues recently. Since the 19 century, the world has been using mainly fossil-based fuels as the energy source, such as oil, natural gas, and coals [1, 2]. However, limitations of fossil fuels are their availability is limited, besides the negative environmental impact of burning them [3, 4].

Energy from the sun in the form of photon (radiation) is the natural energy source. The solar radiation is renewable, clean, and readily available for everyone. Solar radiation can be converted into electricity using devices called solar cells or photovoltaic (PV). Several small solar cells are connected either parallel or series to create a PV panel that could produce large power or energy [5]. Further PV panels can be connected in series or parallel with each other to build a PV system with a specific capacity.

The energy from the sun is continuously and abundantly reaches the earth. However, every geographical position has different potential and characteristics of solar energy. Moreover, the amounts of energy produced by a PV system are affected by the radiance, the temperature, the angle of the panel surface, and shading [6]. Before constructing a real PV system, the simulation techniques are usually carried out to estimate out energy, the cost, technical, as well as environmental impacts [7 – 9]. There are many simulation tools had been proposed either online or online-based, which makes it easy for the user to simulate a PV system. Among the PV system simulation tools are Android-based applications for smartphones and tablets. The problem is the user needs to make sure which applications should be used to obtain the most appropriate results. Several recent works in the literature were found in the topic of simulation of energy [7 - 11] energy, however, all of which were using desktop or laptop computers. There was no comparison of android based simulation tools had been found.

The objective of the present work in this paper is to provide the users the information about the features of several PV systems android-based applications, all at once to promote renewable energy for sustainability. This work reviews the features of several different PV system applications for smartphones and tablets, which are available in Google Play Store [12], and built-in based Android operating system. Most of the apps also available on other operating system bases such as iOS. However, for the work's implications, the android based system was chosen in this review.

II. METHODS

The PV applications for mobile and tablet are searched and selected through Gooogle Play Store The selected applications are then reviewed and discussed. The following five applications are reviewed in this paper:

- Solarpe Pro[13]
- SolarMeter [14]
- My Solar Panel [15]
- Solar Calc [16]
- SolarCT [17]

A simple simulation is carried out to compare the results. The site or location for the simulation is Surabaya City. The given input parameters for the simulation test for each application are similar, as shown in Table I. This is to ensure the results are comparable.

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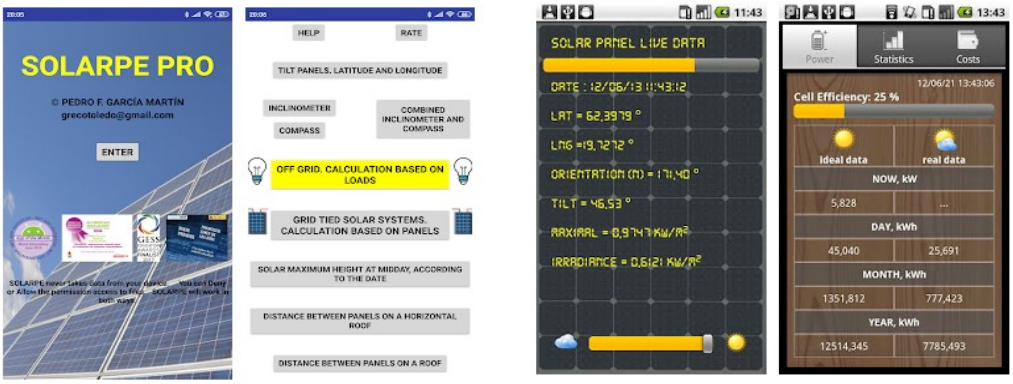
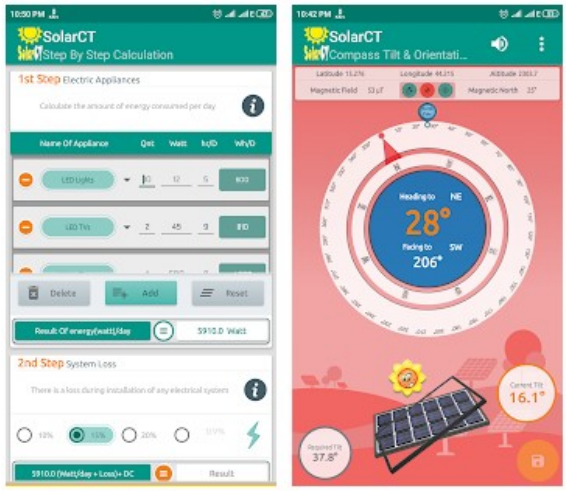


(a) (b)

(c) (d)



(e)

Fig 1. Mobile applications screenshot view: Solarpe Pro (a); SolarMeter (b); My Solar Panel (c); Solar Calc (d); SolarCT (e)

The simulation results were then compared to identify the deviation and accuracy.

