Smart Street Light Using Sensor With Auto Intensity Light Control

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Abstract- *Our manuscript aims to develop a system which will lead to energy conservation and by doing so; we would be able to lighten few more homes. The proposed work is accomplished by using ARDUINO microcontroller and sensors that will control the electricity based on night and object's detection. Meanwhile, a counter is set that will count the number of objects passed through the road. The beauty of the proposed work is that the wastage of unused electricity can be reduced, lifetime of the streetlights gets enhance because the lights do not stay ON during the whole night, and also helps to increase safety measurements. We are confident that the proposed idea will be beneficial in the future applications of microcontrollers and sensors etc*

Keywords- Microcontroller, sensors,

I. INTRODUCTION

Microchip has positioned itself to target the motor control market, where our advanced designs, progressive process technology and industry leading product performance enables us to deliver decidedly superior performance over our competitors, which includes the best of the industry. These products are positioned to provide a complete product solution for embedded control applications found throughout the consumer, automotive and industrial control markets. Microchip products are meeting the unique design requirements of the motion control embedded applications.

An embedded system is a special-purpose system in which the computer is completely encapsulated by or dedicated to the device or system it controls. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few predefined tasks, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Embedded systems are often mass-produced, benefiting from economies of scale.Personal digital assistants (PDAs) or handheld computers are generally considered embedded devices because of the nature of their hardware design, even though they are more expandable in software terms. This line of definition continues to blur as devices expand. With the introduction of the OQO Model 2 with the Windows XP operating system and ports such as a USB port — both features usually belong to "general purpose computers", — the line of nomenclature blurs even more.

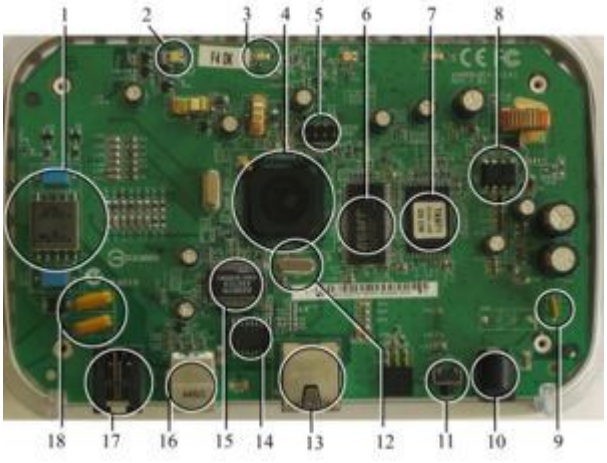

Fig 1:Embedded system of Smart Street light

Examples of Embedded Systems:

- Avionics, such as inertial guidance systems, flight control hardware/software and other integrated systems in aircraft and missiles
- Handheld calculators
- Handheld computers
- Household appliances, including microwave ovens, washing machines, television sets, DVD players and recorders
- Medical equipment
- Personal digital assistant
- Computer peripherals such as routers and printers.

II. BLOCK DIAGRAM

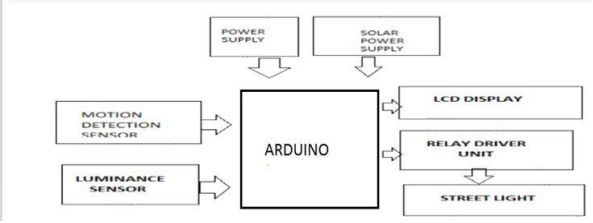

Fig 2:Block diagram of an smart street using sensors with auto intensity control

Figure 2illustrates the overall working mechanism and the features of the proposed lighting concept. Firstly, LDR will sense the intensity value of sunlight and send it to Arduino. Arduino will judge if the received value is above the threshold level (which is set independently by the user from the discrete value: 0-2023), then it will consider it as day-time and LEDs will remain OFF, or if the received value below the threshold level, Arduino will consider it as a night-time. In the night-time, if the value of IR obstacle detector sensor is LOW and detects no object, then DIM LEDs (half of its maximum voltage) will glow, or if IR obstacledetector value is HIGH and detects any object, then HIGH LEDs (full of its maximum voltage) will glow. Arduino will also count the total number of vehicles that crossed the street in the night-time with the help of IR obstacle detection sensor and will demonstrate it to the serial monitor.

A. Arduino Uno Microcontroller:

The ARDUINO UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the ARDUINO IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the ARDUINO NANO and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the ARDUINO website.

B. Liquid crystal display(LCD) and Light Emitting diode(LED)

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character negative LCD will have a black background with the letters being of the same color as the backlight.

