Inclusion of .NET framework for Calculating electrical parameters of solar cell

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Abstract- The present manuscript deals with the development of .NET based framework for calculation of electrical parameters of the solar cells. For the development of graphical user interface we have used Microsoft.NET framework 2018.This framework is introduced for developing applications easily. For Backend we use MS SQL (Structural Query Language) database. MS SQL is a standard language for managing, storing data in Relational Database Management System (RDBMS). For the present investigation we have used three input values i.e. fill factor (FF), short circuit current (Jsc), and open circuit voltage (Voc) and calculated the unknown Vmp (V) and Imp (mA/cm^2) values using random number generation and .net programming. The calculated values are closely matches with the existing results reported in the literature. The results suggested that the .net programming will be useful for the solar cell research.

Keywords- Net Programming, Random Numbers, Solar cell, Simulation.

I. INTRODUCTION

Sunlight is mostly available source of energy. By using sunlight solar cell converts the energy of sunlight into electrical form. Currently available fuels are responsible for the pollutions, so it is necessary to find out alternative solutions to fulfil the increasing energy demand. The solar energy is cost effective and eco-friendly source of energy. It can reduce greenhouse gas emissions and does not polluted nature which great help to the environment. Furthermore, solar cells require low maintenance which results in a less cost of the end product i.e. solar electricity.

To develop a efficient solar cell, it is required to synthesis and characterize the various materials. Various experimental techniques takes very enormous time to market time hence modelling of solar cell will be one of the solutions to reduce time to market period. To deal with such issues modelling is a better choice. A model represents a system which is simple and enables the analyst to predict the effect of the changes to the system. Model validity is very important in modelling. The techniques of model validation are to prepare the model or simulate the model under known input conditions and compare model output with system outputs [2-6].

J. Salinger etal reported that a characterization of the charge carrier lifetime and the extracting parameters of G-R canter is very useful for solar cell utilization [9].Davud Mostafa, Tobnaghi, Rahim Madatov, daryush naderi have been investigated the role of temperature on the electric parameters of solar cells [10]. Zakaria Alomar, Oualid El Halimi, Kaushik Sivaprasad , Chitrang Pandit studied different languages used in software development and compare these languages by characteristics of reusability, reliability, portability, availability of compilers and tools, readability, efficiency, familiarity and expressiveness[11].Mahfound Adberrezek etal have been investigated the effect of temperature on GaInp/GaAS tandem solar cells[12]. White et al have reported low cost & high efficiency solar cell using novel thin film solar cell combined with c-Si [13].Dongale et al have successfully simulate and developed various solar cells [14].
Considering the literature trends and our past experience in the solar cell research, the present manuscript deals with the development of .NET based framework for calculation of electrical parameters of the solar cells. The rest of paper is as follows, after brief introduction in the first section, second section deals with the background details of .NET framework. Section third deals with the discussion of graphical user interface and at the end results are presented.

II. FINDING SOLAR CELL ELECTRICAL PARAMETER USING .NET FRAMEWORK.

NET technology was introduced by Microsoft, came out around the year 2000. It is a platform neutral framework. Applications developed with .NET framework are sustain for longer time so it is more reliable. It has advanced compilation and catching strategies it increases the performance of application. It is capable of handling security of application. It can work with different programming languages like C#, VB.NET. It is useful for creating windows based and Web based applications. .NET is both a business strategy from Microsoft and its gathering of programming support for what are known as Web benefits, the capacity to utilize the Web as opposed to your own PC for different administrations. Microsoft will likely furnish individual and business clients with a consistently interoperable and Web-empowered interface for applications and processing gadgets and to make registering exercises progressively Web program arranged. The .NET stage incorporates servers; building-square administrations, for example, Web-based information stockpiling; and gadget programming. It likewise incorporates Passport, Microsoft's fill-in-the-shape just once personality confirmation benefit.

