

Intelligent Street Lighting System

(extended version of automatic illuminators)

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Abstract: Project deals with extended version of automatic street lights. This public street lighting system is quite different compared to traditional illumination system as it enables light to travel along with you, actually a bit ahead of you. This system is more 'INTELLIGENT' than the already existing systems as citizen's safety has been taken into the consideration. We also referred it to as 'extended' as we have included a safety measures into it, which will provide a safe and secure environment for pedestrians, bicyclists and motorist during evening, night time and early morning hours when the possibilities of crime is at its peak. The 'energy efficient' attribute of the system is enhanced by making use of SOLAR PANELS to further decrease Energy consumption.

Keywords: plug and play, intelligent system, security mechanism, solar panel, energy efficient, camera.

1. INTRODUCTION

The main objective of the project is to provide Automatic street lighting system with enhanced power saving capability, accompanied with security system for citizens. The system proposed adapts the technique of 'plug and play' i. e. We are making use of an electronic kit that fits into existing street lights and turns them into intelligent street lights. The existing street lights need not be replaced by new ones rather just modified by plugging in an electronic kit which will facilitate the required functioning. Power sources are getting diminished and so the power saving is a major consideration. We want to save power automatically rather than doing it manually.

The main functions of the system is-

- The lights dims when no one is in vicinity and glows to full mode as soon as passerby comes within range, and thus, saves a lot of energy.

The street lights illuminates automatically during dark hours if there is some motion detected in the road. But during day hours, even if the motion is detected, street lights remains OFF. A timer circuit is used which provides time delay

proportional to the time constant of the 555 timer so the lamp will glow only for certain duration of time.

Our proposed system also includes security mechanism which becomes active through a switch and danger alert is send to the nearest police station or tolls (as per the availability) and Moreover, it turns ON all the street lights of that particular area. It is also accompanied by a camera for further safety purposes.

2. PAST AND FUTURE

A. History

The concept of intelligent street lighting was initially introduced in 1990s. On April 7, 2006, the first large scale implementation of street lighting system took place in Oslo (Norway) in Europe. The expected results were- reduced consumption of energy by 50 percent, improved roadway safety and minimized maintenance cost.

This Oslo project influenced other cities in Europe, thus paving way for other sustainability initiatives like E-Street initiative.

B. Future Aspect

- 1) Damage detection – signal can be generated by individual lamp post when maintenance is required as the lamp posts are capable of communicating with each other.
- 2) Traffic speed sensors - traffic speeds can be managed through dimming of street lights. During evening or night hours, fast average traffic speed could trigger dimmed street lights. This dimming effect would slowdown the speed of motorist in response, eventhough dimming level would be imperceptible to motorists.

3. INTERNAL ARCHITECTURE

A. LDR (light dependent resistor)

LDRs or Light Dependent Resistors are used in sensor circuits. It is also referred to as photoconductor, photoresistor or photo-conductive cell. Generally LDRs have high resistance of up to the 10, 00, 000 ohms, but the value falls dramatically if illuminated. They are capable of altering their electrical characteristics when comes in contact with light rays, thus they are also considered as one of the Electronic onto sensors. LDRs find application in electronic circuit designs, such as flame or smoke detector, burglar alarm, street lights and others, because of following features- low cost, rugged features and simple structure.

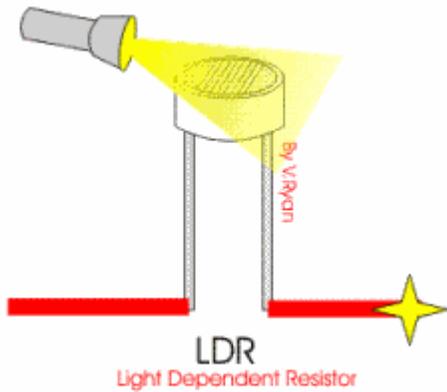


Fig. 1. LDR

B. Block Diagram

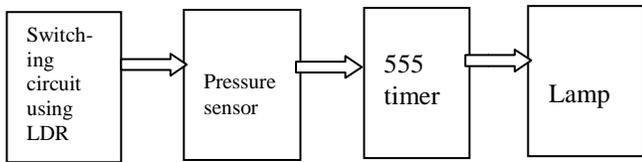


Fig. 2. Block diagram of Intelligent street light

- Switching circuit using LDR- this block is made up of transistors, resistors, LDR
- The LDR is capable of sensing visible light.
- When no light falls on the LDR, the switching circuit sends a HIGH signal. When light falls on the LDR it sends LOW signal.
- Pressure sensor- second block basically deals with working of sensor according to the output of previous block. The sensor used here is a pressure sensor.

- Timer circuit - the third block, gets triggered in response to pressure sensed by sensor. Timer circuit comprises of the 555 timer which is operated in mono-stable mode.
- Lamp- the fourth block i. e. the street lamps are connected to the output terminal of the 555 timer. During night time high output is obtained as no light falls on LDR. Any pressure sensed on pressure sensor now will trigger 555 timer which is operated in mono-stable mode. As a result, lamp will glow for some duration of time depending on time constant of 555 timer.

C. Pressure Sensor

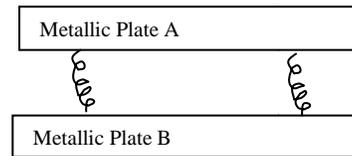


Fig. 3. pressure sensor

As demonstrated in the fig3, A and B are the two metallic plates which are connected via two insulated springs. Plate B is grounded and plate A is connected to 555 timer. Whenever force is applied on plate A, it comes in contact with plate B hence triggering 555 timer. When force from plate B is withdrawn, then two plates are disconnected i. e. plate B restores back to its own position.

