



SMART ROADWAYS LIGHTING PROTOTYPE SYSTEM FOR PUBLIC AWARENESS

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ABSTRACT

Saving and efficient utilization of electricity is utmost importance in the present world. Power saving concept is introduced to street lighting system with automatic detection of vehicles and rainfall. The proposed street lighting automation system is designed using Light dependent resistor (LDR), IR sensor and Raindrop sensor for day or night detection, vehicle detection and rainfall detection. The system is developed using ARM7 microcontroller. In the proposed system the sodium or halogen bulb are replaced with LED's. During night LDR allows all lights to glow at less intensity, IR sensor detecting vehicles allow LED's ahead of vehicle to glow at high intensity and dim the trailing lights, and intensity varied using PWM. Raindrop sensor detecting rainfall allows all lights to glow irrespective of vehicle movements. Implementation of this system saved energy to great extent.

Keywords: street light system, automation, LEDs, Arm-7 processor, LDR, sensors, energy saving.

1. INTRODUCTION

Automation street lighting systems are being developed day to day in automation sector yet this automatic system is combined with power saving concept. The system is designed to detect vehicle movements on road and to increase the intensity of lights ahead of it and to dim the trailing lights to save energy present street lights uses high pressure discharge lamps, sodium lamps or mercury vapor lamps, these are replaced with led's which are highly efficient than regular ones which uses less power and gives high illumination. This system is automated using ARM7 microcontroller. IR sensors are used for vehicle or pedestrian detection, additionally rain drop sensor is also used in this system for if any climatic changes [2].

Present street lights are manually controlled around the world, even though technology developing a lot still all remain using old way this should be changed in a good way using automated street lighting system. Implementing this system is simple; this has a control room in which all the lights of certain area are controlled using microcontroller in which program is dumped. On roads street poles and IR sensors are placed. For every street pole a couple of IR sensors are related. Advantage related to IR sensors is they can be operated both in day and night [3]. As said regular HID lights are replaced with LED's because it offers more advantages like saving power due to high current luminous efficiency. This type of system can also be termed as other generation lighting system and can be implemented all around the world and even at remote places.

2. RELATED WORKS

Energy is very important for better future. Energy saving concept is done through street lighting system. A multi-functional street lights control system done through arm 2 LPC2148. Existing system uses solar power as the source for street lights which is highly expensive to install and replace when damaged and also requires periodic maintenance [1]. Intelligent street lighting system using

day and night detection with LDR and reduction of power consumptions is in the lighting system. Even wireless technologies are being used for smart lighting system which may lead to emission of harmful radiations. This helps to reduce wirings at lamp posts [2].

Surplus amount of energy is saved by implementing smart street light system and here sodium vapor lamps are replaced with LEDs which are highly efficient and long lasting and dimming technology is also added to the system. The light poles cooperate with each other and resembles like exchanging information to brighten the lights. Wireless sensor system is also used for smart lighting system which is also highly expensive to implement and maintain [4]. Present technology being developed in every field rapidly like in street lighting system as like earlier 8015 is used as processor later on it is replaced with pic microcontroller and now arm processor are ruling around [5]. The street poles are operated only at night and this became useful at day too by implementing pollution control operation like CO2 released from vehicle and also sound pollution at traffic. When it reaches the danger level alarm goes on. So that all realize that's harm to society and may control in happening harmful.

The system is mainly concentrated on night vision implementing above concepts can also be very effective to the present world in future [5, 7]. For automation in lighting system long range photoelectric sensors are used for vehicle detection as like when this detects vehicle in front of this sensor it communicates to processor or controller to switch on the light related to that sensor. In this way energy saving is done only turning lights on when vehicles is detected and turned off at remaining times [6]. In this paper arm processor is used for operation and even street lights are connected with IR sensors and each light is given with LDR or fault detection such that damaged light can be replaced for better communication [7]. In this paper automatic street lighting system is done only on detecting day and night using LDR



sensor and this was revolutionary concept and can be said inspiration for present street lighting systems [8].