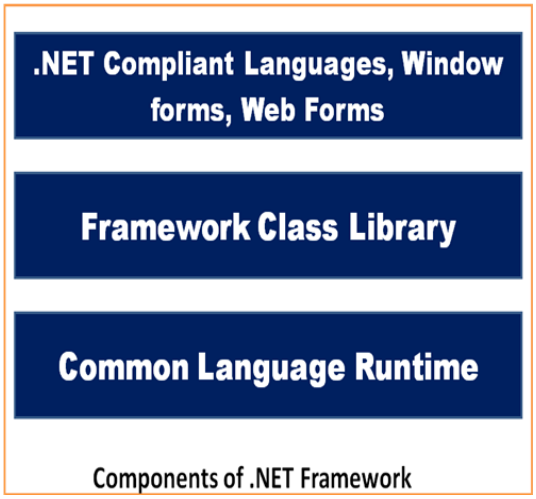

Fig.1: The architecture of .NET Framework

The present paper focuses on the calculations of voltage at maximum power point (Vmp) and current at maximum power point (Imp) values by using .net framework. The Vmp and Imp calculated by generating random numbers (to generate random numbers Random class provided by .NET Framework have been used) and solving the solar cell equations. Here we consider min. range and max. range 16 values and these values are as follows,

minrang[]={1.3800,1.3800,1.3800,1.3800,1.3800,1.3700,1.3600,1.3800,1.3800,1.3800,1.3900,1.3900,1.3900,1.3900,1.3900,1.390

maxrang[]={1.3944,1.3946,1.3954,1.3953,1.3954,1.3887,1.3820,1.3757,1.3954,1.3986,1.4008,1.4024,1.4024,1.4023,1.4023,1.402};

For calculating Fill Factor following formula is used

$$FF = Vmp * Imp / Voc * Jsc$$

Where,

FF= Fill Factor
Vmp= Voltage at Maximum Point
Imp= Current at Maximum Point
Voc= Open Circuit voltage
Jsc= Short Circuit Current

For calculating Current at maximum point we used below formula

$$Imp = FF*Voc*Jsc / Vmp$$

For Vmp value we generate random numbers. For random number generation we provide a maxrange and minrange value of Vmp. By using formula Current at maximum point is obtained.

III. WORKING MODEL

For the development of graphical user interface we have used Microsoft .NET framework 2018. To store the results, MS SQL has been used. This MS SQL provides results in very efficient manner and with minimum time span. Security of data point of view also it has very unique features. So for this study we have preferred these technologies.

Figure.3: represents the Working Model of proposed solution.

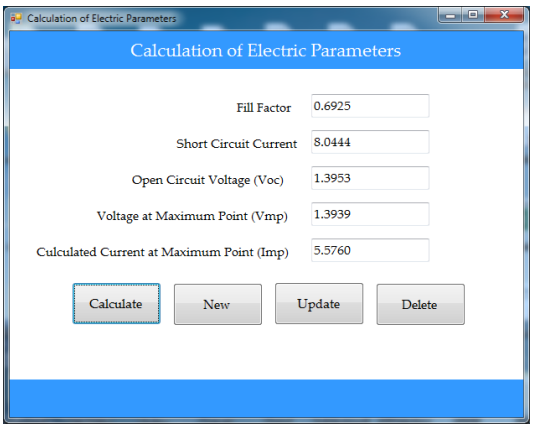

Fig.3: Working model of proposed system

IV. RESULTS AND DISCUSSIONS

The output generated by program is shown in Table 1. For the present investigation we have used three input values i.efill factor(FF), short circuit current(Jsc), and open circuit voltage(Voc) and calculated the unknown Vmp (V) and Imp (mA/cm^2) values using random number generation and .net programming. The calculated values are closely matches with the results reported in the reference [14]. The results suggested that the .net programming will be useful for the solar cell research.

Table1: Results obtained from the developed .NET Framework

Short Circuit Current (mA/cm2) [14]	Open Circuit Voltage(V) [14]	Fill Factor (FF) [14]	Vmp (V)	Imp (mA/cm2)
7.7567	1.3944	0.6924	1.3943	5.3708
7.9065	1.3946	0.6924	1.3896	5.4937
8.0540	1.3954	0.6925	1.3930	5.5866
8.0445	1.3953	0.6925	1.3939	5.5760
8.0540	1.3954	0.6925	1.3873	5.9483
4.9121	1.3887	0.6920	1.3793	3.4225
3.4676	1.3820	0.6916	1.3614	2.4343
2.6244	1.3757	0.6912	1.3784	1.8103
8.0540	1.3954	0.6925	1.3812	5.6345
9.2982	1.3986	0.6925	1.3839	6.5072
10.1857	1.4008	0.6928	1.3923	7.0993
10.8707	1.4024	0.6929	1.3931	7.5823
10.8707	1.4024	0.6929	1.3994	7.5483
10.8627	1.4023	0.6929	1.4013	7.5317
10.8624	1.4023	0.6929	1.4013	7.5318
10.8626	1.4023	0.6929	1.3943	7.5698

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