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Energy Generation by Using Ultraviolet Radiation Emitted By Electric Arc Welding

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Abstract— **solar photovoltaic panels have been used in connection with the LED lights (load). This set up is placed near the electric arc welding process in open and isolated environment and reading were taken while welding was performed. Hence available amount of effective irradiance can be converted into energy by use of solar photovoltaic panels. It includes a UV-light-into-electricity conversion device and an LED lights. The Welding operation Zone has a Welding apparatus for welding a work piece. This Welding apparatus generates strong UV light during a Welding operation. The UV-light is converted into electricity when absorb by the device. Finally, the electricity is generated by the UV-light. Hence, it can convert the harmful UV light into useable electricity. The entire structure of this invention is simple.**

Index Terms— **energy from arc welding, non-conventional energy, non-conventional energy utilization of harmful UV-rays, UV- rays to electricity conversion device.**

I. INTRODUCTION

The energy is capacity to do work. The energy exists in many forms. There are many sources of energy available on the earth. These sources are mainly classified into two types, one is conventional energy sources that are fossil fuels etc., and other are non- conventional energy sources in which solar energy, wind energy, tidal energy etc. fall.
As most of the reserved fossil fuels are used it may last up to only 200 to 300 years. A solution to this energy crises, the world is facing right now and will be facing in future also is the use non-conventional energy sources. As the major source of energy to the whole universe is the sun, the sun gives energy to whole universe by electromagnetic waves in form of light. These are nothing but ultraviolet rays differing in wavelengths.

It was found that light emitted from the arc welding has ultraviolet rays present in it. These ultraviolet rays are harmful to the human beings. For the preventing humans associated with arc welding processes it was necessary that amount of ultraviolet rays emitted should be known and must be measured to calculate energy potential they are possessing.

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In 1976 Emmett EA, Horstman SW performed series of experiments and found various factors influencing the output of ultraviolet radiation during welding. The report was published in 1976 J Occup Med 18:41-4.

In 1997 Dennis JH, Mortazavi SB, French MJ, Hewitt PJ & Redding CR performed series of experiments and came with very useful data. They found the effects of welding parameters on ultraviolet light emissions, ozone and Cr4 formation in MIG welding. It was published in 1997 Ann Occup Hyg 41:95-104.

Tsutomu Okuno, Jun Ojima & Hiroyuki Saito in 2000 made a systematic set-up to measure amount of ultraviolet radiation emitted from carbon di oxide arc welding.

There was insufficient reliable data available on the level of UVR emitted by arc welding. In particular, the effects of specific conditions have not been examined systematically. Therefore Bennett AP & Harlen F measure the UV radiation hazard to welders and it was appeared in Weld Metal Fab in October 1980 :541-9.Later to them Mariutti G, Matzeu M. carried measurement experiments and came up with magnitude of ultraviolet radiation emitted from welding arcs. The measurements were published in Health Physics in 1988 in 54:529-32.

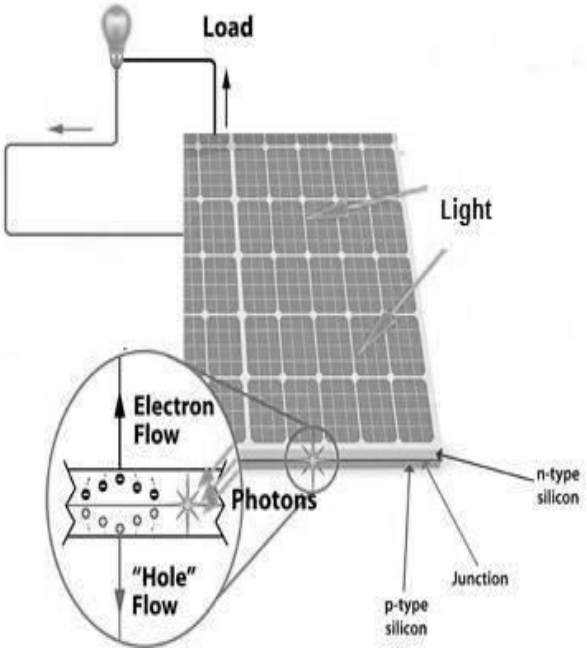
The arc welding was chosen because it was most commonly employed welding method throughout the world.

