Tracking of effective sunlight for increasing power generating efficiency in charging stations

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ABSTRACT
The globe has turned its attention to sustainable development and renewable energy as a result of climate changes brought on by global warming and ozone layer depletion. As a result, solar PV systems are now seen as a viable source of energy due to their direct conversion of sunlight into electricity, simplicity of operation, and production of clean energy. The panel land-based PV systems, however, use up a lot of usable land. For the same quantity of energy production, a solar PV pole only needs a small portion of that area of land. It is also more efficient than a land-based system at capturing sunlight. This solar pole aids in tracking the sun and improving the effectiveness of electricity generation**.**
Keywords: solar PV systems, effective sunlight, panel land based PV systems, global warming

INTRODUCTION

It is a kind of renewable energy source that can compete in some respects with fossil fuels. Hydropower is the term for the kinetic energy of moving water. It produces almost all of the renewable energy in the country. Facilities that produce electricity using hydroelectricity do not harm the environment or use any resources. The thermonuclear fusion process in the sun, a spherical hydrodynamic body of extremely hot ionised gases (plasma), produces energy. The interior of the sun, where energy is released by hydrogen and helium fusion, is thought to be between 8 and 40 degrees Kelvin in temperature. Solar energy is usually recognised as the easiest and cleanest way to produce renewable energy due to its abundance and simplicity. solar architecture, solar photovoltaic, and solar thermal are the approaches for direct conversion of solar radiation into useful form. The biggest issue with harnessing solar energy is the need to install massive solar collectors, which necessitates a lot of room. To solve this problem, we may set up an Arduino-based photovoltaic charging station that takes up very little space. Solar panels are installed on the roof. Solar panels convert sunshine into electric energy, which is subsequently used to charge batteries in phones, laptops, and other electronic devices, as well as for street lighting. Its appealing and modern design will blend seamlessly with our campus's public areas, allowing all students and guests to freely use its resources.Along with the promotion of renewable energy sources. The employment of energy saving technology, such as LED street lighting, is also promoted via an Arduino-based charging station powered by photovoltaics.

ENERGY SCENARIO

In order to get a good sense of what these non-conventional sources of energy are and how much of an impact they have on our lives, it's a good idea to get a sense of conventional sources of energy, to see what we're calling conventional sources of energy and how prevalent they are and to what extent we're impacted in our lives because of these sources of energy.So, to begin, I've put together a little bit of a timeline, which I think is very interesting to see for a variety of reasons, the most important of which is that as we talk about conventional sources of energy, I think this timeline will convey to you what time frame we're talking about over which these conventional sources of energy have become a very major part of our existence, okay? Of course, it's all occurring because we're using that energy, right? As a result, everything is happening for that reason.So, on some fundamental level, yes, in terms of existing present lifestyle, these oil wells are vital because they support the production of energy, and we, the general public, use that energy.Because everything we do, our ability to travel somewhere, our ability to be entertained, our ability to live in a nice setting, even if it is extremely hot or rainy outside, all of these things appear to be associated with energy**.**In fact, we have become so entwined with energy in our existence that if there is a major power outage, which essentially means a major energy outage, everything comes to a halt. I mean, your telecommunications go down, your ability to travel to any location goes down, your ability to get entertainment goes down.If your power is out, your ability to acquire information goes down, and everything goes down in a couple of hours. And you know that cities face really challenging and extremely difficult situations, and that they are frequently unprepared for a significant power outage. So, any major city in the globe that experiences a complete power outage for even two days slides into pandemonium.I'm referring to the level of anarchy that that city sinks to in terms of all services that are available, all of which are critical services that are affected almost instantly and that seek reality today. As a result, energy has become a very important component of our lives. We are no longer living in the days of old, when we simply lived each day from the time the sun rose to the time it set.A lot of our ancestors basically did that because they only had one day from sunrise to sunset, and once the sun set, regardless of whether it was nice or not, it could be 6 p.m., 7 p.m., or 8 p.m. depending on where you were in the world, they would all just basically retire, I mean build a fire to warm themselves, watch the night sky, and then retire, and that is how you know actually a lot of astrologers started.

CONSTRUCTION OF PHOTOVALTAIC CELL

PV cells are made from semiconductor materials such as arsenide, indium, cadmium, silicon, selenium, and gallium. The cell is primarily made of silicon and selenium. Consider the diagram below, which depicts the components of a silicon solar cell. The cell's upper surface is constructed of a thin layer of p-type material, which allows light to readily pass through it. The metal rings are wrapped around the positive and negative output terminals of the p-type and n-type materials, respectively.

The PV cell is made up of a single unit of multi-crystalline or monocrystalline semiconductor material. The mono-crystal cell is carved out of the semiconductor material's volume. The multicell is made from a material with several surfaces. The output voltage and current of a single unit of the cell are extremely low. The output voltage and current have magnitudes of 0.6v and 0.8v, respectively. The various combinations of cells are employed to boost output efficiency. The PV cells can be combined in three different ways.

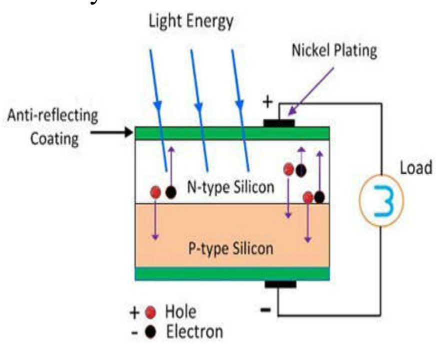

Fig 1 photovoltaic cell

WORKING OF PV CELL:

The light that strikes the semiconductor material may flow through it or be reflected. The semiconductor material used in the PV cell is neither a full conductor nor an insulator. This feature of semiconductor material helps it convert light energy into electric energy more efficiently. When light is absorbed by a semiconductor material, the substance's electrons begin to emit. This occurs because light is made up of little energising particles known as photons. When photons are absorbed by electrons, they become energised and begin to move into the substance. The particles move solely in one direction due to the impact of an electric field, and current emerges. Metallic electrodes are present in semiconductor materials and are used to conduct current.

