Electroluminescent Display Panel

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***Abstract*—We made a model for Electroluminescent Display panel that can work with solar energy. And we can use it as a replacement of Advertisement Board. So by our project we are trying to replace the existing market of Advertisement board. In advertisement board market they used poster to advertisement so in day time you can see easily what is written on poster but at night time they have to have some back light so that poster can be visible. So for that purpose in conventional market people use LEDs (Suppose they are using $10W$ LED). For same purpose we can use Electroluminescent ($5mW$ per ft square) display panel and stick the advertisement poster on the ELD panel and this is so much power efficient as per our calculations our model can work for continuously $20,000hours$ after full charge the battery. We are operating ELD display panel at $220V$ and $50Hz$. The brightness of ELD panel is dependent on applied voltage and frequency so as we increase the frequency or voltage brightness of ELD increases. So it is 2000 times more power efficient then LEDs and the life time of ELD panels are also more than LEDs and because so less power consumption we can use this ELD panel in rural aresas with small power source.**

***Index Terms*—Electroluminescent Display (ELD),Light Emitter Diode(LED),Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET),Direct Current(DC),Aleternative Current(AC)Liquid Crystal Display(LCD).**

I. Introduction

ELECTROLUMINESCENT display panel is flat panel that emit radiation of visible light range so in out project we are making this panel solar powerable so that for advertisement purpose we can use this panel in rural and remote area where electricity is not avaiable.And these displays are so much power efficient and chipper so these display can be the future of advertising market. And it's light is very soft for eyes. So it is a better replacement of LEDs and LCD.

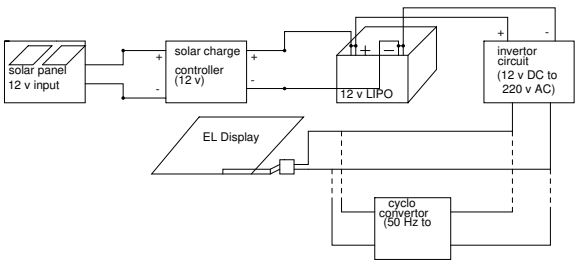

Fig. 1. Shemetic diagram of our Electroluminescent display panel

The major components which are used for making the device and has a major role in project are discussed here:

A. Solar Panel

Solar panel is basically combination of smaller units called photo voltaic cells. And when photons(energy particle of light) from sunlight strikes on solar panel it they gives there energy to free electrons it's generate a flow of electricity(basically flow of charge).

Fig. 2. Solar panel for charging the battery so that we can use it in night

B. Charge Controller Circuit

A charge controller or charge regulator limits the rate at which electric current or electric charge is added or drawn from electric batteries. It prevent battery to overcharge or we can say provide a protection from over voltage. And it's also prevent the battery to discharge the battery at night time because at night time voltage at solar panel is lower than the battery's voltage . Basically the main purpose of charge controller is to increase the life span of battery .

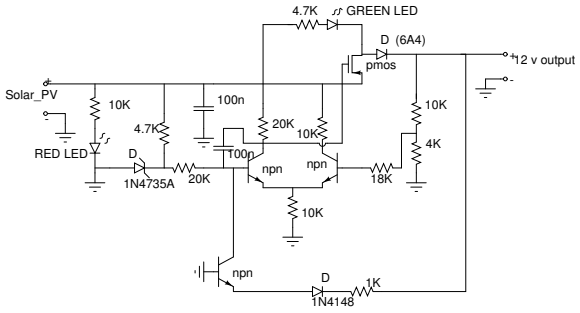

Fig. 3. Charge controller circuit for charging the battery and regulate the voltage

C. Inverter

This circuit is used for getting desired output AC voltage from DC voltage. It contains switching mosfet pair , for change the DC to high frequency(In our case it's $44KHz$) and small voltage (Lower amplitude) AC waveform(in our case it's $4V$) and a transformer for boost up the voltage, and a rectifier circuit for decrease the frequency at same voltage. So by using this Inverter circuit we got our desired usable output for ELD display panel.

D. Cyclo Converter Circuit

A cycloconverter circuit is used for increasing or decreasing frequency of an AC waveform of high voltages using high power MOSFET or thyristor or triac . Cyclo converter circuit doesn't change the amplitude of voltage.

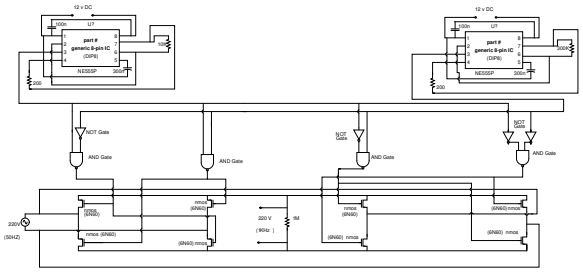

Fig. 4. Circuit of cyclo converter for increasing the frequency

It only changes frequency of AC waveform by using switching operation which is aquired by giving pulses at GATE terminal at working component of cyclo converter. There is two type of cyclo converter:

1) Step Up Cyclo Converter: It increase frequency of AC waveform and we get incremented frequency of AC voltage without any change in voltage.

2) Step Down Cyclo Converter: It decrease frequency of AC waveform and we get decremented frequency of AC voltage without any change in voltage.

There is two difference between step up and step down cyclo converter. First is we give low frequency pulses than input frequency to gate terminals in step down cyclo converter and in step up cyclo converter , we give high frequency pulses than input frequency to gate terminals . Second one is we see output across a combine impedance (resistor and inductor) in step down cyclo converter and in step up cyclo converter , we see output across a single resistor.