D. Security Mechanism

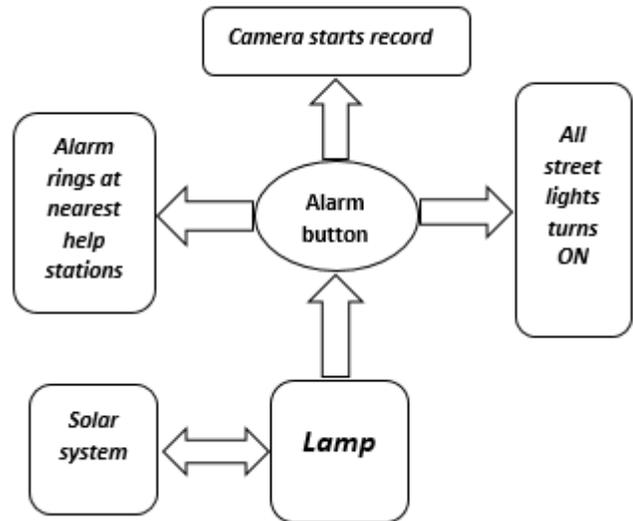


Fig. 4. Block diagram of Security mechanism

The main key feature of our security mechanism is the alarm embedded at certain locations on the street, following the same path as that of the street lights.

- The button in the system, when pressed, activates alarm located at help centers which is the indication that 'help' is required at that specific location.
- As alarm activates, simultaneously all the street lights of that particular area (within specified range) are switched ON in order to alert the people nearby of the help required.
- Parallel to the ongoing process, camera provided at the location where alarm is pressed, starts recording the current situation for later reference if required.
- Solar panel acts as a backbone for our security mechanism. In case of power failure, solar energy collected through the panels acts as a backup, to ensure that people's safety is not compromised in any case.

4. A BETTER ALTERNATIVE TO STREET LIGHTS

A. Need

Illumination of city's street during dark hours is one of the important part of city's infrastructure. One major challenges with public lighting is that they keep on working all night even no one is around. This is the big waste of energy.

This is the problem we are trying to solve. So we need an Intelligent street light technology - a system that dims when no activity is detected but brightens when movement is detected. It automatically senses motion in the road and visible light. Use of this system helps to save energy by switching ON the street lights as and when required and it also reduces manual work at most up to 100 percent. This Technology helps in reducing Light Pollution as well.

Further, the safety mechanism involved will lead to decrease in crime rate. Safety buttons embedded on specific locations on street will allow people to send a signal for help directly to the nearest police station. Thus ensuring quick help and thus security of the people.

B. Advantages

- 1) There is lighting only where needed thus decreasing energy consumption which results in faster payback or cost recovery.
- 2) Safety mechanism included, ensures safety and security of people.
- 3) Reduction of light pollution.
- 4) Dimming capability allowing to dim each light individually as activity level decreases on street.

- 5) Reduction in CO2 emissions: with reduction in energy consumption, CO2 emission is also reduced.
- 6) Elimination of manpower to higher extents.
- 7) Maintenance of safety: since the lights are dimmed and not turned off completely, safety is maintained.
- 8) Plays a part in sustainable development.

C Analysis

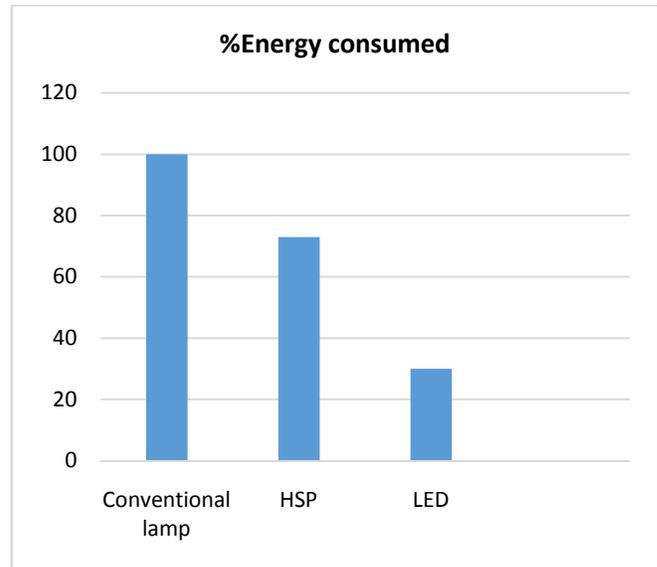


Fig. 5. Energy consumption index of various sources of light

The above graph represents the energy consumption index.

- Analysis of graph indicates that in comparison to conventional lamps, HSP (High pressure sodium) lamps consumes 25- 35% less energy.
- LED (Light emitting diode) lamps stands out both the above mentioned sources as 50-60% more energy is saved in comparison when HSP is used and the count increases to 70-80% in comparison to the conventional lamps.

D. Drawbacks and its solution

- Drawbacks of this project are –
 - Initial cost
 - Maintenance
- Initial cost would not be a problem if the long term benefits like faster payback is considered.

Cost of the project can be minimized through good resource planning and advancement in technology.

5. CONCLUSION

This project is a cost effective as the components used such as LDR, Pressure Sensor etc. are of low cost.

Approximately 80% of energy will be saved by implementing this project, thus making it ecofriendly.

This project is also effective in tackling one of the major problem faced in today's world scenario – saving of energy. Other than street lights, the project can find application in parks, industries, campuses, parking lots etc.

Thus, 'Intelligent Street Lighting System' lends a hand in lighting the way to Safe Street, healthier environment and better bottom line.

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