FLOATING SOLAR SYSTEM WITH SOLAR TRACKING AND AUTO CLEANING MECHANISM FOR NON-INTERRUPTED POWER SUPPLY

RAJENDRA KODAMANCHILI, Assitant Professor, Department of EEE, Ramachandra College of Engineering, Eluru, AP, India

Mr. A V N S L Narayana, Assistant Professor, EEE Department, Ramachandra College of Engineering, Eluru

Mr. Ch S K B Pradeep Kumar, Assistant Professor, EEE Department, Ramachandra College of Engineering, Eluru

Abstract: This paper is an automated system where Solar Panel direction is controlled based on the time by using Real Time Clock (RTC). This paper uses a couple of RTC block, which will be detecting time. These sensors are connected besides the Solar Panels. These panels will be fixed on DC Servo motors. The DC motors will move towards the direction of maximum sun energy. The signals from the light sensing device will be processed by the microcontroller and the microcontroller drives the DC Servo motor in the desired direction.

A prototype of solar panel system with a real time clock (RTC) based automated solar tracker has been developed for its use in urban residential areas. The panels will be fitted with the solar tracker to track the sun to maximize the energy collection. Experimental result shows that the developed system can harness about 20-23% more energy while occupying 33% less area than that by the conventional fixed panel system of same size. An 8-bit the ARDUINO microcontroller is used for this purpose.

The programing of this microcontroller is done using Embedded C programs and to cross compile the .c file into hex. The programing of hex file into microcontroller done using ARDUINO IDE programmer. The Rotating Solar Panel Using Arduino paper aims at charging a 12VDC Battery with the help of a Solar Panel mounted on platform which can rotate with the help of a servo motor. The position which has the highest energy capacity is chosen to charge the Battery.

Keywords: ARDUINO ,Time Clock (RTC), microcontroller, Embedded C, Battery, Solar Panel.

I.LITERATURE SURVEY

The first floating PV system was built in 2007 in Aichi, Japan. American, Danish, French, Italian and Japanese nationals were the first to register patents for floating solar between 2007 and 2014. However, initially, these small-scale systems were built for research and demonstration

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purposes. ATI put about 20,000 solar trackers into homes as the home market grew. But it remained a niche market. Then, in 2001, BP Solar granted ATI its first utility-scale paper, to install a 250-kW solar tracker system. This contract itself led to further innovation of the ATI solar tracker.

II.INTRODUCTION

Various floating PV system projects have been planned to enhance the productivity of this system. This system exploiting functions such as cooling, concentrating, and tracking have precisely been deliberated and the outcomes have designated an important influence of cooling and tracking on the system competence. In recent years, renewable energies have grown rapidly worldwide. Due to its power and duration, solar energy is considered the most interesting substitute source of energy. Solar energy is available for free worldwide. Through a photovoltaic (PV) system is the most common utilization of sunlight energy. The most sustainable, efficient, and environmentally responsive system in the field of renewable energy is a Photovoltaic (PV) system.

Different countries have distinct reservoirs, which can reduce land savings and power generation costs. Therefore, the purchase of a photovoltaic solar system can be a very reasonable choice for utilizing solar energy by the water resources and helps improve the economic stability of solar projects. Although the energy obtained from photovoltaics is renewable energy, long-term use can maintain the efficiency of less than. The cooling effect of water generates more electricity than floating solar supports and roofing systems. It also reduces the evaporation and growth of algae in shaded tanks. The floating platform can be recycled 100 times using high-density polyethylene that resists ultraviolet rays and corrosion Solar photovoltaic module tracking optimisation is one of the alternative renewable energies' sources and its major source the radiated solar energy is unlimited. However, electricity power generation has faced daunting new challenges in its implementation of abundant and clean energy supplies for the future.

The mounting of photovoltaic solar panels will bring a lot of lands, which will always be a quality product. However, the panels are vulnerable to often overlooked, on site omnipresent practicalities such as deposition of dust, bird droppings and water stains which significantly degrade the efficiency of the solar installations. Dust is a lesser acknowledged factor responsible for decreasing the efficiency of PV installations. As we know solar panels are left under open sky in dusty environment. When not cleaned for a long duration of time (from few days to many months), the dustgets accumulated on the front surface of the panels which block the direct incident light from the sun. Thus, it is significantly important to clean the panels at regular intervals of time for maintaining a constant efficiency of the panels.

III.FLOATING SOLAR SYSTEM

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In some countries where deficiency of land usage,the prevalence of using solar panel systems to generate electricity has been hampered by a lack of space and space limitations on the roof. Local PV companies are constantly competing for land, including agriculture, industry, and population growth. These companies have recently discovered innovative alter-natives. The installation of floating panels on lakes, dams, reservoirs, and the sea. Floating solar technology is very advantageous for countries with weak land electrical networks.

Figure 1 Floating solar power plants

The geometry of the floating system has been intended with2 foremost aspects in mind. First of all, the module should protect as much water as possible to avoid water evaporation Second, the size of the module imperatively adapted to the commercially available PV modules.Solar problems examined included: size and angle of inclination of the photovoltaic module, number of modules to be installed, distance between rows of panels (to avoid shadow effects) and, easy access for prolongation.

III.A.FLOATING PV SYSTEM COMPONENTS

A pontoon is an automatic structure that can automatically load a large amount of buoyancy. This series is designed with an appropriate quantity of PV modules in combination with parallel based on the requirements of the platform and available space.**Mooring systems** generally refer to permanent structures capable of storing containers. Examples include quays, wharfs, jetties, piers, anchor buoys, and mooring buoys. When the solar system is turned off, the system can keep the panel in the same position in the morning and prevent the panel from folding or turning off. Installing a mooring system in deep water can be difficult and expensive. A wire rope and a nylon harness can be used to complete the mooring system of the exit platform. The rope can be attached to the terminal on the edge and hit at any corner.

