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Highway Light Energy Saving With Respect To Time

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ABSTRACT: The Highways lighting is one of major components in total energyconsumption in cities & outside areas. The paper is focused on a concept of highwaylights control systems and function organization with remote &time-based monitoring to reduce maintenance costs and energy consumption. We all are already aware energy scenario in entire world, Non-renewable rapidly destroying it's directly proportional to energy generation. So, it's ourresponsibility to save energy.

I. INTRODUCTION

The Highway lighting installations provide citizens with safe roads, stylish and inviting public areas and enhance the security in their homes, businesses and citycentres. They are very important elements of infrastructure in cities highway around the

world. Unfortunately, according to different reports, the highway lighting is one of thebiggest electrical energy consumptions. For this reason, we are implementing time & motion-based system for HighwaylightingThat saves our energy and cost also increase equipment life cycle, from this reason also maintenance costs and breakdown time decreases in our project which is the energy saving by the highway lights through motion sensing, we will get to know that through the energy saving and census. we can save the energy of the street light which are activated in whole night so with the help of PIR, switches, Relay, SPTP, IR sensor and one slide switch we can reducethis energy saving to a limited amount through the motion sensor we can limit the light of the sensor to a particular distance the main component of our project is DIP switch SPST relay DPDT relay SPDT, PIR sensor white LED and slid switch in thisproject we need a help of ID no through which we can program a certain situation so that we can activate our sensor 10th the motion happen. Another side we can see the Timer relay circuit that means we can operate the circuit or our system by givenprogrammed time. So, from this we designed a smart and energy saving system, also if required we can add a multifunction meter for calculation of consumed energy or any electrical data.

II. DESCRIPTION OF THIS PROJECT

So, let's now its times to detailed discuss about this project, we are usingprogrammable timer for time-based lights controlling and other side one method isPIR motion detection sensor. Motion sensor works when any, body passes fromthere then sensorgives control command to Relay or contactor after then contacts.Refer to circuit diagram in which the circuit divided into two parts-

1 Timer based control circuit-

In timer based controlling we are using GIC67DDT9 programmable timer. In this circuit operation based on programmedbased set time that mean we can set ON and OFF times for all outputs.Only thattime our load (lights) can power on.

• GIC 67DDT9/0 timer-

It's 16/25 programmable mode timer, which we can easily use to maintain time-based circuits, so it's easy to use this in ourhighway lights circuit. this timer we can easily understand by its features. Which are as follow-

- Highly accurate RTC with low drift.
- Flexibility writing 25 ON/OFF & 16 ON programs.
- Easy to reset and rewrite and Easy text LCD interface for daily/weekly programming.

- CRONO: ideal for highway or street lighting.
- Day exclusion programming (FRI-SAT, SAT-SUN).

GIC 67DDT9/0 timer is shown here-

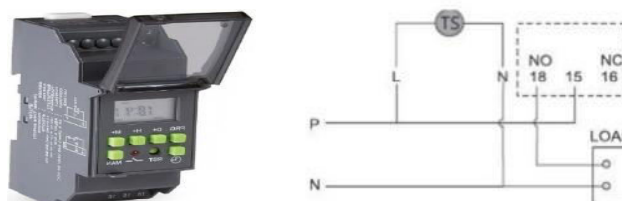


Fig.1 GIC 67DDT9/0 timer and internal circuit

Clock setting & Programming

 + MAN	Press clock key  & MAN key simultaneously to toggle between 12/24 hour clock mode. AM/PM
 + D+	Keep the Clock key  pressed & then press the D+ key to set day. MO/ TU/ WE/ TH/ FR/ SA/ SU
 + H+	Keep the Clock key  pressed, then press the H+ key to set hour. 00-23 - in 24 Hour Mode 01-12 - in 12 Hour Mode
 + M+	Keep the clock key  pressed, then press M+ key to set min. 00- 59

2. PIR based circuit

This circuit controlling based on PIR sensor, in which when anybody passes Infront of this sensor it will gives an O/P signal, that signal we are using for highway lights controlling. We setup these sensors on highway roads and connect to our lights control circuit. This sensor we can set for particular distance, one sensor is used for 500mtr and we giving OFF timers for each PIR. Means after un-sense the sensor circuit will off after certain set time.