A LED (light-emitting diode) is a PN junction diode which is used for emitting visible light when it is activated, as presented in. When the voltage is applied over its elements, electrons regroup with holes within the LED, releasing energy in the form of photons which gives the visible light. LEDs may have the Dim/full capability.

C. Light Dependent Resistor (LDR):

LDR is a Light Dependent Resistor whose resistance is dependent on the light impinging on it. The resistance offered by the sensor decreases with the increase in light strength and increases with the decrease in light strength. This device is used for detection of day-time and night-time because when sunlight falls on it, it will consider as day-time, and when there is no sunlight falls on it, it will be regarded as a night. These are very beneficial, especially in light/dark sensor circuits and help in automatically switching ON /OFF the street lights.

D. Infrared Obstacle Avoidance Sensor

An obstacle avoidance sensor consists of an infrared-transmitter, an infrared-receiver and a potentiometer for adjusting the distance,. Whenever an object passes in front of a sensor, the emitted rays hit the surface of an object and reflect to the receiver of the sensor so it will consider this as a motion. It is a heat sensitive sensor and used for detection of motion

III. SCHEMATIC DIAGRAM OF AN SMART STREET LIGHT USING SENSOR

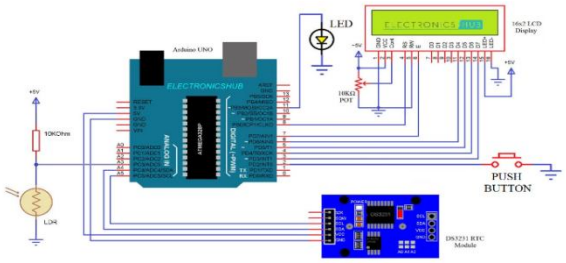

Fig 3: Schematic Diagram

The voltage supplied to the street lights is controlled by chopping off firing angle on both sides of the AC waveform. For this the Arduino sends pulses to the Gate pin of BT136 TRIAC. When the circuit is powered ON, the Arduino sketch initializes the circuit and start reading analog voltage provided by the LDR sensor at A0 pin. The zero voltage crossing is detected by the 4N25 circuit.

The AC voltage from main supplies is stepped down to 12V AC by the transformer and rectified by the 1N4007 diode full-wave rectifier.

The AC voltage once converted to DC voltage drives the IR diode of 4N25 forward biasing it for voltage levels greater than 1.1 Volt. When voltage level of the rectified wave is above zero voltage crossing, photo-transistor of 4N25 remains in forward biased condition, short circuiting the VCC supply at pin 2 of Arduino to ground. Therefore, for majority of the waveform, a LOW logic is received at pin 2 of Arduino. When voltage level approaches zero voltage crossing, the IR diode of 4N25 does not get the required voltage for forward biasing. So, the photo-transistor of 4N25 switches to unbiased condition and the pin 2 of Arduino get a HIGH pulse upon zero voltage crossing.

The Arduino detects the zero voltage crossing and determines a firing angle based on voltage supplied through variable resistance at pin A0. The analog voltage at A0 pin is read by the Arduino and converted to a digital reading using in-built ADC channel. A time interval based on digitized voltage reading is calculated in the Arduino Sketch.

In power control application using TRIAC, the voltage pulse before the emergence of triggering pulse at Gate terminal of TRIAC gets chopped off while the part of AC voltage wave after the emergence of triggering pulse at Gate terminal of TRIAC remains available for supply to the street lights.

Check out the Arduino program which is detecting zero voltage crossing based on digital logic at pin 2, calculating a time delay for triggering pulse by digitizing analog voltage through LDR sensor at A0 pin and generating a triggering pulse at pin 10 in an interrupt routine.

IV. RESULT

In the section, the setup of the whole research work is depicted in a step by step manner. Sample screenshot are displayed once the components are fixed and connected to each other. All the components are connected to each other and thus complete the system setup which helps one to understand the steps in a simple and easy way.

V. CONCLUSION

The proposed streetlight automation system is a cost effective and the safest way to reduce power consumption. It helps us to get rid of today's world problems of manual switching and most importantly, primary cost and maintenance can be decreased easily. The LED consumes less energy with cool-white light emission and has a better life than high energy consuming lamps. Moving to the new &renewable energy sources, this system can be upgraded by replacing conventional LED modules with the solar-based LED modules. With these efficient reasons, this presented work has more advantages which can overcome the present limitations. Keep in mind that these long-term benefits; the starting cost would never be a problem because the return time of investment is very less. This system can be easily implemented in street lights, smart cities, home automation, agriculture field monitoring, timely automated lights, parking lights of hospitals, malls, airport, universities and industries etc.

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