Solar PV module until now, standard crystal line solar modules have been used in floating solar systems. Furthermore, as more and more designs are installed on the saltwater surface, specially designed modules need to be exposed to salty moist for a long time. Overtime, almost all metals corrode, which is why it replaces standard aluminium frames and supports such as polymer frame is required.

Power comes from the solar system and is transported to the local site. As a result, electricity can be injected into the grid network or stored in batteries. So far, in the commissioned paper, the cable has not been dragged under water, but the cable has been kept on the water surface.

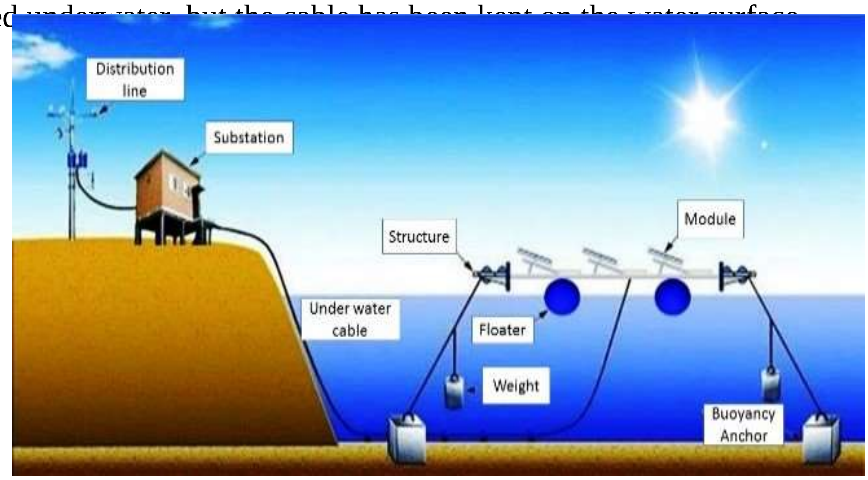

Figure 2 Floating solar power plant layout

The most important parameter for evaluating FPV performance is the ability of photo voltaic to convert effectively into operating conditions, which influences energy production and is, therefore, the highest valued device of this module.

III. TRACKING SOLAR SYSTEM

The solar photovoltaic tracking optimization techniques improve the output energy efficiency of the solar photovoltaic system, ensuring that a concentrated amount of sunlight reaches the solar photovoltaic module throughout the day. The sun tracking optimization techniques involve the use of a solar photovoltaic tracker device orientating the solar photovoltaic module towards the sunlight rays. This technique increases the amount of energy produced as compared to the fixed solar photovoltaic systems in reviewed literature.

III A Dynamic Single Axis Tracking Optimization

A dynamic single axis tracking optimization involves a tracking technique with only one degree of rotational axis aligned along the north meridian. The path of rotation is azimuthally from east to west following the path of the sun during the day. The overall objective of the single axis tracker is to effectively improve the efficiency performance and reliability of solar photo voltaic module, thereby reducing the cost of electricity utility and the negative environmental impact of green house gases.

III B. Horizontal Single Axis Tracker (HSAT)

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This is one of the most common single-axis trackers; the conventional axis of rotation is an east to west horizontal movement with respect to the ground. The tracking technology is mostly used and proven to be very effective in low-latitude regions.

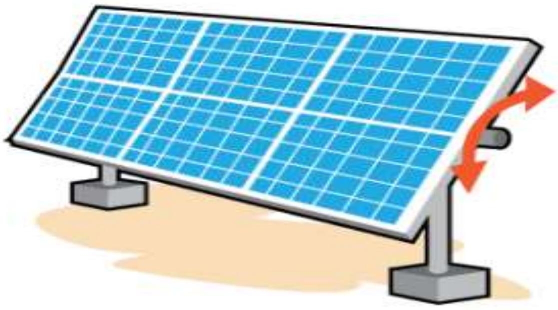

Figure 3 Horizontal single axis tracking

III C.Vertical Single Axis Tracker (VSAT)

A vertical single axis tracker system rotates from east to west with the axis perpendicular to the ground. The system is more profitable in the northern latitudes between 40^0 and 45^0. Due to the system orientation, the system tends to have a relatively low power density per acre, spreading units of installed solar photovoltaic module stands to avoid self-shading.

Figure 4 A vertical single axis tracking(VSAT)

III D.Tilted Single axis Tracker (TSAT)

A tilted single axis tracker seems to be more complex in nature compared to the other single axis tracker systems and is found to be more efficient in the mid/low latitudes region. The conventional axis of rotation is from east to west tilted upwards and towards the south (in the northern hemisphere).In variably ,the tracker is relatively expensive due to the added cost for concrete foundations, is not scalable and requires spreading of units of solar photovoltaic modules to avoid self-shading.

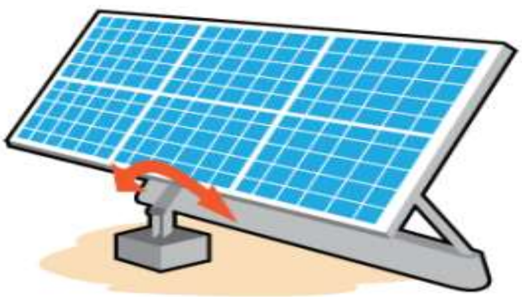

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Figure 5 Tilted single axis tracker

III E, Polar Aligned Single Axis Tracker

The polar aligned single axis tracker has similar characteristics to the tilted single axis tracker and is aligned to the polar star. The conventional rotational movement for the solar photovoltaic modules aligns with the earth's axis of rotation reducing the aperture to $\pm 24^0$ in the north-south direction. The aperture angle is minimal for the polar single axis tracker installed in the south.