There was no data available for energy generation by welding UVR. As this concept of environment friendly energy generation or moreover capture of such energy which is going in environment as waste light have not been thought by anyone.

II. THEME OF THE PROJECT:

- As we know the UV rays emitted from electric arc is harmful in various manners. The main objective of our project is to grab these UV rays and utilize it for useful purpose.
- Nowadays welding has been widely used in industries. So by this we may reduce wastage of energy.

III. . WORKING PRINCIPLE:



PRINCIPLE OF ELECTRICITY GENERATION

When light shines on solar cell, the energy of the light penetrates into the solar cell, on a random basis; "knocks" negatively charged electrons loose from their silicon atoms. To understand this, you can think of light as being made of billions of energy particles called "photons". (These are not the positively charged "protons" located at the nucleus of atoms). The incoming photons act much like billiard balls, only they are made of pure energy! When they
Collide with an atom, the whole atom is energized, and an electron is ejected or ionized from the atom.

The freed electron now has extra potential energy, and this is what we call "voltage" or electrical "pressure". But the problem is how to get the freed electron out of the solar cell. This is accomplished by creating an internal electrostatic field near the front surface of the cell during manufacturing. The flow of electrical charges with extra potential energy or voltage is what we call "electrical current".

IV. METHODOLOGY:

Firstly we need the electric arc welding setup and the work piece to be welded, uv rays absorbing device (solar panel), mutimeter for measuring the uv rays.

Step 1: Using a dry soft cloth clean the front surface of the photovoltaic panel as it will comes in direct contact with welding light. After that fix the photovoltaic panel in the movable stand. Then position the panel with the help of movable stand. The distance between the panel and welding area must be 2ft or 5ft as required for our experiment. After that set the angle of the panel at 50-60 degrees in front of welding setup such that the maximum amount of light should be absorb by the photovoltaic panel.

Step 2: connect the multimeter and photovoltaic panel to take the readings of voltage and current. Now firstly note down the reading in open environment (day time). Infact it is an advantage still we Consider this reading as an error as our objective is to utilize the uv-rays emitted from the electric arc welding only not with the surrounding light. While taking the reading in isolated environment the multimeter will not display any readings this means no error.

Step3: further now keeping the panel in **open environment** at a distance of **2.5ft** from welding area with the help of movable stand at the required angle. Now start the welding process. The welding arc should be maintained continuously for 5-6 seconds and take the reading for **open circuit** and note down.

Now keeping the panel at a distance of **5ft**. from welding area with the help of movable stand at the required angle. Now repeat the same welding process and take the readings for **open circuit** and note down.

Step4: connect the LED lights with the photovoltaic panel now it is a **closed circuit**. further keeping the panel in **open environment** at a distance of **2.5ft** from welding area with the help of movable stand at the required angle. Now start the welding process. The welding arc should be maintained continuously for 5-6 seconds and take the reading for **closed circuit** and note down.

Then keeping the panel at a distance of **5ft.** from welding area with the help of movable stand at the required angle. Now repeat the same welding process and take the readings for **closed circuit** and note down.

Step5: further now keeping the panel **in isolated environment** at a distance of **2.5ft** from welding area with the help of movable stand at the required angle. Now start the welding process. The welding arc should be maintained continuously for 5-6 seconds and take the reading for **open circuit** and note down.

Now keeping the panel at a distance of **5ft**. from welding area with the help of movable stand at the required angle. Now repeat the same welding process and take the readings for **open circuit** and note down.