TABLE I. INPUT PARAMETERS FOR SIMULATION

Specifications	Unit/Explanation
Location Astronomical location	Surabaya City, Indonesia Lat. -7.342; LNG 112.804
System type	On-grid/Grid-connected PV system
Solar module type	Monocrystalline
PV system capacity	1000 Wp
Module orientation	Fixed position facing north (180°)
Module inclination	20°

III. RESULTS AND DISCUSSION

A. Solarpe Pro Application

Solarpe Pro is offered by SOLAR SOFT Spain, released on August 27, 2019. Solare Pro can be used as a guide for the design and installation of PV Systems either on grid and off-grid systems.

The screen view of Solarpe Pro is shown in Fig. 1 (a). The application allows the user to perform the following functions [13]:

- connecting with NASA database for know to check parameters of the installation place,
- knowing the tilt of the panels for more efficient use of the system,
- measuring the tilt,
- orienting the panels according to the optimum orientation,
- calculating the distance between panels to avoid shadows,
- calculating the maximum solar height depending on the day of the year,
- calculating all components´parameters based on the loads and days of autonomy, for off-grid systems, and,
- calculating all components´parameters based on panels, for an on-grid system

B. Solar Meter

SolarMeter is Android application provided by Vistech. The application can be used the tool to analyze PV system. It allows the user to calculate, estimate and visualize PV system output at a specific location using a phone or tablet. The application helps users to check the solar potential of the roof, how much solar power you are getting at a certain location throughout the year. In addition, it can estimate how much energy a PV system is able to produce per month. The screen view of the application is shown in Fig. 1 (b). Some important feature of SolarMeter are[14]:

- automatic current location search using GPS and network,
- real-time PV system calculation based on the current location, panel orientation, and panel tilt,
- PV system power and energy calculation for the daily, monthly, yearly period,
- providing calculated and experimental statistical solar data,
- sensor-based inputs for orientation and tilt,
- plot 2D graph and data presentation,
- controlling solar panel efficiency,
- estimation of bill and caving based on user input,

C. My Solar Panel

My Solar Panel Android application is managed by NRG Labs [15]. The application enables the users to get the best performance results for any desired location and configuration of PV system. It provides users the flexibility for designing your PV panels, solar power inverter and all other PV equipment. The users can make configuration according to their needs and set their PV system on any desired location on the map. The screen view of the application is shown in Fig. 1 (b).

The main important features of the application are:

- solar PV Simulator model with real-time data for electricity generation.
- shading modeling for calculation of self-shading losses between strings.
- tool for calculating the number of panels needed for a PV system with specific characteristics of the panels.
- it provides a number of parameters, including monthly irradiance, optimal tilt angle, monthly and daily optimal tilt angles, optimal orientation, annual electricity generation, monthly electricity generation, the total area of all panels, number of panels needed, total land area, the payback period in years, capacity factor, energy degradation in 25-years period, avoided CO2 emissions, levelized cost of electricity, energy yield, optimization module with comparison option, shading module for calculation, and real-time Solar PV Simulator for electricity generation [15].

D. Solar Calc

Solar Calc Android application is developed by eSolaronic. This application can be used to calculate the Solar PV system and Electrical related calculations. The main features of the application are [16]:

- solar PV calculations, including PV cell efficiency and output, Plant performance ratio and power generation,
- PV array shadow calculations, including obstruction object, and PV array row spacing,
- off-grid load calculations, including the number of batteries, total system load, number of backup hours, and system battery voltage,
- PV water pumping calculations,
- solar voltage drop calculations,
- voltage drop calculations,
- cable cross-section calculations,
- busbar flat strip calculations, and,
- the calculation for inverter, transformer, transformer fault level, and earthing conductor cross-section

The screen view of the Solar Calc application is shown in Fig.1(d)

E. SolarCT

SolarCT Android application is developed by a developer named M.N.N. The application can be used to calculate the requirements of PV systems. The main features of the application are [17] :

- step by step way to calculate the requirements of the PV system,
- solar radiation and cumulative production of panels,
- running hours of battery,
- calculating appliance consumption,
- determining the orient and tilt solar panels,
- reminder for the next tilt of solar panels,
- connection in series and parallel of the battery and solar panels, and
- calculating of wires gauge AWG, mm² and SWG & drop voltage.

Fig. 1 (e) shows the screen view of the SolarCT application

F. Comparison of Simulation Results

Simulations were run for each application with similar parameters, location, and condition, as mentioned in Table 1. The PV system with 1000 Wp module capacity is simulated to find the energy output for one year. The results of the simulation are presented in Table II.

The simulation result shows that PV system energy output by different software applications varies from 1440 kWh per year to 1650 kWh/year. It is obviously seen that there are different results; however, statistically, the standard deviation from the five software was found about 0.21 with the accuracy of about 95%. This means that the result of the simulation relatively similar. Therefore, users may use any of the five reviewed applications to estimate their PV system design.