III F. Dynamic Dual-axis Solar Tracker

The conventional dynamic solar photovoltaic tracking movement for the dual axis tracker has two axial degrees of rotation. The primary axis of rotation is at fixed position relative to the ground and the secondary axis of rotation regarded as the reference position. The dynamic solar photovoltaic tracking system combines both the azimuth and altitude tracking mechanisms simultaneously ensuring the solar photovoltaic modules constantly face the sun at all the times as the earth rotates yielding the best performance in terms of system energy output and efficiency.

Figure 6 Dual axis tracker architecture.

III G. Tip-Tilt Dual-axis Tracker

The solar photovoltaic tracking mechanism is mounted on the top of a T- or H-rotating bearing shaped device providing the normal east west tracking movement and upward tracking focus movement of solar photovoltaic module frame structures. The tip-tilt dual axis tracker is **typically aligned** to the axis of rotation and possibilities of alignment in any cardinal direction is achievable with advanced developed tracking **algorithm. With** the implementation of a tip-tilt dual axis tracker on a solar photovoltaic **farm, the** unit's arrangement should be placed at a fairly low density to avoid self-shading, minimizing sun shading there by maximizing the harvested sun energy.

III H. Azimuth-Altitude Dual-axis Tracker

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The tracking system is typically mounted on the ground with the solar photovoltaic module mounted on a series of roller shaving its weights evenly distributed. The primary axis has its reference to the ground and the secondary (altitude) axis normal to the primary axis. The rotational movement is quite different from the tip-tilt dual axis tracker system, as the azimuth-altitude axis tracker rotates using the large roller base ring mounted on the ground for its horizontal movement Summary Chart of Solar Photovoltaic Sun Tracking Types. simply represents a brief summary of the different types of solar photovoltaic tracking systems currently available in the solar photovoltaic energy industry. The sub-division of these two major classifications of solar photovoltaic tracking systems have been addressed in Section.

IV.SIMULATION AND RESULTS

IV.A SIMULINK MODEL OF A PV PANEL:

The Simulink model of 750W PV cell operating at 25^{0}C with irradiance value of 1000. It is connect to a load of 250Ω.

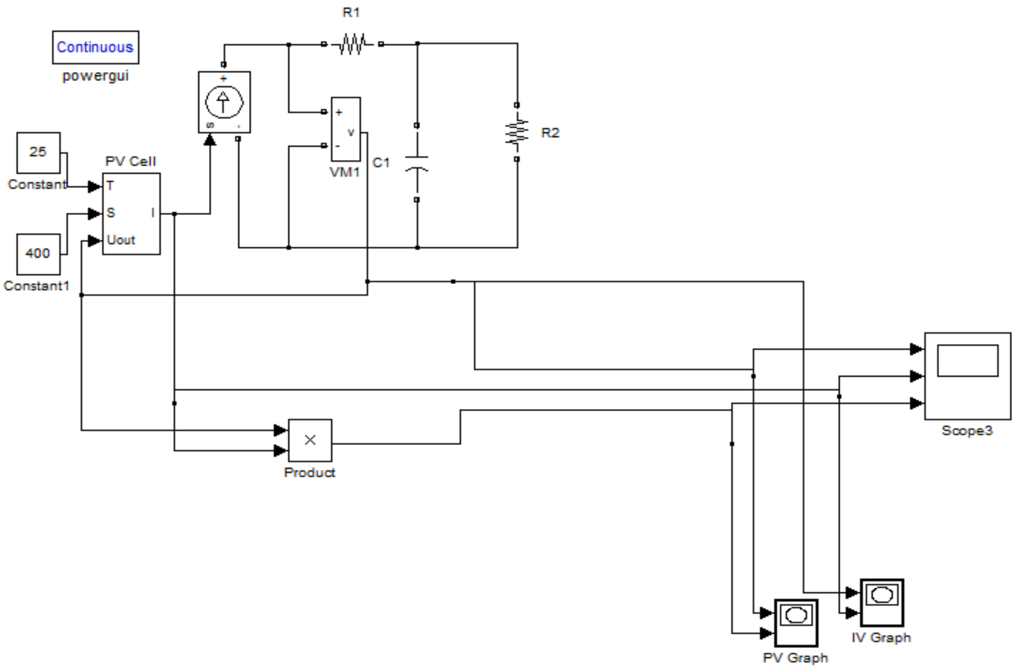

Figure 7 Simulink diagram of a PV Panel

The diagram shows the results are voltage, current and power outputs of a PV panel.