3. PROPOSED ROADWAYS LIGHTING SYSTEM

The block diagram of proposed smart lighting system is shown in Figure-1. The arm 7 processor LPC2148 is interfaced with many components as its being the heart of complete system. It is chosen because it has following features, low power, high speed flash/EEPROM technology, 32 I/O lines, 8 to 40 KB of RAM, in built timers, multiplexers, analog to digital convertors and operating speed of max 20 MHz and power 3.3 V. The source is the regular power supply and the components connected to this are LDR sensor which is a photosensitive detection component, here threshold value is set initially for day or night detection and we have IR sensors to detect vehicles.

These IR sensors are available with various ranges and depending on application chosen selectively. For this vehicle detection infrared detection is used as the vehicle passes by IR sensor it detects and communicates with processor to switch on lights with high intensity. Rain drop sensor is also interfaced with arm processor which detects the rainfall and communicates to turn on all lights with high intensity. LED's are connected and these are replaced with sodium vapor lamps because these are low power high efficiency lighting components and finally LCD is also connected to the arm processor for displaying different conditions like night, vehicle detected .

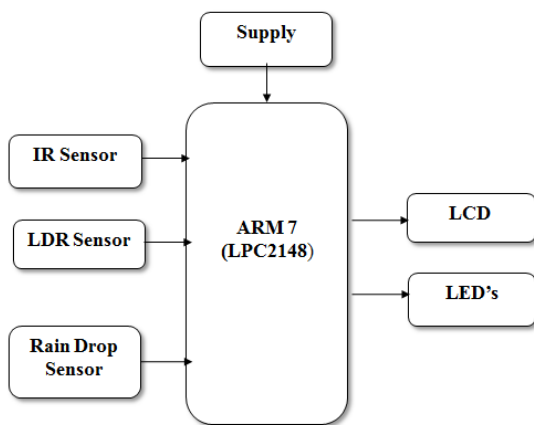


Figure-1. Block diagram of proposed system.

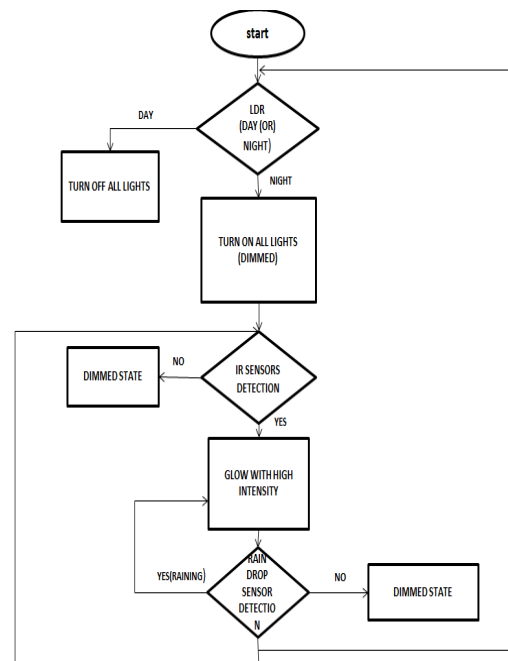


Figure-2. Flowchart of proposed street light system.

The operation is explained using flowchart in Figure-2. This system mechanism is explained well in 3 cases.

Case 1: LDR operation

LDR (light dependent resistor) is a photosensitive component. Resistance of 400ohm to 400kohm, sensitivity 3msec, operating voltage 3v to 5V Photoconductivity is like resistance of a material is reduced and conduction occurs when light is absorbed by material. Using this principle as LDR detects night, all LED's glow with low intensity when no vehicles are on road.

Case 2: IR detection

Infrared sensors have transmitter and receiver transmitter is like it continuously sends infrared rays as IR blinking light and receiver is like light dependent resistor. Supply voltage 3.3V, range ~30cm and detection angle 35° its operation in this system is to detect vehicles continuously until LDR detects day light. When an IR sensor detects vehicles the LED's next to IR sense this and glows with high intensity and remind dimmed state after the vehicle moves away.

