Monitoring And Controlling Of Solar Photovoltaic Panel By Using Machine Learning

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Abstract- The renewable energy source are the more reliable form of energy that can be used as an alternative to the energy consumption from the electric grid. These renewable energy are non-conventional form of energy that are eco-friendly and promote a greener environments. In certain rural areas, where the electric power is not available from electricity board, solar energy can be used effectively for many purpose. To limit the usage of power from electricity board, the renewable energy source are introduced. These renewable energy are classified as solar, wind, tidal, hydroelectric and biomass. One among them is the solar energy source. It uses a photovoltaic panel (PV) panel to absorb the solar energy and converts it into electrical energy source. Thus the solar panels are controlled and monitored by using the machine learning, a kind of artificial intelligence to obtain higher efficiency with accurate output.

Keywords: Solar panel, eco-friendly, machine learning, artificial intelligence.

I. Introduction

Nowadays due to increased population growth and the wide range of usage of electrical appliance leads to the enormous usage of electrical energy. This leads to increase in the usage of coal. To reduce the coal and fossil fuels consumption, the renewable form of energy are enhanced [1]. The solar energy are highly available form of energy and can be used as an alternative source for the grid connected energy source. The solar energy is converted into an electrical energy through the photovoltaic panels that converts the solar energy into electrical energy [2] . These photovoltaic panels are controlled and monitored to obtain higher efficiency. The advancement in the technology leads to the rapid development in the usage of the renewable energy sources. This helps to enhance the power consumption by automatic detection and control. The power obtained through the renewable energy source are ecofriendly and thus promote greener environment. There is no need of electricity from electricity board because solar acts as a source of energy [3]. This solar energy provides the power to the street lights at the day time and in the night time, the solar energy is stored in the battery for usage [4].

The solar energy obtained can be stored in the battery for future usage. At night time, the energy obtained from the solar energy is stored in the battery and used as a backup source [5]. The energy obtained from the solar source is a direct current source. It is converted into an alternating current source using an inverter. The inverter is a device that is used to convert the direct current source into an alternating current source and fed to the AC loads [6].

The battery acts as a backup for the storage of energy. The renewable energy sources are highly used for generating electric power in recent days due to the higher demand in consumption [7]. The renewable energy source are indispensable part of the renewable energy systems. In some remote villages, where the continuous supply of electricity is not available, the people go for an alternative energy source for their need. To overcome this contraints in power generation, renewable energy source are utilised [8].

This system works by deriving the energy obtained from solar source which is converted by the photovoltaic panels. This automated energy system enables automatically hence to save the human interference. This automated solar energy source is implemented with lesser computational time with low cost in implementation due to sun as a source of energy [9].

II.Proposed system

The proposed system involves the control and monitoring of the solar panel using machine learning techniques. The machine learning are the form of artificial intelligence that works based on the human intelligence by incorporating the training and testing of the input. The optimum output is obtained through the decision making technique with number of inputs that produce a desired optimum output.

Solar panel:

The solar panel used in our project is 12V, 20W which is sufficient to run the street lights. The sun's light energy is converted into 12V DC and it is fed to the battery through charge controller which regulates the DC output of the solar panel. The charge controller and the solar panel together helps to sustain a charge and improves battery's life. The three types of solar panel cells are polycrystalline, monocrystalline and thin-film [10]. The figure 1 shows the solar panel.
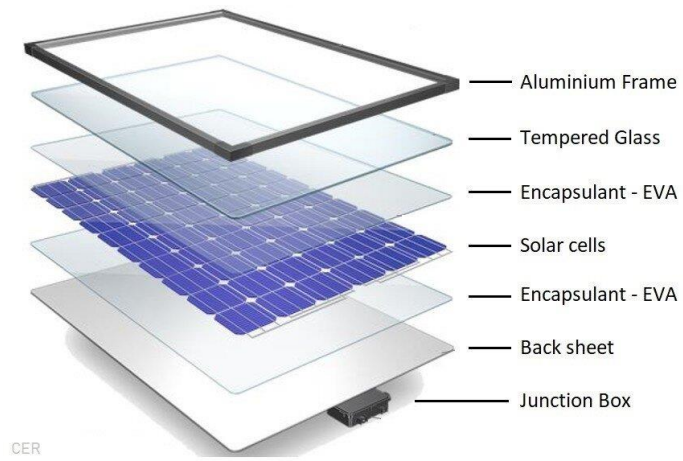

Fig 1: Solar panel

III.Machine learning

The machine learning is a kind of artificial intelligence that performs by solving the problems by the using the training and testing done by problem solving techniques. They includes the decision making as similar to the human intelligence [11]. This includes the problem formulation to feature extraction and concluded with the evaluation and model implementation. The figure 2 shows the stages in machine learning