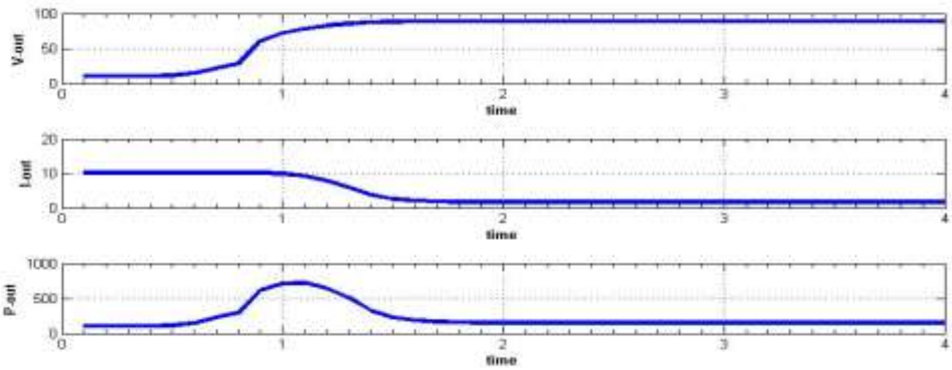

Figure 8 Voltage, current and power outputs

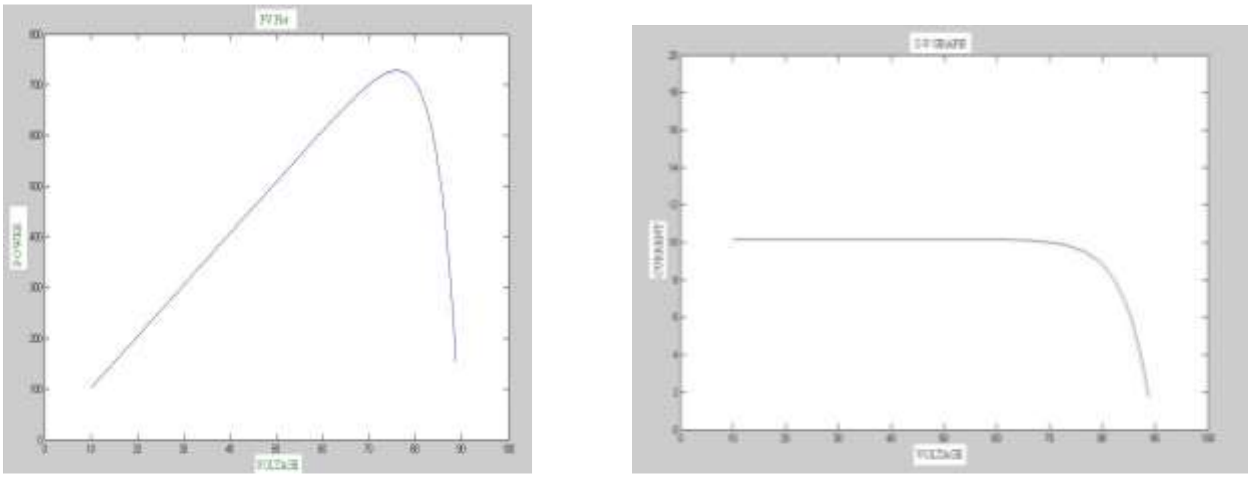

Figure 9 a. P V graph b.Plot of I-V

IV.B SIMULINK MODEL OF BOOST CONVERTER

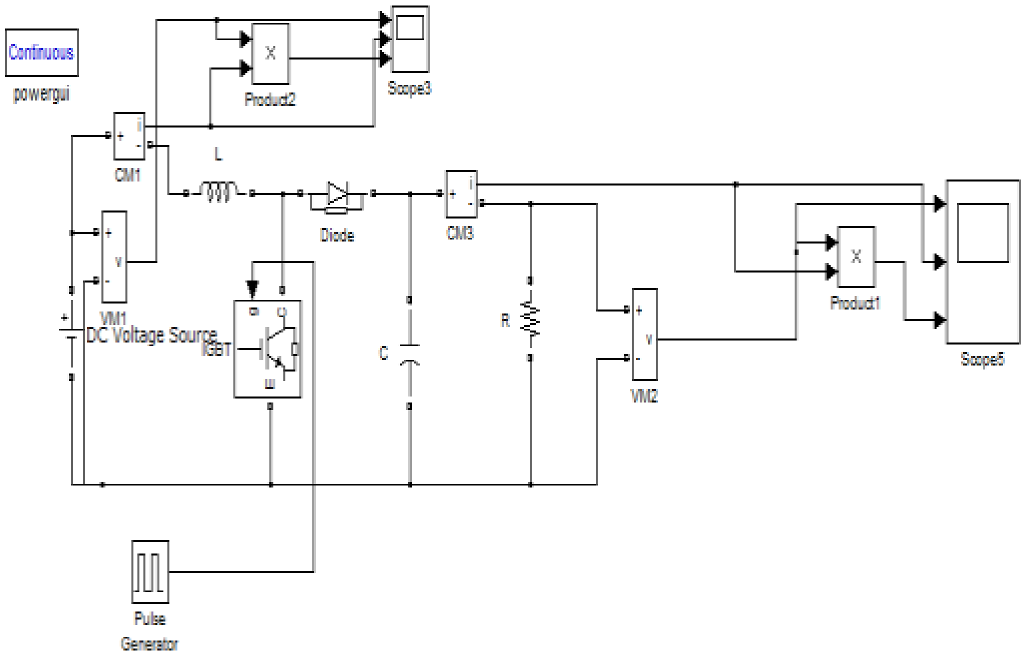

Figure 10 Simulink diagram of Boost Converter

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Simulation results for boost converter figure shows the simulation results of voltage, current and power inputs are 90V, 7.9A and 730W respectively of Boost converter. It shows the voltage, current and power outputs are 178V, 3.9A and 720W of boost converter with a load of 250Ω.

