Intelligent Street Light Controller

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Abstract-*Power saving is very important factor in this modern age. Because as the demand for electric power supply increases with increase in human population and number of electricity consuming appliances, the generation of electric power cannot be increased with same rate as of demand. This has become very important issue as we cannot afford electricity power supply cut-offin some areas of applications, to save the electric power. So we need to use such technology and equipments which will not consume unnecessary amount of energy and resolve the electric power demand and supply issue. These equipments should make use of electric power whenever it is required only and not as long as power supply is ON even if it not needed, therefore, providing power saving and avoiding wastage of electric power . Such a system can be constructed by using microcontroller and any set of devices according to application. This type of system can be implemented in case of street light lamps.Therefore, we used Intelligent Street Light Control which is based on the idea that street light glows only when it is required and provides intelligent power saving. The street light glows only when it detects any vehicle on a road and intensityof sunlight is low.*

(Keywords: Street Lights, Power saving, PIR sensor, Light intensity, LDR, etc.)

1. INTRODUCTION

Intelligentstreet light controlleris a power efficient system which is based on a basic idea of limited power usage which consumes less power than ordinary street light system and therefor is an auspicious system. Ordinary Street lights continues to glow as long as the power source is connected to it and remains ON until power supply is disconnected even when no vehicle is on a road and it is not neededstreet light to glow.And therefore, ordinary street light system consumes more electric power than necessary and wastage of electric power occurs which cannot be ignored. But in Intelligent Street Light system, Street light glows only when it is neededto glow that is when some vehicle or object is on a road and intensity of natural light is low. Rest of the time, street light does not glow even when the electric power supply to system is ON when it is not actually necessary. Therefore, this system providespower saving and helps to have a better future for next generation. The operation of this systemis based on the two principles which are"Object detection" and "Light intensity mensuration".It is microcontroller based system which uses LDR (Light Dependent Resistance) and PIR (Passive Infrared) sensor for its operation. Object detectionis done by PIR sensor and light intensity measurement is done by using LDR. Implementationof this system is very simple with low cost and also a system is easy inmaintenance.

2. OVERVIEW OF INTELLIGENT STREET LIGHTS CONTROLLER

When the system detects any moving vehicle or any other moving object on a road, it turns ON the street lights for certain period of time. At other times, it does not glow even when the electric power supply is connected to it. Also one more condition is there for the street lights to glow which is the amount of light intensity present. Therefore, Street light glows only on detection of moving vehicles and when intensity of light is lower than pre-determined value. So basically, street light glows only when it is necessary and does not consume electric power at other times when it is not necessary. Operation of "Detection of vehicle" and "Measurement of Light Intensity" is explained below:

2.1 Detection of Vehicle

Detection of vehicle on a road is doneby PIR (Passive Infrared) sensor. These sensors are mounted on the same side of a road where street lights are also mounted. PIR sensor detects infrared radiation emitting from vehicle or any other objects as every object emits some amount of radiation. Therefore, these sensors can be used in motion sensors. This can easily detect objects in the range of fifteen feet. Whenever a moving vehicle or any other moving object passes through the range of PIR sensor, it gives output as high input to the microcontroller. Microcontroller in turn, gives response to output of PIR sensor when light intensity is below certain limit by turning ON the street light for certain period if intensity of natural light is low. PIR sensor is used because it does not need any transmitter source as it receives infrared transmissions from bodies.
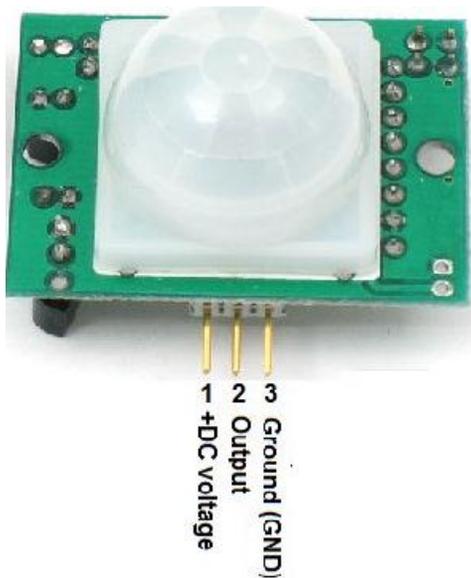
2.2 Light Intensity Measurement