PIR Sensor-PIR sensor is a small low-priced passive infrared motion detector sensor. As the name suggests it doesn't emit radiation but it detects the changes in infrared radiation of the source. It's very facile to use and hence used in diverse applications. It works on the principle that whenever it detects a change in infrared radiation, it generates a digital output signal.

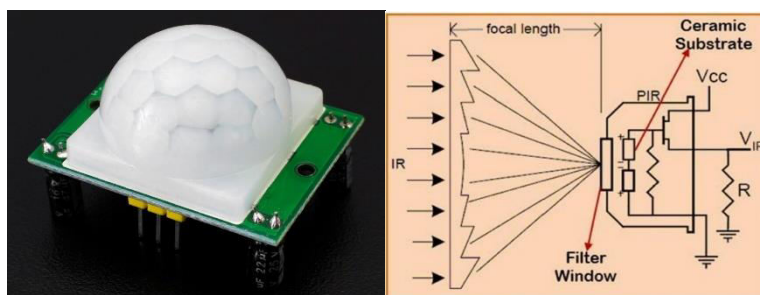


Fig.2 PIR sensor and its internal structure

III. REQUIRED APPARATUS

In which having required components which is required to complete this circuit.

- **SMPS**- we required 12V, 5 amperes switch mode power supply because this circuit consist on 12VDC control supply, shown in fig.-

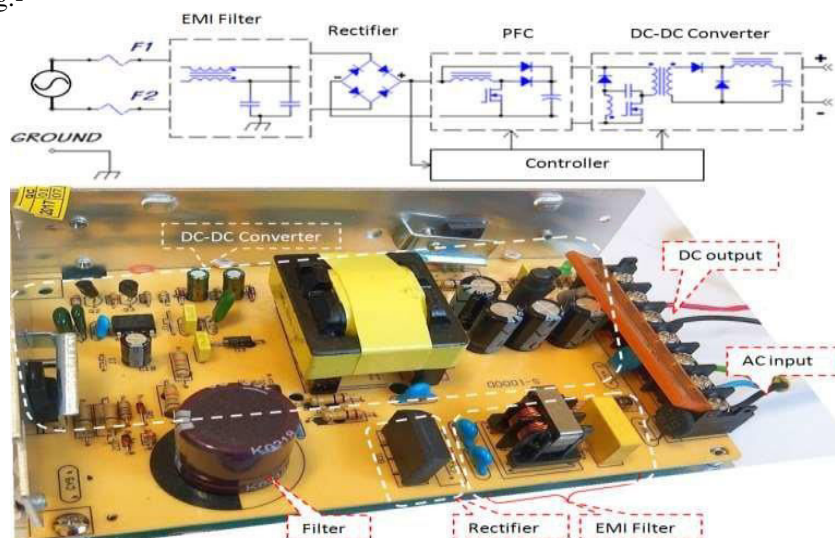


Fig.3 SMPS

- **DPDT/DPST/SPDT/SPST switch**-we required DPST/DPDT switches to complete our circuit, this type of switches uses to changeover or off any circuit. DPDT stands for Double Pole Double Through Switch which is Sown in fig.

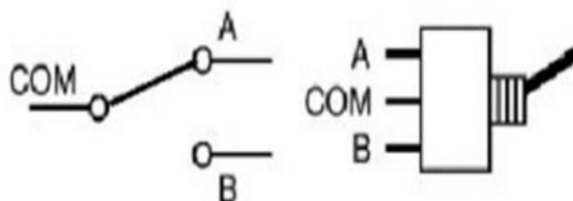


Fig. 4 DPDT Switch

- **Relays**-A switch is a component that opens (turn off) & close (turn on) an electrical circuit. Whereas, a relay is an electrical switch that control (switch on & off) a high voltage circuit using a low voltage source. A relay completely isolates the low voltage circuit from the high voltage circuit. Control input terminals are two input terminals of a relay that controls its switching mechanism. A low power source is connected to these terminals to activate and deactivate the relay. The source can be AC or DC depending on the type of the relay. This terminal is internally connected with either of the other two terminals depending on the state of the relay. A relay is shown in fig.-