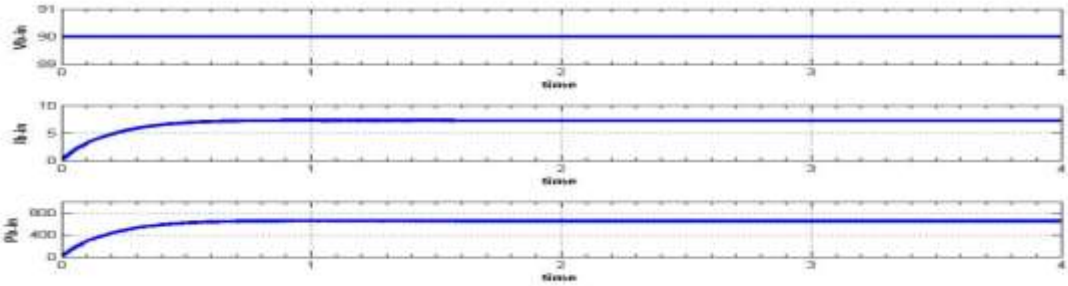

Figure 11 Voltage, current and power inputs of Boost converter

IV.C SIMULINK MODEL OF PV FED BOOST CONVERTER (WITHOUT MPPT)

Figure 12 shows a Simulink model of 750W PV panel operating at 25^{0}C with irradiance value of 1000, fed Boost converter without MPPT with a 50% duty ratio. It is connected to a load of 250Ω.

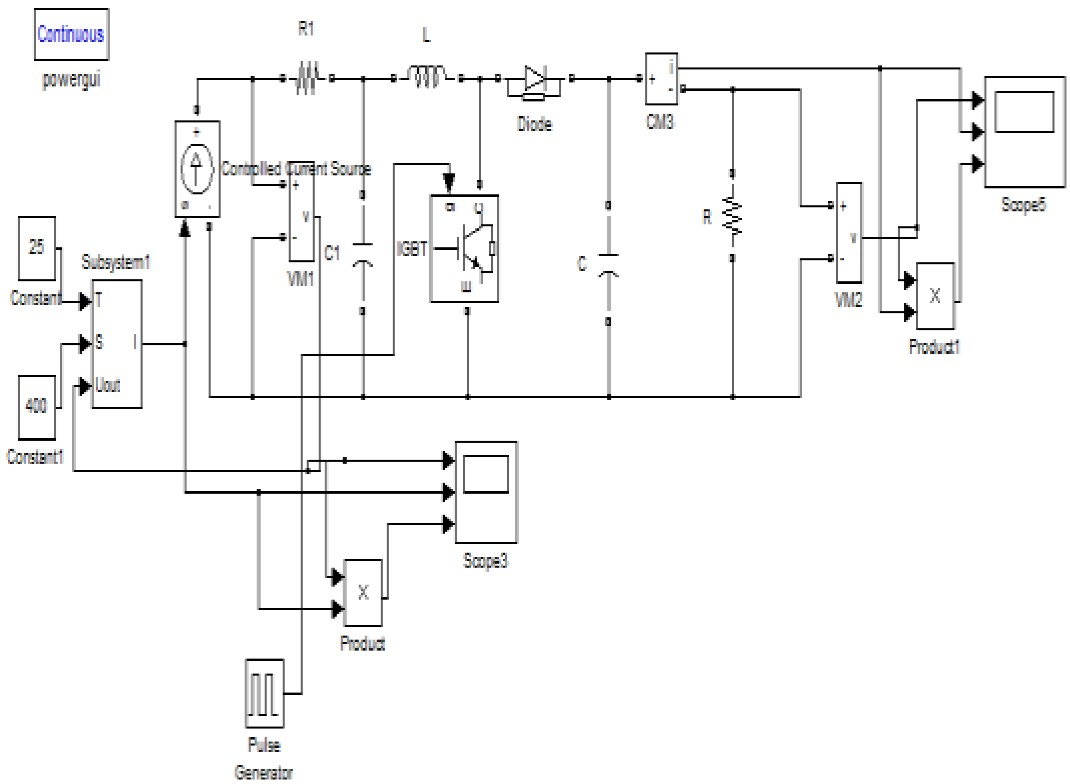

Figure 12 Simulink diagram of PV fed Boost converter without MPPT

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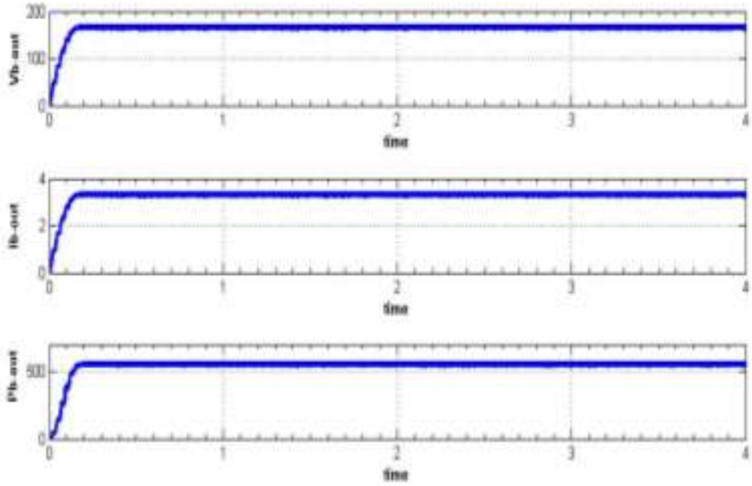

Figure 13 Voltage, current and power outputs of Boost converter with PV Panel

IV.D SIMULINK MODEL OF PV FED BOOST CONVERTER(WITH MPPT)