Measurement of intensity of light is done through LDR (Light Dependent Resistor). LDR is a device whose resistance varies with the intensity of light falling on it. Its resistance decreases with increase in the intensity of light falling on it, as the charge carrier gets enough energy from light to move. In the time of darkness, the resistance of LDR is in the range of mega ohms, while in the presence of light it decreased to few hundred ohms. Therefore, when intensity of sunlight falling on LDR decreases its resistance increases. So at the time of a day, when sunlight gets poor, LDR senses it and provides high resistance in a circuit. So, LDR supplies current to the microcontroller in accordance to the time of a day. And microcontroller in turn gets in standby position to turn ON street lights when LDR provides current when intensity falls below certain limit. Now if any vehicle is detected by PIR sensor, system turns the Street lights ON. One can also control intensity of street lights, like in case if there is complete dark situation with no natural light then street light will glow with maximum brightness. And when there is some amount of natural light present, street light will provide brightness in accordance with intensity of natural light as the current from LDR depends upon intensity of natural light. This variation in brightness is within certain range, minimum value of which can be set in system
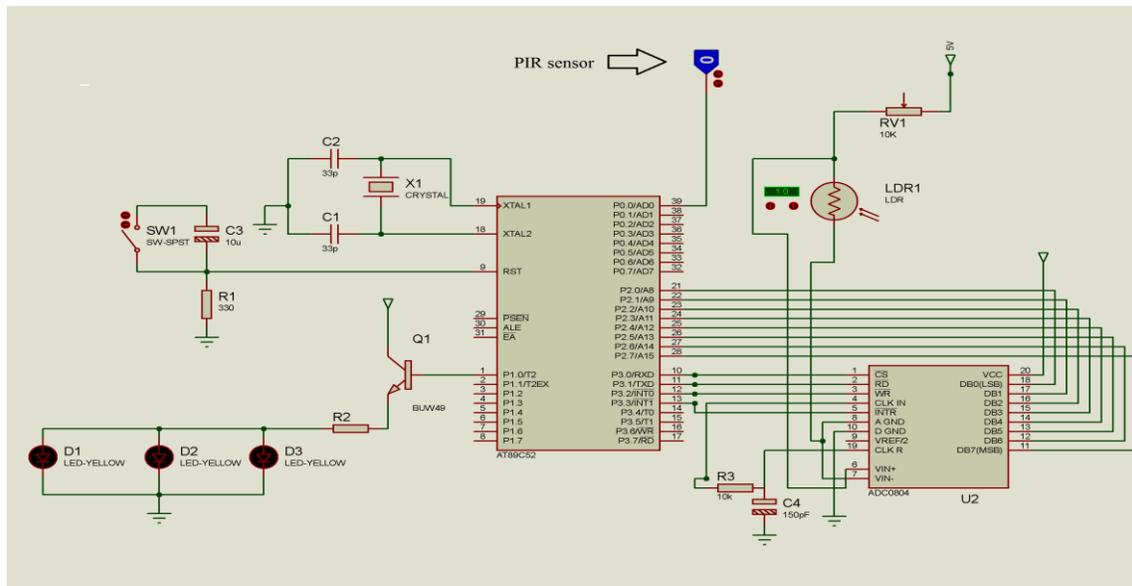
3. DESIGN AND WORKING OF A SYSTEM

Fig -3: Circuit Diagram of Intelligent Street Light Controller

3.1 Design and Connections:

PIR sensor is directly connected to 8051 microcontroller as it gives output in only two states; High and Low, as in digital form. LDR, whereas connected to 8051 microcontroller through 0804 ADC because it gives analog output as current from LDR is a function of intensity which may have many intermediate values. Pin numbers 7 and 8 of ADC are connected together and one terminal of LDR is connected to this common connection. And the other terminal of LDR is connected to the pin number 6. A potential divider circuit is formed using variable resistor while connecting LDR to ADC. As ADC provides 8-bit digital input to microcontroller, its 8 lines are connected to one port of the microcontroller. And power is supplied to LDR through this potential divider circuit.

LED's as street lamps are connected to microcontroller as three LED's together by using transistor. Transistor is used because in actual circuit power required for street lights is more than that supplied by microcontroller which is supplied by external source.. A group of LED's are used because on detecting vehicle a set of more than two street lamps should glow, so vehicle on road will get its path illuminated always. This is done by considering that speed of vehicle will be high enough that it will pass the area covered by a single street lamp quickly. On a signal road, an array of such sets of connection is used. The figure shown above is considered as a single set. At two ends of each road ordinary set of street lights are installed i.e. streets lights those glows continuously as long as power supply is given. This is very important in order to make it easy for drivers to know the exact position, curvature and width of a road and also at a turning of roads to know direction of each road for navigation. This ensures the safety and avoids any possible damage that would come if driver do not know these details about road.

3.2 Working of a system:
Initially power supply is given to the system. But street light does not glow just after power supply is given. It turns ON after sensing the presence of vehicle on road and intensity of natural light available. When a the intensity of natural lights falls below certain limit, resistance of LDR increases and amount of current that passes through LDR decreases. LDR is connected to ADC (Analog to Digital Converter) which converts analog input from LDR into 8 Bit binary output to the microcontroller as in digital form. So when the current through LDR decreases with decrease in light intensity, ADC provides output to microcontroller in form some digital value and microcontroller is programmed in such a way that if it gets digital input from ADC which is less than predefined value, it gets ready to turn ON the street lights but does not immediately turns on until detection of vehicle on road. This value is also decided by the variable resistor connected to the

LDR. Like the total resistance offered is the sum of resistances from LDR and variable resistor. Also below this value till the lowest value of input from ADC, brightness of street light is set to vary in accordance to the intensity of natural light available. As the resistance of a LDR vary in accordance to the intensity of natural light. Now if PIR sensor detects any moving vehicle or other moving object on a road, it provides high input to the microcontroller pin and now microcontroller turns ON the street lights by supplying current to the base of a transistor and brightness of street lights is in accordance with the intensity condition. So basically controller turns street lights ON when it gets pre-defined input values from both PIR and LDR

This street lights does not turn off immediately after vehicle passes but made to remain in ON state for some period. This provision is made because if two vehicles are going on a road with some distance between them, the street light does not need to turn OFF as the first vehicle passes and again to turn ON as second vehicle comes in a range of PIR sensor. This reduces the turning ON-OFF frequency of street lights. The street lights turns off when it PIR sensor detects no vehicle for certain amount of time

4. CONCLUSIONS

The Intelligent Street Light Controller works on two basic principles of operations and therefor very easy to construct and implement. And more importantly, this system provides a power efficient street lights which do not consumes unnecessary amount of power supply. It uses the supplied power only when it is needed. So this system is like a need of future as it saves energy, which could be available for future generations if not used properly.

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