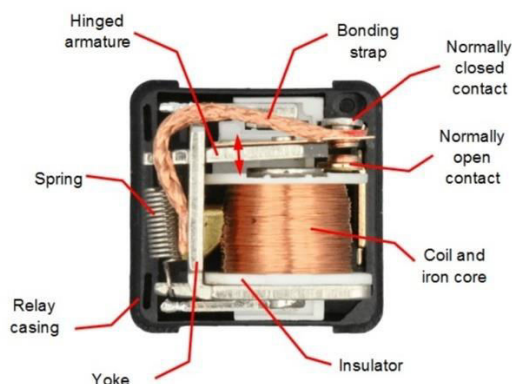


Fig.5 Relay

- Timer relay module**-It's relay module circuit which is used for timer delay for any circuit. in our circuit we are using this for PIR sensors circuit we need to any lights ON minimum 40-50sec, so we need to apply some time delay that why we are using this. Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE and SI do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable. This circuit consist of one relay and programmed IC, in which we can easily adjust TOFF time for circuits. When a body passes through the PIR sensor after suddenly output signal will off and all lights will be off but we want to continue lights on for some time, this is the reason to we are using this TOFF relay module. And it is shown in Fig.-

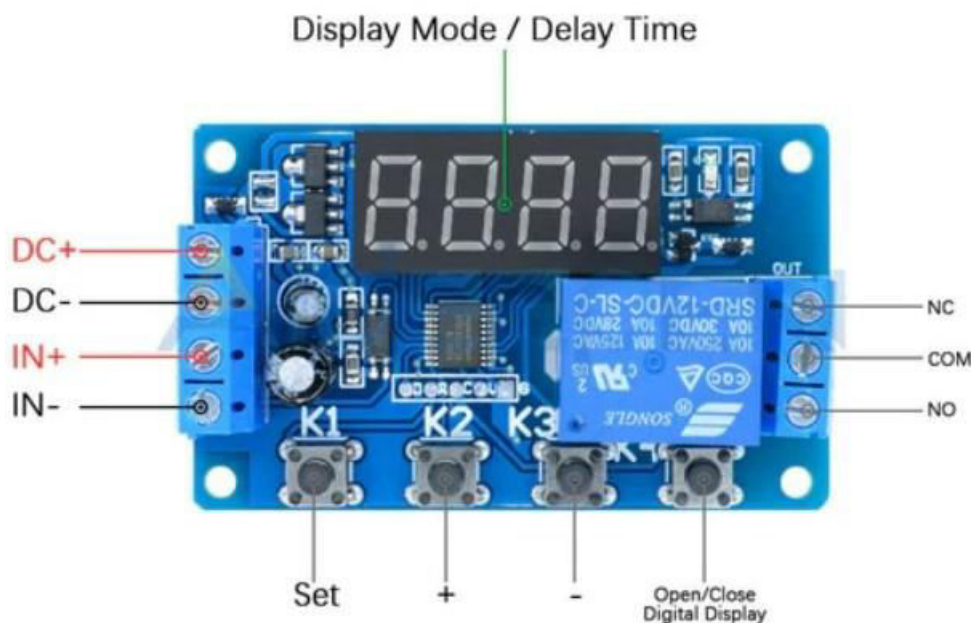


Fig.6 Timer Relay Module

- LED light**-LED lights are used in place of load to show detailed load analysis. A light-emitting diode (LED) is a semiconductor device that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The colour of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light emitting phosphor on the semiconductor device. LEDs have many advantages over incandescent light sources, including lower power consumption, longer lifetime, improved physical robustness, smaller size, and faster switching. In exchange for these generally favourable attributes, disadvantages of LEDs include electrical limitations to low voltage and generally to DC (not AC) power. LED is shown here-