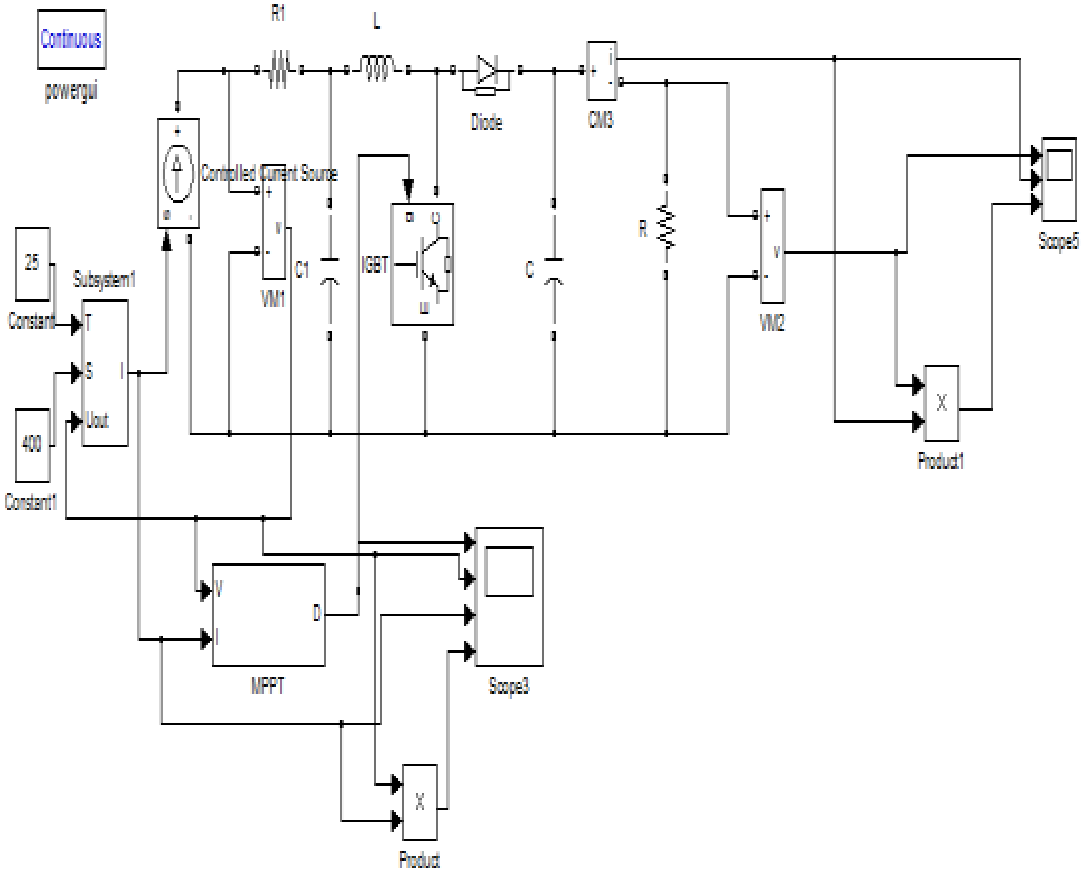

Figure 14 Simulink diagram of PV fed to Boost Converter with MPPT

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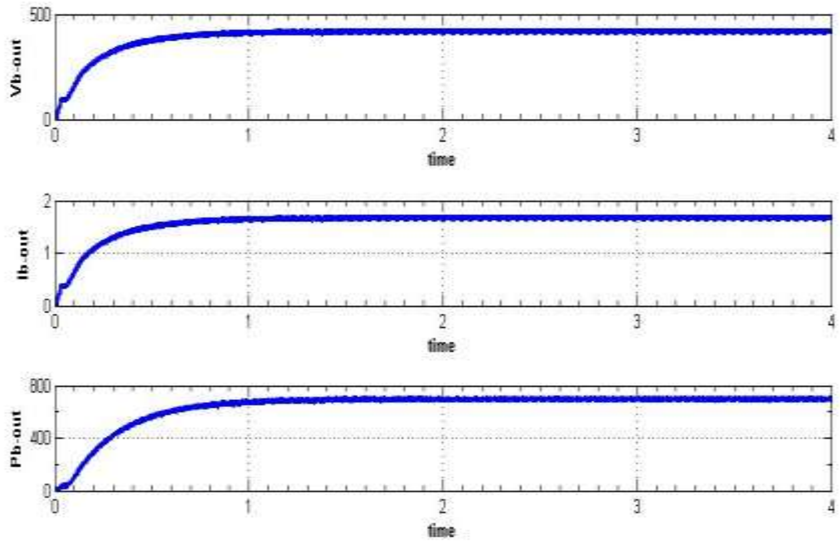

Figure 15 Voltage, current and power outputs of boost converter

V.HARD WARE IMPLEMENTATION

Floatovoltaics, also known as floating solar, is a solar power generator that is deployed upon water bodies. They are mounted upon a firm platform. Unlike the system used in solar PV plants, the floating PV uses pontoons (pontoons can float while carrying heavy loads) as floats. A prototype of solar panel system with a real time clock (RTC) based automated solar tracker has been developed for its use in urban residential areas. The panels will be fitted with the solar tracker to track the sun to maximize the energy collection. Experimental result shows that the developed system can harness about 20-23% more energy while occupying 33% less area than that by the conventional fixed panel system of same size. Despite their location, floating solar panels work the same way as land-based systems.

However, the inverters and the arrays are affixed on a floating platform. Combiner boxes collect the direct current electricity after generation. Then, it is converted into alternating current by solar inverters by using PLC software for small use, SCADA for medium and large generation.