Case 3: Rain detection

Rain drop sensor interfaced with arm processor having working voltage of 5V and current <2ma and working temperature ~30° detects the rainfall and if it detects rain then irrespective to individual vehicle movement all LED's glow with high intensity till rainfall goes off so that there will no inconvenience to the vehicles to move.

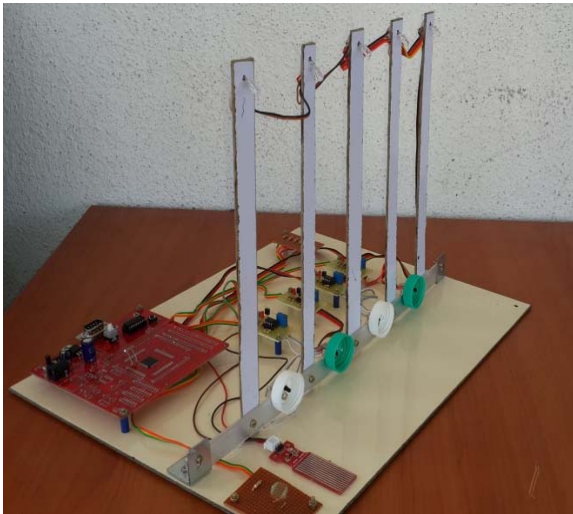


Figure-3(a). Prototype of the roadways lighting system.

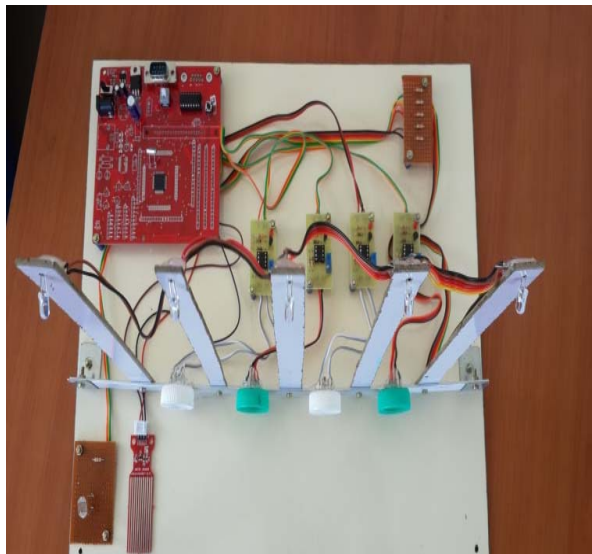


Figure-3(b). Prototype of the roadways lighting system top view.

The Figures 3(a) and 3(b) represent the prototype of the roadways lighting system with all components fixed to a wooden frame having all 3 sensors and arm processor.

4. RESULTS AND DISCUSSIONS

Arm processor being heart of Smart Street lighting system. this processor is dumped with a code using Flash Magic and code is made using Keil software. Present system simulation results in proteus software are shown in following figures. As the threshold value differs to the initial threshold then LED'S turn on. This is explained through screen shots of proteus software. LDR operation is explained in following screen shots figure 4 and figure 5.

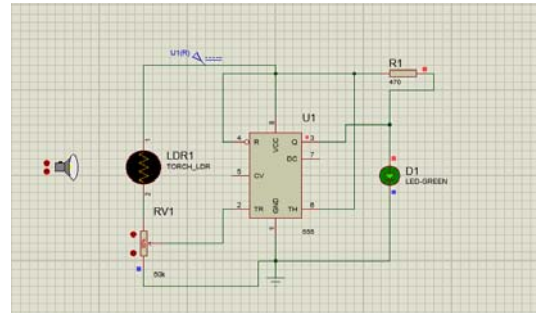


Figure-4. simulation output of LDR circuit functioning without light.

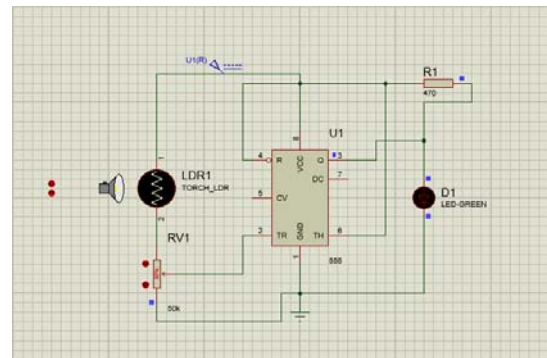


Figure-5. Simulation output of LDR circuit functioning with light.