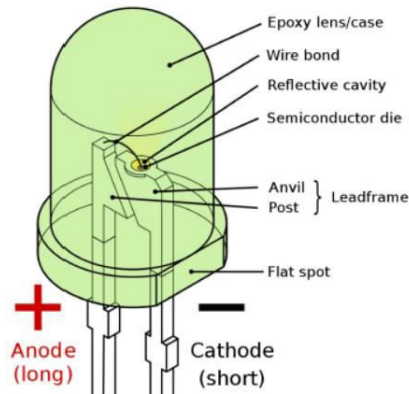


Fig.7 LED Light

IV. BLOCK DIAGRAM OF THE CIRCUIT

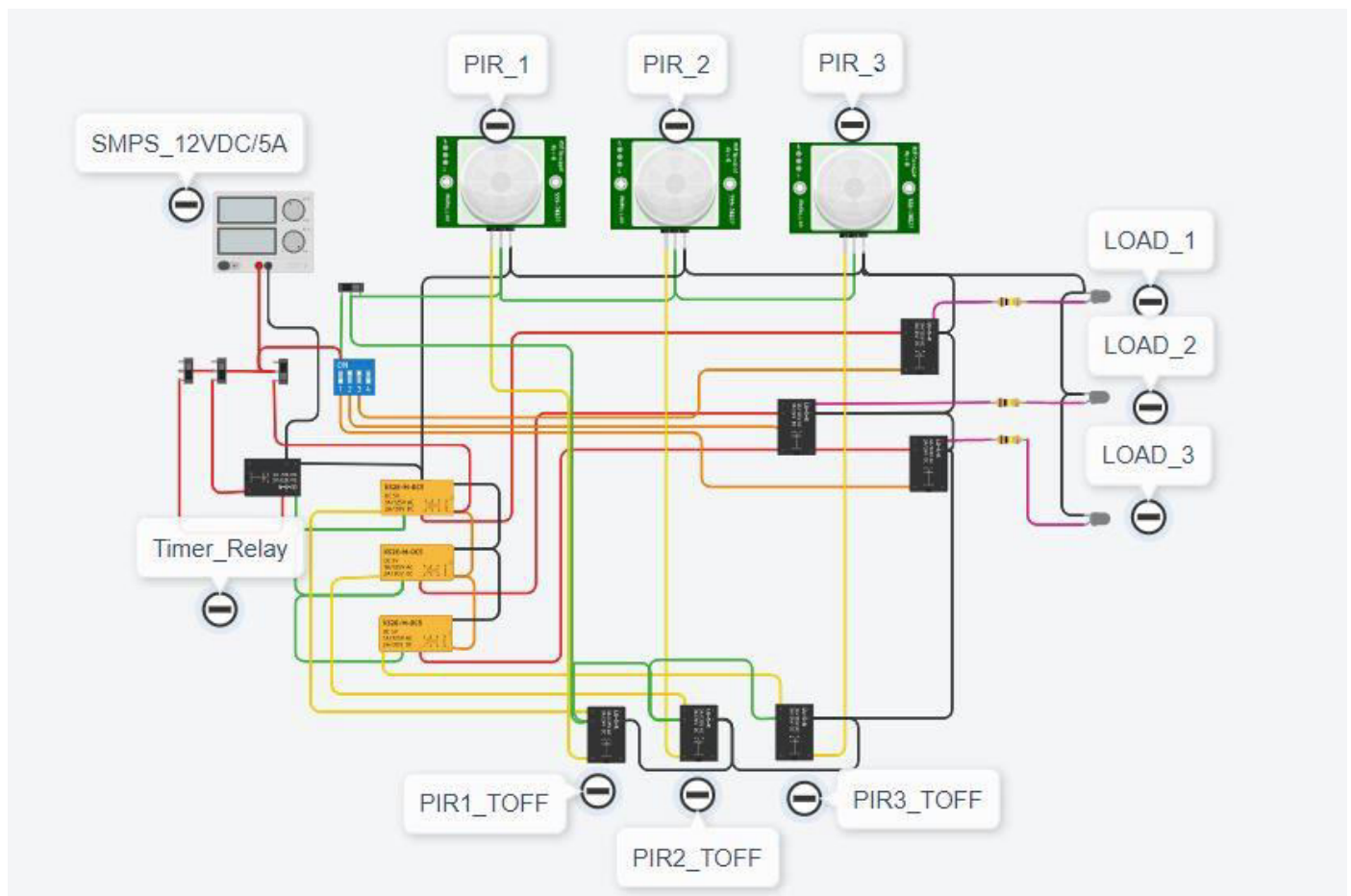
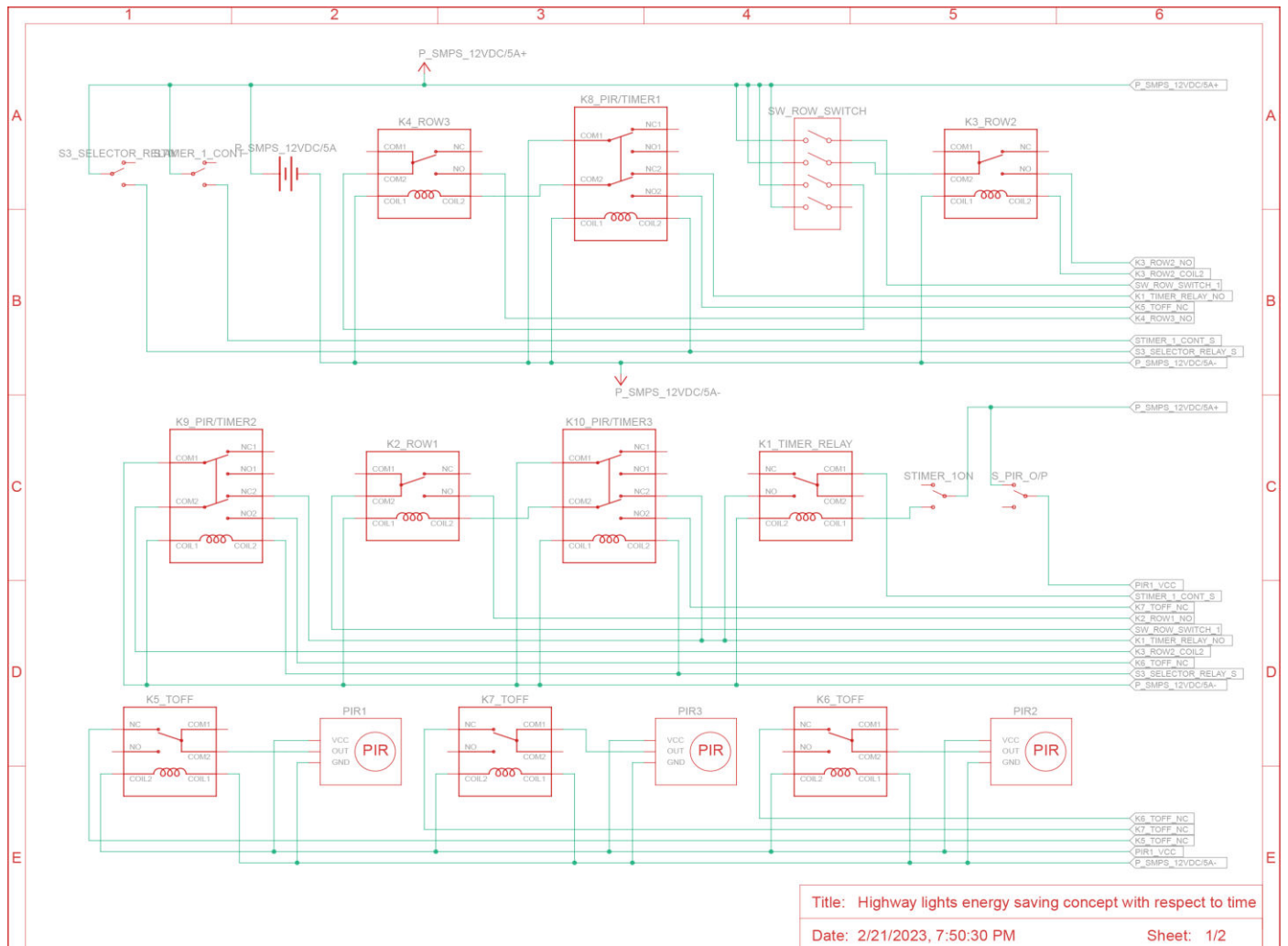