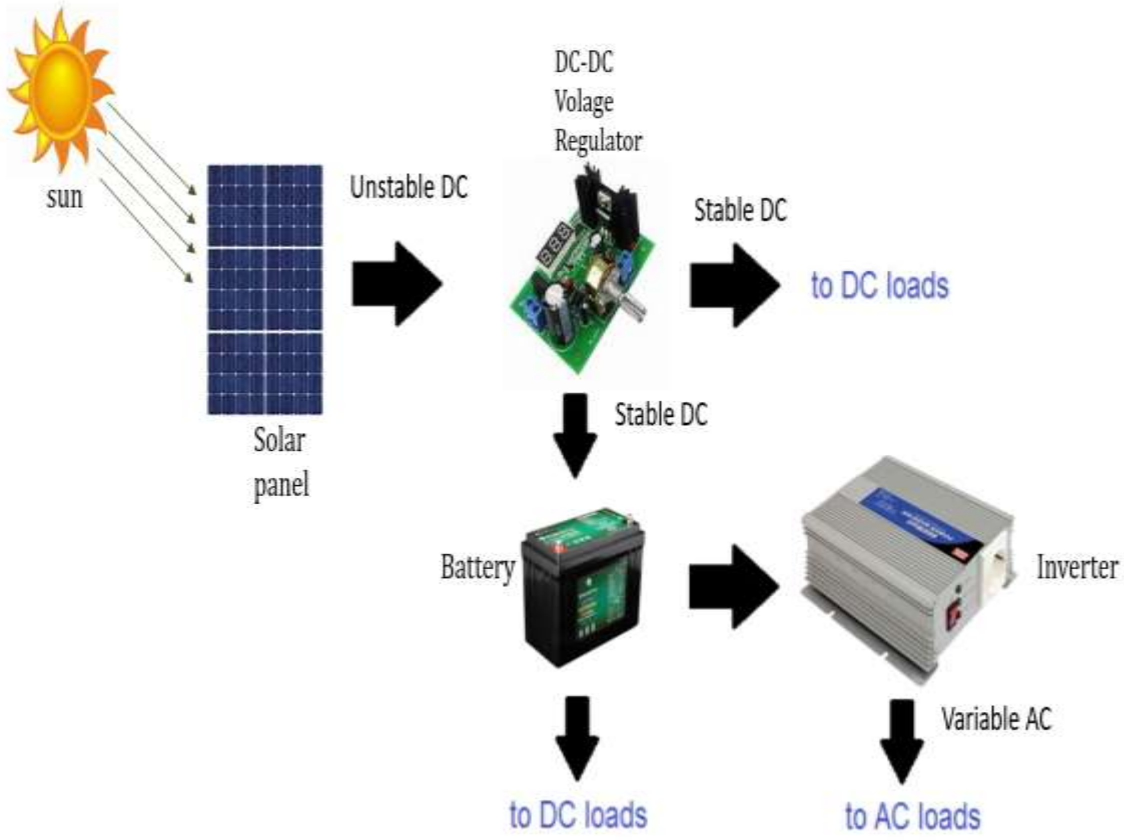

Figure 16 Block Diagram

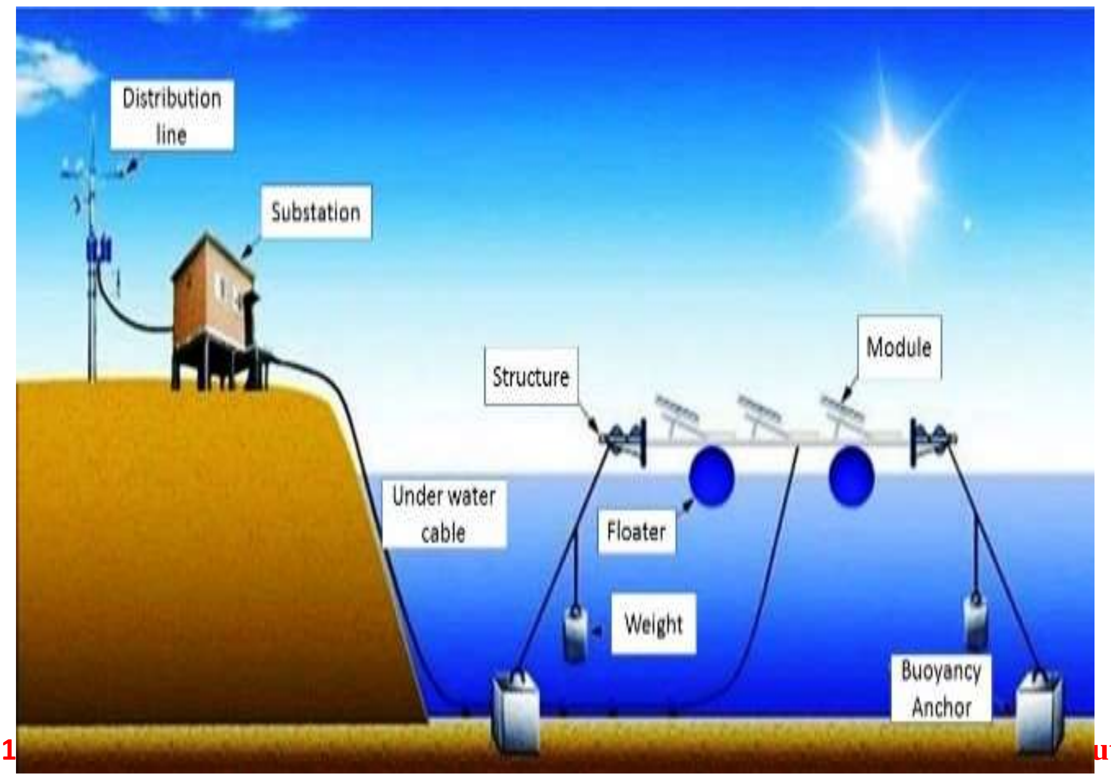

Figure 17 Schematic Diagram

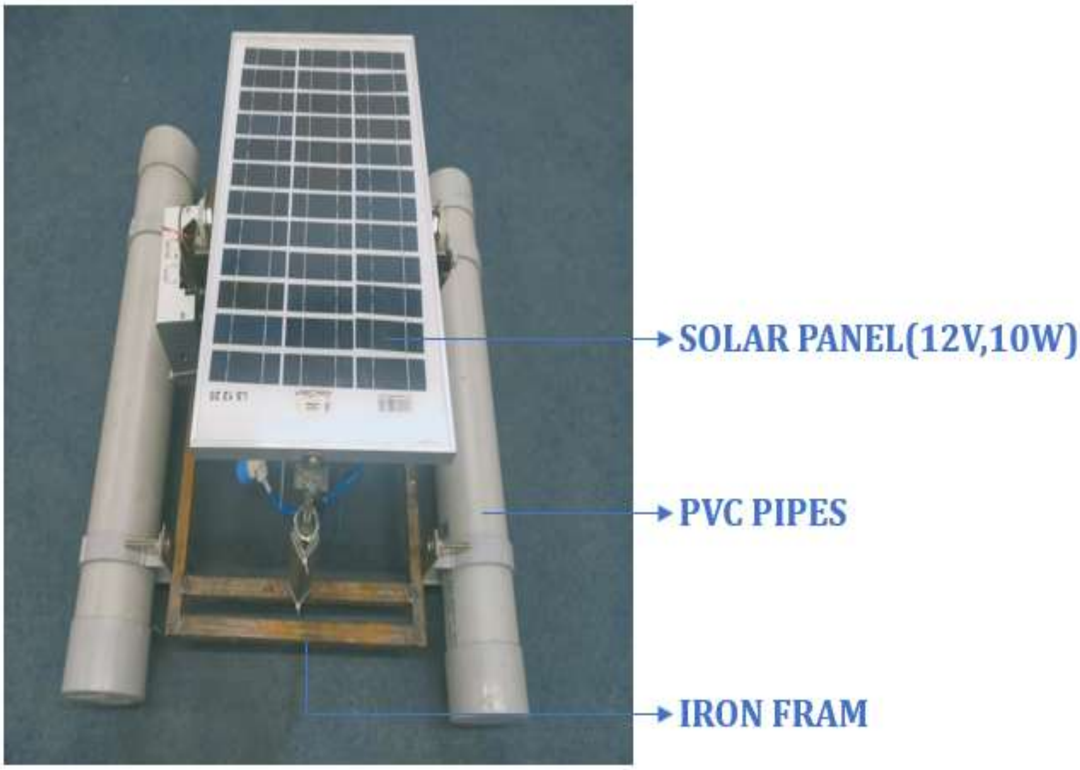

Figure 18 Hardware setup of developed floating solar system picture1

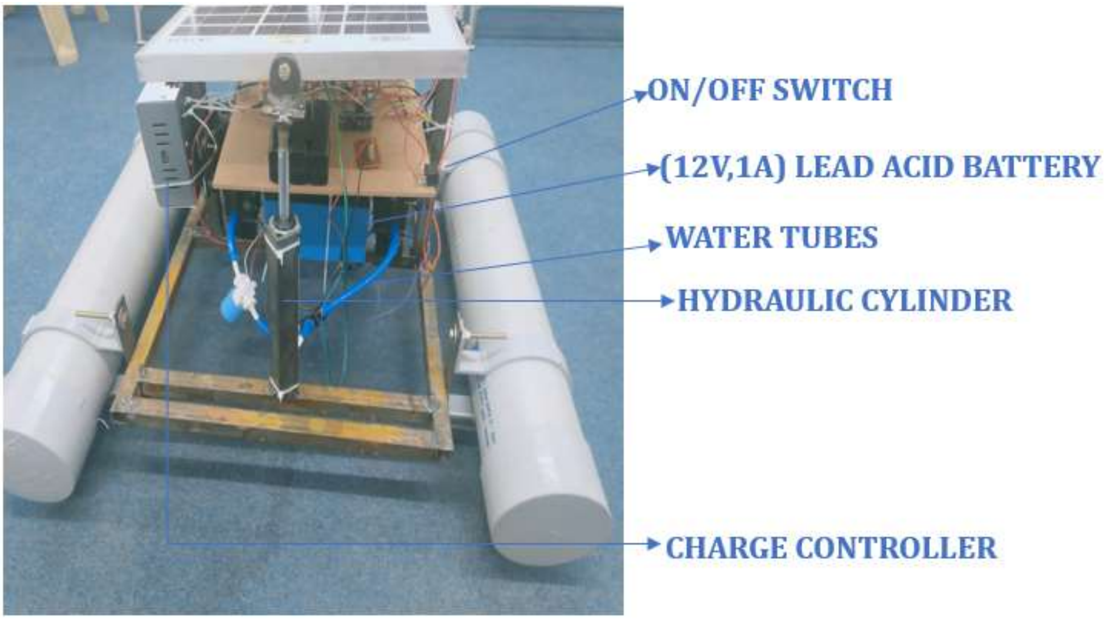

Figure 19 Hardware setup of developed floating solar system picture 2

Figure 20 Floating solar system digital display

VI.CONCLUSION

This paper is the advantage of the floating system is reduction of evaporation, thus helping preserve water levels during extreme summer. When panels are installed on floating platform, the heating problem of solar panel on land is solved to a great extent.

Compared to their traditional fixed-position counterparts, solar systems which track the changes in the sun's trajectory over the course of the day collect a far greater amount of solar energy, and therefore generate a significantly higher output power.

The invention of Solar Tracking System helps us improve the performance of PV solar system in a simple way. Used relative method of sunlight strength. Established a model of automatic tracking system to keep vertical contact between solar panels and sunlight.Improved the utilization rate of solar energy and efficiency of photovoltaic power generation system.

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