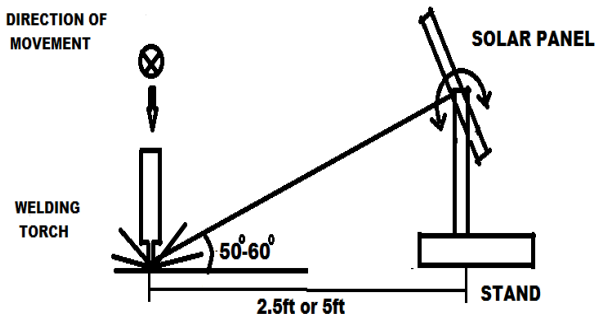
Step6: connect the LED lights with the photovoltaic panel now it is a **closed circuit**. further keeping the panel **in isolated environment** at a distance of **2.5ft** from welding area with the help of movable stand at the required angle. Now start the welding process. The welding arc should be maintained continuously for 5-6 seconds and take the reading for **closed circuit** and note down

Then keeping the panel at a distance of **5ft.** from welding area with the help of movable stand at the required angle. Now repeat the same welding process and take the readings for **closed circuit** and note down.

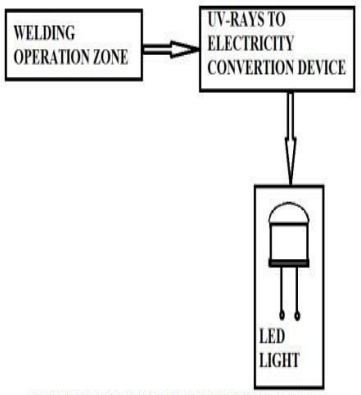
V. EXPERIMENTAL SETUP:

The arrangement of this setup is given below:

The photovoltaic panel is arrange in the correct position with the help of movable stand generally at 50-60 degrees in front of the welding setup. Here the distance between the welding setup and the panel is set at 2.5ft and 5ft.



SCHEMATIC REPRESENTATION OF EXPERIMENTAL SETUP



BLOCK DIAGRAM OF EXPERIMENTAL SETUP

- UV-light-into-electricity conversion device (solar panel)

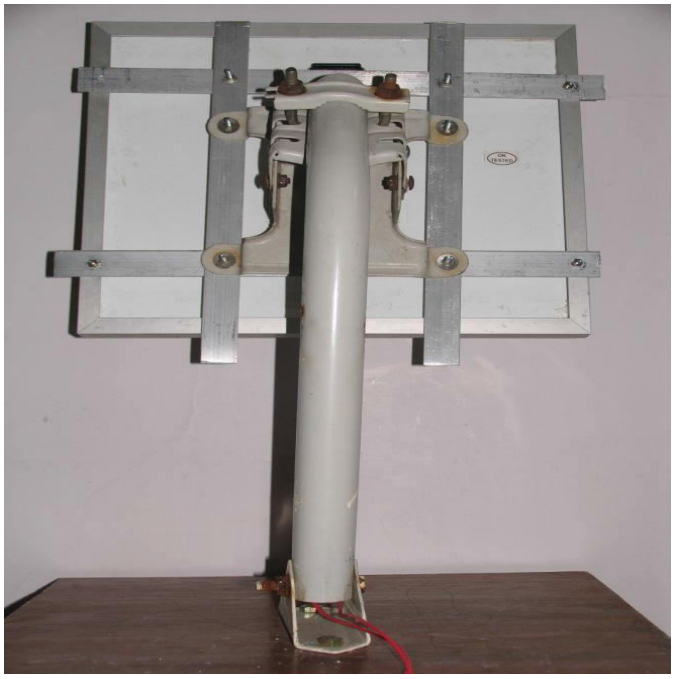
The photovoltaic panel or solar panel is set or fix in the desired position with the help of movable stand at prescribed angle i.e. at 50-60degrees from the work piece or plate And the distance of the solar panel is maintained at 2.5ft and 5ft from the welding setup.