IR sensors and rain drop sensor operations are shown combine using proteus simulation in following Figure-6 and Figure-7 and figure8. Here RV1 resembling threshold voltage variation of rain drop sensor and RV2 resembles threshold voltage variation of IR sensors.

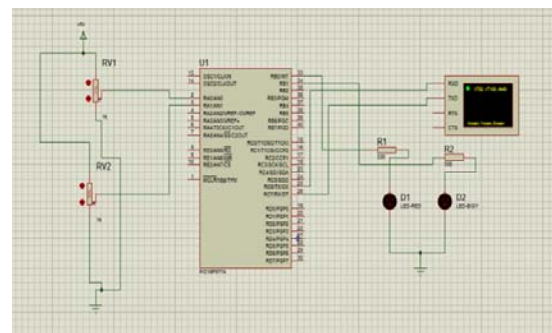


Figure-6. Simulation output of the lighting system without input signal.

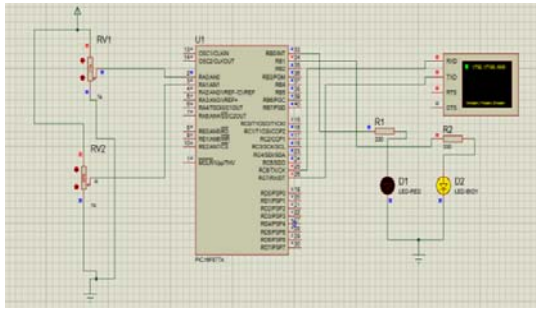


Figure-7. Simulation output of the lighting system with IR input signal.

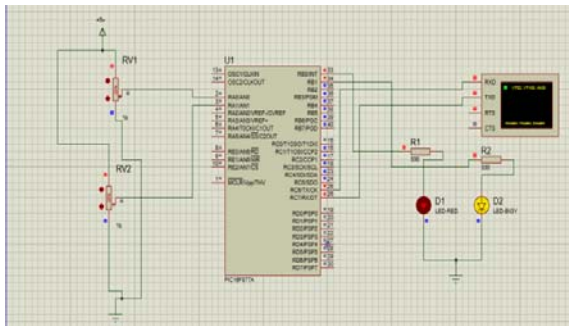


Figure-8. Simulation output of the lighting system with water sensor input signal.

Prototype model implemented practically and shown in screenshots below in Figure-9 showing LDR detecting day and night case (i) and in Figure-10 IR sensor detecting vehicle case (ii) and in Figure-11 water sensor detecting rain case (iii)

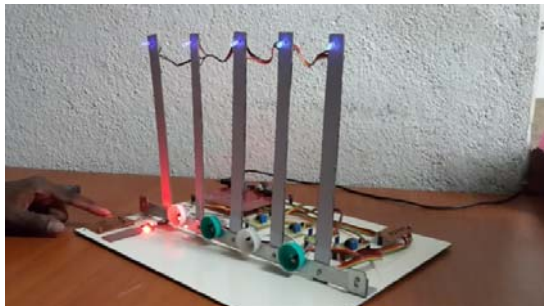


Figure-9. Prototype model output for case (i).



Figure-10. Prototype model output for case (ii).



Figure-11. Prototype model output for case (iii).

5. CONCLUSIONS

Street light consumes more energy during night period in the cities. The conventional automated street light system is controlled based on two conditions either night or day time. The proposed smart roadways light systems is a fully automated and more energy efficient in different conditions. During day time all lights are in off conditions, and during night time all lights are in dull conditions when there is no object in the road. If the object is detected by IR sensor, that nearer pole lamps are glowing bright. Raining condition is detected by rain drop sensor and control the brightness of the light. The proposed concept is implemented in prototype model. This system is more energy efficient in street lights and outdoor industries.

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