Problem
Formulation

↓

Feature
Extraction

↓

Model
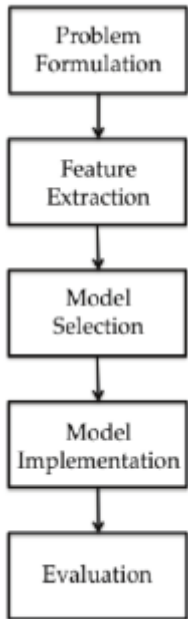Selection

↓

Model
Implementation

↓

Evaluation

Fig 2: Stages in machine learning

The machine learning employs the artificial neural network with genetic algorithm. The machine learning includes the problem formulation as the basic step. The number of complications are recorded in the input and proceeded to the feature extraction [12]. The feature extraction is the process of converting the raw data into the desired data. The feature extraction is done by the preprocessing stage. It is the neglecting of the dataset with noise and certain harmonics. The noise are neglected by using the filters. The clean dataset is much essential to produce to the next stage and produce the desired outcome [13]. There are several kinds of filters namely band pass, low pass, high pass and band stop filters.

The clear dataset is obtained and proceeded to the next stage to employ the computational algorithm. The data are proceeded to the model selection and model implementation [14]. The model selection helps to find the better means of the exact solution by using the intelligence. The data acquisition is enabled to read the data from the dataset to find the optimum solution. The complex problems can be identified and neglected using the computational algorithm. Then the machine learning employs to evaluate the data with the preprogrammed dataset [15]. They are the list of data proceeded based on the functionalities after the model implementation, the dataset are evaluated and the desired optimum solution for the complex program is obtained.

IV.Simulation result

The code implementation for the monitoring and controlling the solar photovoltaic panel is depicted in figure 3 shown below.

Fig 3: Python code implementation

The figure 4 demonstrates the exact functioning of the solar module. The monitoring and controlling are done with tilting the panel in the direct of sunlight to obtain higher efficiency.
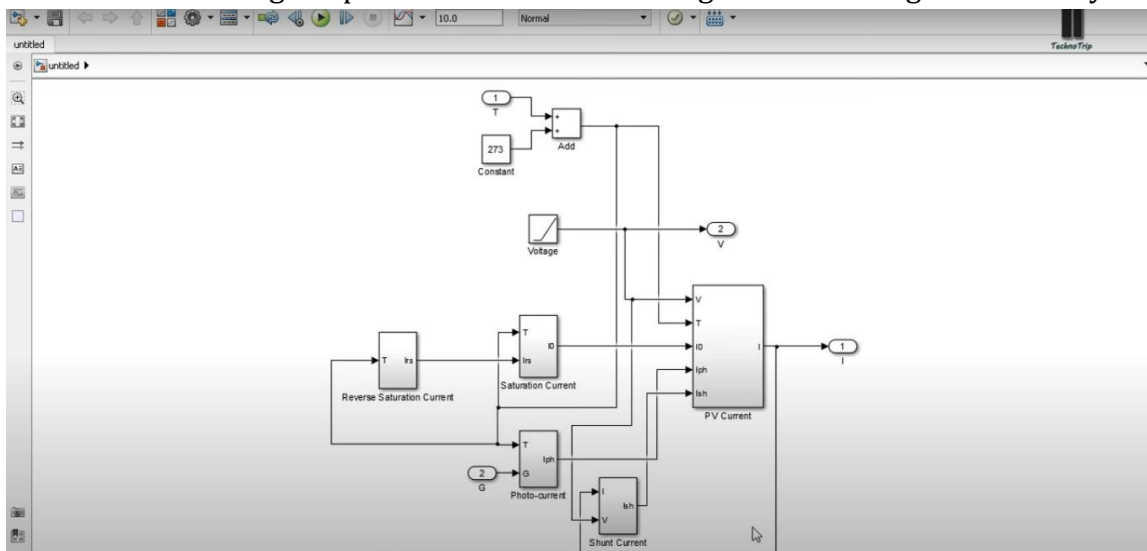

Fig 4: Simulink model

V.Conclusion

The main objective of the system is to obtain automatic control of the solar photovoltaic panel using the machine learning. The automatic control is enhanced to produce the optimum level of output with the adjustments that are made towads the photovoltaic panel. The machine learning employes to work based on the problem solving nad decision making as similar to human intelligence. Thus the use of

machine learning or artificial intelligence helps to obtain the control and monitoring of the solar panel with higher output ratio.

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