TABLE II. SIMULATION RESULTS FROM FIVE DIFFERENT PV SYSTEM ANDROID-BASED APPLICATIONS

Android App	1000 Wp PV system energy output	
	Annual	Daily Average
Solarpe Pro	1569 kWh	4.36 kWh
SolarMeter	1650 kWh	4.58 kWh
My Solar Panel	1447 kWh	4.02 kWh
Solar Calc	1440 kWh	4.00 kWh
SolarCT	1470 kWh	4.08 kWh

VI. CONCLUSIONS AND RECOMMENDATIONS

The five Android-based PV system applications: Solarpe Pro, SolarMeter, My Solar Panel,Solar Calc, and SolarCT have been reviewed. The simulation result shows that PV system energy output by the software applications varies from 1440 kWh per year to 1650 kWh/year. However, statistically proved that the difference is relatively small. Therefore, users may use any of the five reviewed applications to estimate their PV design. It is recommended that the user tried to take advantage of the available features of the applications to optimize the PV design prior to installing the real system.

REFERENCES

[1] S. O. Alba and M. Manana, "Energy research in airports: A review," Energies, vol. 9, no. 5, 2016.

[2] P. Bertheau, "Supplying not electrified islands with 100% renewable energy based micro grids: A geospatial and techno-economic analysis for the Philippines," Energy, vol. 202, p. 117670, Jul. 2020.

[3] M. W. Zafar, M. Shahbaz, A. Sinha, T. Sengupta, and Q. Qin, "How renewable energy consumption contribute to environmental quality? The role of education in OECD countries," J. Clean. Prod., vol. 268, p. 122149, Sep. 2020.

[4] K. Saidi and A. Omri, "The impact of renewable energy on carbon emissions and economic growth in 15 major renewable energy-consuming countries," Environ. Res., vol. 186, p. 109567, Jul. 2020.

[5] B. Kiriş, O. Bingöl, and M. H. B. Uçar, "Photovoltaic panel simulation using a mobile application," Acta Phys. Pol. A, vol. 132, no. 3, pp. 922–925, 2017.

[6] M. M. Rahman, M. Hasanuzzaman, and N. A. Rahim, "Effects of various parameters on PV-module power and efficiency," Energy Convers. Manag., vol. 103, pp. 348–358, 2015.

[7] A. Sola, C. Corchero, J. Salom, and M. Sanmarti, "Simulation tools to build urban-scale energy models: A review," Energies, vol. 11, no. 12. MDPI AG, 01-Dec-2018.

[8] C. Y. Siu and Z. Liao, "Is building energy simulation based on TMY representative: A comparative simulation study on doe reference buildings in Toronto with typical year and historical year type weather files," Energy Build., vol. 211, p. 109760, Mar. 2020.

[9] S. Sreenath, K. Sudhakar, A. F. Yusop, E. Solomin, and I. M. Kirpichnikova, "Solar PV energy system in Malaysian airport: Glare analysis, general design and performance assessment," Energy Reports, vol. 6, pp. 698–712, Nov. 2020.

[10] T. Hong, Y. Chen, X. Luo, N. Luo, and S. H. Lee, "Ten questions on urban building energy modeling," Build. Environ., vol. 168, p. 106508, Jan. 2020.

[11] A. Arias-Rosales and P. R. LeDuc, "Modeling the transmittance of anisotropic diffuse radiation towards estimating energy losses in solar panel coverings," Appl. Energy, vol. 268, p. 114872, Jun. 2020.

[12] Https://play.google.com/store, "Google Play," https://play.google.com/store, 2019. [Online]. Available: https://play.google.com/store.

[13] Solarpe Soft, "SOLARPE PRO ☀□ PV PHOTOVOLTAIC SOLAR POWER SOLARPE SOFTe," https://play.google.com, 2019. [Online]. Available: https://play.google.com/store/apps/details?id=com.grecotoledo.SOLARPE_PRO.

[14] vistech.projects, "SolarMeter solar panel planner," https://play.google.com/store, 2019. [Online]. Available: https://play.google.com/store/apps/details?id=com.vistechprojects.solarmeter.

[15] NGR Labs, "My Solar Panel," https://play.google.com, 2019. [Online]. Available: https://play.google.com/store/apps/details?id=com.exigo.solarpowerpro.

[16] eSolaronic, "Solar Calc - Solar PV and Electrical Calculations," https://play.google.com, 2019. [Online]. Available: https://play.google.com/store/apps/details?id=in.esolaronics.solarcalcads.

[17] M.N.N, "SolarCT - Solar PV Systems," https://play.google.com, 2019. [Online]. Available: https://play.google.com/store/apps/details?id=com.mnn.solarct.

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U

Umberto Papa

W

Wan Samiati Andriana

Wan Mohamad Daud

Y

Yuliarman Saragih

Z

Z. K. A. Baizal

Zaenal Abidin

Zakarias Situmorang