Fig.8 Block diagram of the circuit

V. ELECTRICAL CIRCUIT DRAWING



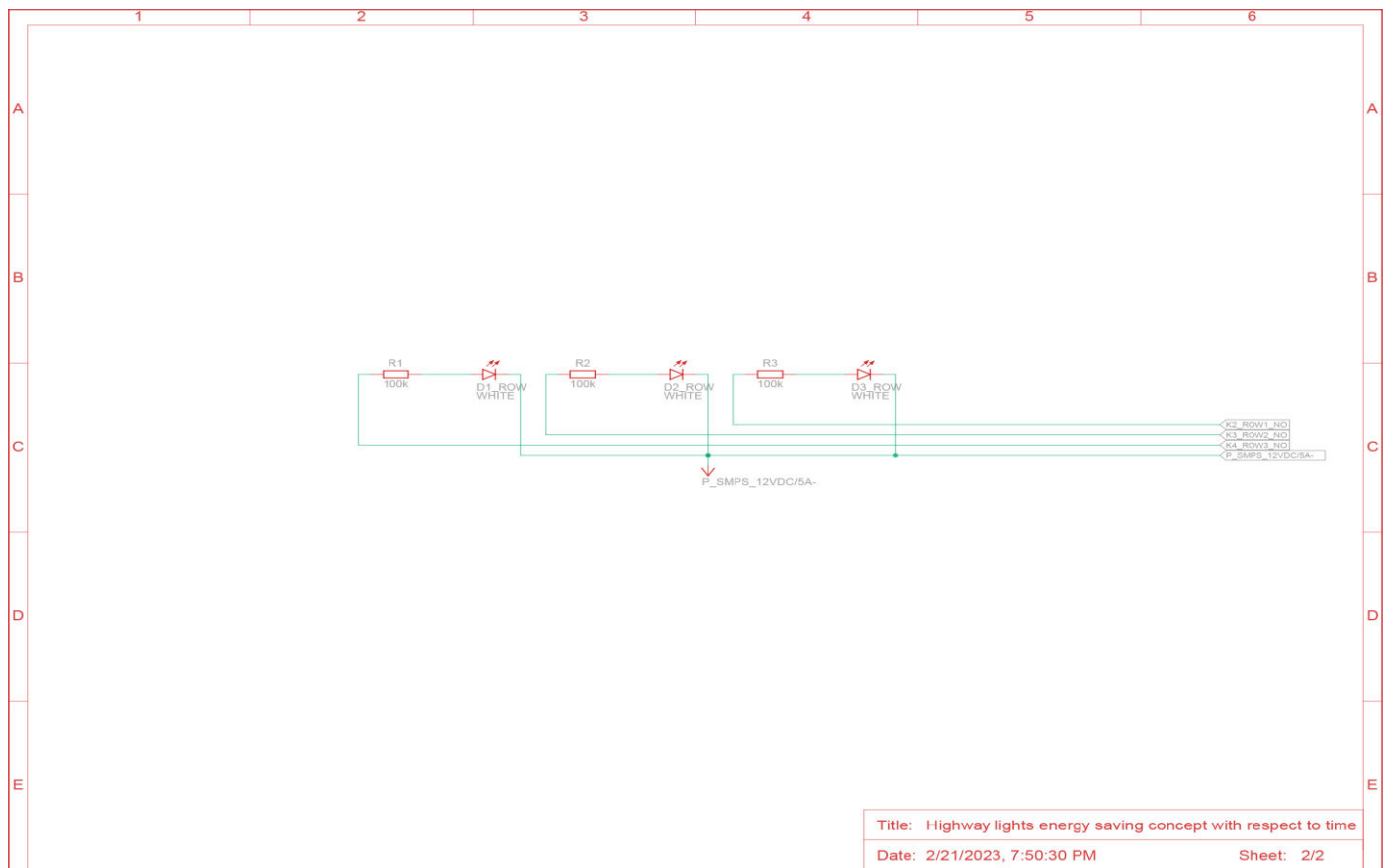


Fig.9 Schematic circuit

VI. OPERATION

According to Circuit drawing it having 24V DC control supply to control entire circuit. In this circuit main supply is supplied by 24VDC/5A SMPS. This supply is directly given to the circuit by switches as follows-

S1= Relay timer on supply

S2= Relay timer contact supply

S3= Mode selector supply for relay

K1= GIC 67DDT9 timer

K1, K2, K3= Load pick-up relays

K5, K6, K7= PIR on command relay

K8, K9, K10= PIR contact supply

Mode 1: -

In this mode based on timer relay, we can set turn on and off timer by this relay that time only circuit will operate. For this operation need follow these steps-

1. S1 should be ON.
2. S3 Should be Off
3. S2 should be ON
4. K8, K9, K10 requires to off because it PIR contact supply.

After following these steps circuit will automatically operate according to our programmed time, it is called time-based operation.

Mode 2: -

this mode is based on **PIR** sensor, according to this circuit it will operate when anybody or a vehicle (in case of actual Highway) passes through the sensor. For this operation we need to follow given steps-

1. S4= PIR supply ON
2. S3= mode selector should be on
3. SW= row switches will be ON

After following these steps surely your system will work when anybody (or a vehicle in case of actual Highway) passes through it, it's called Motion sensor based mode. In this circuit we used 3 laser led lights for the load. LED will glow when any one mode is active, if any issue in circuit the signal LED will not glow. So, we can easily trace if there is any fault in our network. For wiring we are using Red & Black single core, 0.75sqmm wire. This wire size is enough for control wirings. For actual highway and on a real level we can replace these components with large capacity components. For example- relays replaced with contactors, timer etc.