It was found that light emitted from the arc welding has ultraviolet rays present in it. These ultraviolet rays are harmful to the human beings. For the preventing humans associated with arc welding processes it was necessary that amount of ultraviolet rays emitted should be known and must be measured to calculate energy potential they are possessing.

IMAGES OF SETUP

FRONT VIEW:

BACK VIEW:



- Welding setup:

The welding setup has electrodes, holder to hold the electrodes, welding machine, welding suit and goggles.

During welding the ultraviolet radiation emission takes place .here the welding arc were struck in the open and isolated environment for 5-7sec. the welding process is done continuously for 5-6sec.

With the help of mutimeter we measure the voltage and current. This meter measures voltage in range of 200m DCV to 1000 DCV and current in range of 200µ DCA to 200m DCA and ignores the radiation of frequency above 50Hz where it does not response

While during welding process the precautions should be taken by wearing the welding suit because the rays emitted during welding is harmful.

OBSERVATION:

FOR 5W SOLAR PANEL :

a) Open circuit reading for duration of 5-7 sec. (open environment)

Distance	Voltage(v)	Current(amp)	Power(W)
2.5 ft	9.03	-	-
5 ft	8.05	-	-

b) Closed circuit (2 LED) reading for duration of 5-7 sec. (open environment)

Distance	Voltage(V)	Current(amp)	Power(W)
2.5 ft	5.1	0.05	0.255
5 ft	4.6	0.03	0.138

c) Open circuit reading for duration of 5-7 sec. (isolated environment)

Distance	Voltage(V)	Current(amp)	Power(W)
2.5 ft	4.3	-	-
5 ft	4	-	-

d) closed circuit (2 LED) reading for duration of 5-7 sec. (isolated environment)

Distance	Voltage(V)	Current(amp)	Power(W)
2.5 ft	4.3	0.04	0.1688
5ft	4	0.02	0.08

FOR 10 W SOLAR PANEL :

a) Open circuit reading for duration of 5-7 sec. (open environment)

Distance	Voltage(V)	Current(amp)	Power(W)
2.5ft	16	-	-
5ft	11.5	-	-

b) Closed circuit (4LED) reading for duration of 5-7 sec. (open environment)

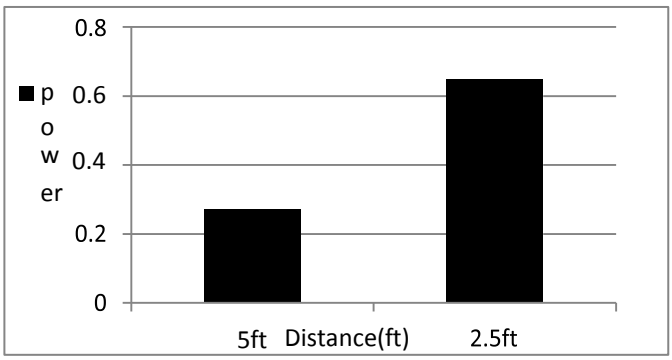
Distance	Voltage(V)	Current(amp)	Power(W)
2.5ft	13.0	0.05	0.65
5ft	9.1	0.03	0.273

c) Open circuit reading for duration of 5-7 sec. (isolated environment)

Distance	Voltage(V)	Current(amp)	Power(W)
2.5ft	14.8	-	-
5ft	11.9	-	-

d) closed circuit (4 LED) reading for duration of 5-7 sec. (isolated environment)

Distance	Voltage(V)	Current(amp)	Power(W)
2.5ft	11.0	0.08	0.88
5ft	7.6	0.04	0.304



VII. CONCLUSIONS

The effective irradiance at 25cm from the arc of electric arc welding is in the range 6.454-13.267 W/m^2, for 50cm it is 5.23-10.26 W/m^2 and for 75cm it is 3-6.83 W/m^2 from the arc under the non-stable conditions. The corresponding permissible exposure time per welding operation is only 1 minute, suggesting that UVR from electric arc welding can be used to generate electricity and also it is hazardous for the eye and skin.

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