Consider the diagram below, which depicts a silicon PV cell with a resistive load linked across it. The P and N-type layers of semiconductor material make up the PV cell. The PN junction is formed by joining these layers together. The junction is the point where p-type and n-type materials meet. When light strikes the junction, electrons begin to move from one region to the next.

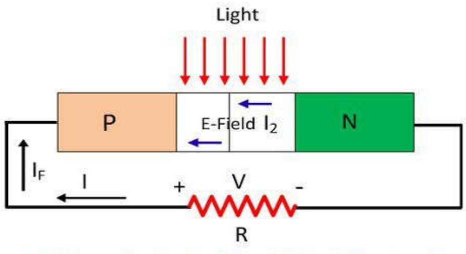

Fig 2 P-N junction Solar cell with resistive load

V-I Characteristics of a Photovoltaic Cell

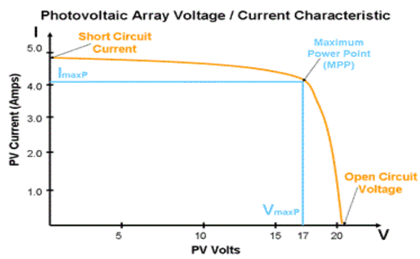

Fig 3 V-I characteristics of PV cell Characteristic equation of a Solar cell,

$$I = I_L - I_0 \left\{ exp \left[\frac{q(v + IR_S)}{nKT} \right] - 1 \right\} - \frac{v + IR_S}{R_{SH}}$$

FORMULATION OF THE PROPOSED CHARGING STATION

In this project, a photovoltaic conversion panel will be employed in a solar tracker system controlled by a microcontroller. Our goal is to create a single-axis solar tracker. The sun is tracked by the tracker, and its position is altered such that the power output is maximised. When the solar plate is perpendicular to the incident rays, the solar panel produces the most energy (Sun rays). As a result, the system that maintains a constant 90-degree angle with the sun will be more efficient than a traditional fixed solar panel system. Our project's goal is to develop and build a system that can track the sun continually and align the solar panel perpendicular to the sun's rays. The solar panel is moved by a linear actuator so that the sun's rays can stay aligned with it. The device's operational architecture is based on a linear actuator that is intelligently controlled by a dedicated drive till it moves a 12V, 100 watt solar panel. The presence of two light sensors (LDRs) improves the efficiency of the sun tracking.

CIRCUIT DIAGRAM:

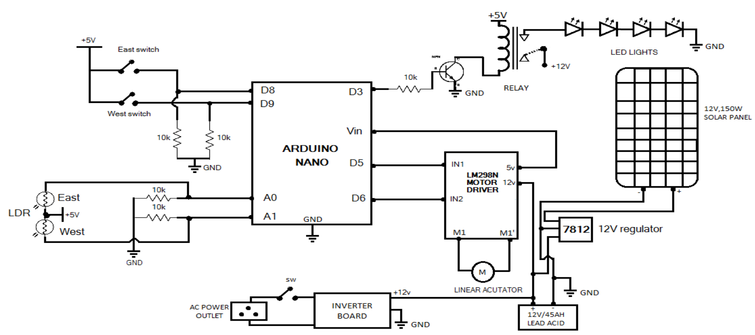

Fig 4 circuit diagram

CONTROL UNIT:

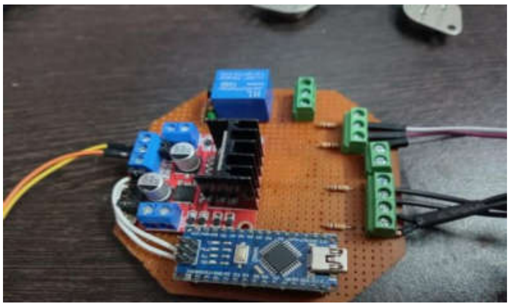

Fig 5 control circuit

RESULTS:

Fig 6 How whole set up looks in the night

Fig 8 Mobile charging during night by the power in the battery

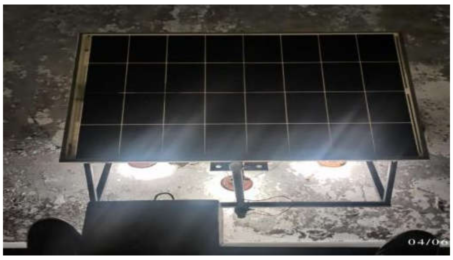

Fig 9 Led lights during night time

CONCLUSION

This initiative was designed to address a problem with community safety and was less expensive than setting up a sizable solar or wind farm. The project would support the neighbourhood's adoption of renewable energy in gradual increments. The goal of an Arduino-based photovoltaic charging station is to increase the efficiency of solar energy systems, which are one of the only power generation options that are completely pollution-free. This Arduino-based charging station with photovoltaic power tracks the position of the sun and generates power effectively. This idea might significantly reduce the amount of energy used by the street lighting system. The Arduino-based charging station's provision of power outlets satisfies the emergency power needs in many remote areas and urban areas etc. These technologies are the stepping stones for switching into pollution free green energy mission.

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