Here S1 Timer_1 ON switch is present in this circuit to supply timer relay on command, if we turn on this switch then K1 Timer Relay will be on. We will set timer for lights on and off by this relay. S2 Timer count switch needs to be on after setting the timer. This is the contacts supply of the timer relay. When timer relay is on then ON command will be given by NO contact. S3 switch is present for switching the PIR operation mode or Timer relay-based mode. If we turn ON the S3 switch then K8, K9, K10 will be ON and PIR operation mode will be operated, if take off condition of S3 switch then K8, K9, K10 will be OFF and Timer relay mode will be operated.

S4 PIR on switch adding in this circuit for PIR sensors & relay switch. If we want to turn off the PIR based mode, we turn off the S4 switch, then complete this mode is off. In series of load LED, we added 100K-ohms resistor in each LED. For overvoltage protection and current limiting. Each LED shows a particular load. Series, it's easy for any network to distribute the complete network in separate circuits so then easy to find breakdown in case of any failure.

VII. APPLICATION

- **Highway Lights:** -PIR motion based & Timer based lighting system we can easily implement at any highway lighting design. This system is very easy to implement any network. And it will improve road safety.
- **Street Lights:** -It can be easily implemented to city street lights, where it's Required and applicable.
- **Domestic Equipment's:** -It's very useful for domestic appliances; we need to make small changes according to appliance and implement them. Like- Restroom lights, room lights, AC etc. sometimes when we leave the house or forgot to turn off light or any of the electrical appliances, they consume lot of electrical energy and increase our economic burden and it also increases carbon emission in the atmosphere. It will help to reduce all those disadvantages.
- **Industries:** -This power saving concept is very useful in industries, because in industrial plant consumption is too much. That is the reason this system is needed in industries and it's very useful.
- **Public Restrooms:** -This technology is very useful in public usable restrooms. In any washroom at normal configuration. When restroom is not in use, the lights are kept glowing and waste energy and after installation of this project the light will turn ON only when somebody uses the restroom.