E. Electroluminescent Display panel

Electroluminescent display panel is a flat panel display and we can make it by sandwiching a layer of Electroluminescent material (GaAs) in between two conductor layers. When AC current flows or we can say when AC electric field generates the electroluminescent material emits radiation in the form of visible light. And one of the conductor layer must be transparent or other one should non transparent so we can see the emitted light. When we supply a strong AC electric field through this conducting layer , atoms in insulator get excited and achieved higher energy level. When atoms comes in lower energy level , than they emits energy in form of photons with specific frequency. With changing the electroluminescent material we can control the energy of photons(color of emitting light).

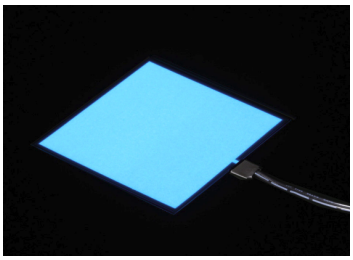

Fig. 5. Electroluminescent display panel that emits light

II. Appartues Required

Sr.No.	Apparatus	Quantity
1	12V SPARKEL solar panel	1
2	12V /1.3AH Lipo rechargeable battery	1
3	Step-Up Transformer (4V to 220V, 44KHz)	1
4	Bread Board	4
5	FWDZ 12V DC fan	1
6	AND and OR gate	1
7	NE555P timer IC	1
8	6N60 n-MOSFET	8
9	FEQ switching MOSFET	2
10	IRF9630 pMOSFET	1
11	Fuse	1
12	HER205 rectifier diode	1
13	Red and Green LED	1
14	1N4148 diode	1
15	Resistance (values are shown in circuit diagrams)	20
16	Capacitors (values are shown in circuit diagrams)	10

III. Working Procedure Of Our Project

Our ELD panel is working on $220V$ and $50Hz$ frequency so for that we followed following procedure. We took a solar panel of $12V$ that can give us $15V$ to $21V$ variable voltage dependent of intensity of sunlight and angle of sun with normal of solar panel surface. So for charging our battery we need a constant voltage (better for battery's lifespan) so to regulate the voltage we made a Buck-Boost charge controller circuit that can give us constant voltage for charging the battery in case of low voltage in boost the voltage and in case of high voltage it reduces the voltage . After charging the battery we have $12V$ DC so now our task is to change it to AC and increase the voltage amplitude. So for that we made a inverter circuit so in this inverter circuit we made $4V, 44KHz$ AC current using switching MOSFETs and then we used a step-up transformer to increase the amplitude of our input. And now we can use this AC voltage to operate our ELD panel. And we know that the brightness of ELD panel is dependent on operating frequency so for that we used a cyclo-converter circuit that can increase the frequency without changing the amplitude of voltage.

IV. Results And Discussion

We got working model of Electroluminescent Display panel that is working on $220V$ and $50Hz$ frequency. And it's power consumtion is only $5mW$.

TABLE I
COST REPORT OF OUR PROJECT

Sr.No.	Name of components	Cost
1	Display	200
2	12V /1.3AH Lipo battery	400
3	Step-Up Transformer (4V to 220V, 44KHz)	400
4	cyclo conveter circuit	460
5	DC Fan	30
6	Solar panel	1000
7	Total	2490

V. Conclusion

ELDs are chipper and power efficient and can be usable for various purposes. And we can save a lot of energy using these ELD displays.

A. Advantages Of Our Electroluminescent Display Panel

1) Very low cost as compare to LCD and LED.
2) 2000 times more power efficient then LEDs so power consumption is very low.
3) For advertising purpose we just want to show the content that is written on the poster and ELD panels are giving soft light compare to the LEDs, in LED case light is too bright so that is just waste of power.
4) Working life of ELD panels are too long and as our calculation after full charging the battery we can use these panels for $20,000$ Hours.
5) ELD panel don't required any maintenance after making once they can work for long time without any interruption.
6) It is solar powerable so in hilly area or rural area where electricity is not available we can use these ELD panels there also.
7) It is reliable also and we can change our advertisement just my remove the existing poster from panel and stick the another poster on ELD panel so it is easy to use also.

B. Application

1) Bill Boards
2) Rail sign boards
3) Cab advertisement
4) Car decoration
5) Display stands
6) Number plate of vehicles

Fig. 6. Number plate of a car made by using Electroluminescent display panel

7) Bus stop

Fig. 7. Route of bus written by using Electroluminescent display panel

8) Floor graphics

Fig. 8. Decorated a sheet using Electroluminescent display panel

9) Reception desk and for various kinds of posters.

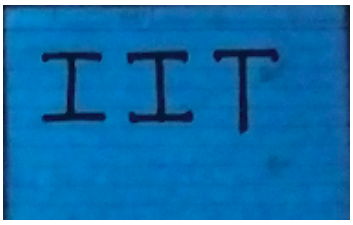

Fig. 9. Name of IIT written by us using Electroluminscent display

VI. Source of Error

For increasing brightness of ELD panel we have to increase the frequency so for that we used Cyclo-Converter circuit so in that we used 6N60 nMOSFET that can work till $600V$ but for that we have to use some heat sink and some insulators but they are not available in Mandi so we used that circuit without using them so first we got 987.4 Hz but after some all MOSFET got burned.

Acknowledgment

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References

[1] Behzad. Razavi, *Design of Analog CMOS Integrated Circuits*, Mc Graw Hill Education Pvt. Ltd, 2nd Edition 2017.
[2] Solar panel Image [ONLINE] Available: https://www.urjakart.com/solar/solar-panels. Accessed:2017-05-18