VIII. FIGURE AND TABLE FOR COST CALCULATION

Total consumed in month			98.4	Kwh	Cost/Day (Rs.)	29.52
Total Consumed in day			3.28	Kwh	Cost/Month (Rs.)	885.6
		charge	9	Rs		
Normal condition						
Sr NO.	Load	Rating (watts)	Avg. uses/day (hours)	Consumption/day (Kwh)	Avg. uses/month (hours)	Consumption/month (Kwh)
1	Light 1	80	11	0.88	330	26.4
2	Light 2	120	12	1.44	360	43.2
3	Light 3	80	12	0.96	360	28.8

Total consumed in month			56.4	Kwh	Cost/Day (Rs.)	16.92
Total Consumed in day			1.88	Kwh	Cost/Month (Rs.)	507.6
		charge	9	Rs		
With Energy saving concept						
Sr NO.	Load	Rating (watts)	Avg. uses/day (hours)	Consumption/day (Kwh)	Avg. uses/month (hours)	Consumption/month (Kwh
1	Light 1	80	6	0.48	180	14.4
2	Light 2	120	7	0.84	210	25.2
3	Light 3	80	7	0.56	210	16.8

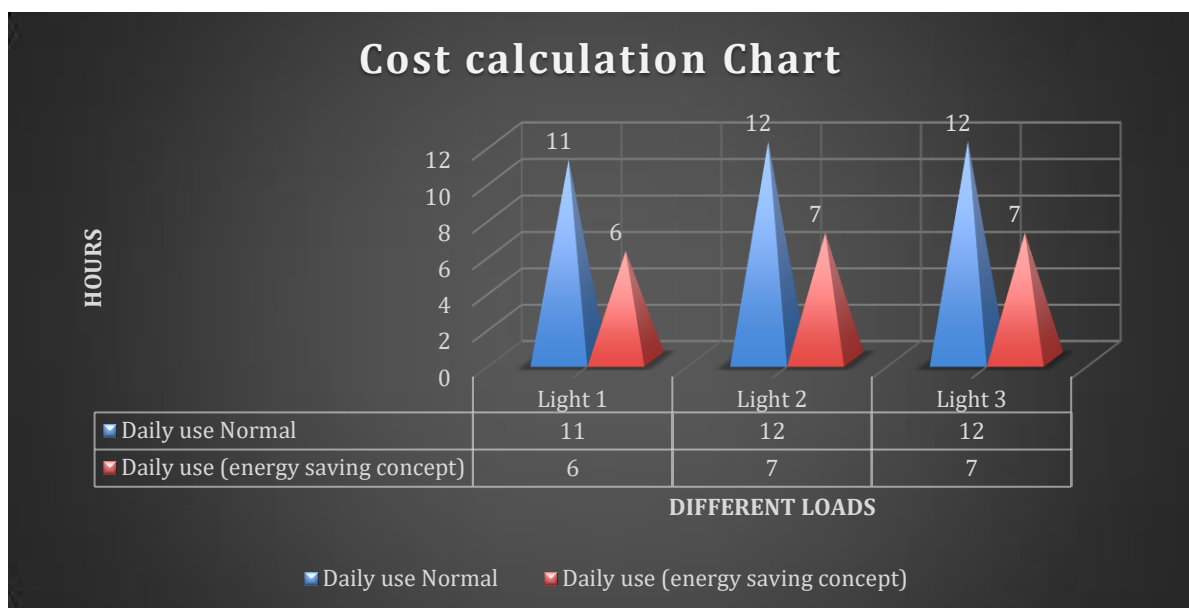


Fig.10 Cost calculation Chart



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