POLITEKNIK SEBERANG PERAI

STREET LIGHTS THAT GLOW ON DETECTING VEHICLE MOVEMENT

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ABSTRACT

The project is designed to detect vehicle movement on highways to switch ON only a block of street lights ahead of it (vehicle), and to switch OFF the trailing lights to save energy. During night all the lights on the highway remain ON for the vehicles, but lots of energy is wasted when there is no vehicle movement. This proposed system provides a solution for energy saving. This is achieved by sensing an approaching vehicle and then switches ON a block of street lights ahead of the vehicle. As the vehicle passes by, the trailing lights switch OFF automatically. Thus, we save a lot of energy. So when there are no vehicles on the highway, then all the lights remain OFF. High intensity discharge lamp (HID) presently used for urban street light are based on principle of gas discharge, thus the intensity is not controllable by any voltage reduction. White Light Emitting Diode (LED) based lamps are soon replacing the HID lamps in street light. Sensors used on either side of the road senses vehicle movement and sends logic commands to microcontroller to switch ON/OFF the LEDs. Thus this way of dynamically changing intensity ON/OFF helps in saving a lot of energy.

ABSTRAK

Projek ini direka untuk mengesan pergerakan kenderaan di lebuh raya untuk bertukar ON hanya satu blok lampu jalan lebih awal daripada itu (kenderaan), dan untuk menukar OFF lampu trailing untuk menjimatkan tenaga. Pada waktu malam semua lampu di lebuh raya kekal ON untuk kenderaan, tetapi banyak tenaga sia-sia apabila tidak ada pergerakan kenderaan.Sistem ini dicadangkan penyelesaian untuk menjimatkan tenaga. Ini dicapai dengan mengesan kenderaan yang menghampiri dan kemudian beralih ON satu blok lampu jalan di hadapan kenderaan. Selepas kenderaan berlalu, lampu belakang mati secara automatik. Oleh itu, kita menjimatkan banyak tenaga. Oleh itu, apabila tiada kenderaan di lebuh raya, maka semua lampu kekal OFF. Intensiti tinggi pelepasan lampu (HID) pada masa ini digunakan untuk lampu jalan bandar adalah berdasarkan kepada prinsip pelepasan gas, dengan itu keamatan tidak dikawal oleh mana-mana pengurangan voltan. Lampu (LED) berasaskan tidak lama lagi menggantikan lampu HID di lampu jalan. Sensor digunakanpadakedua-duabelah pergerakan kenderaan deria jalan dan menghantar logik arahan untuk pengawal mikro untuk beralih ON / OFF LED. Oleh itu cara ini dinamik berubah keamatan ON / OFF membantu dalam menjimatkan banyak tenaga.

ACKNOWLEDGEMENT

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This project is designed to detect vehicle movement on highways to switch ON only a block of street lights ahead of it (vehicle), and to switch OFF the trailing lights to save energy. During night all the lights on the highway remain ON for the vehicles, but lots of energy is wasted when there is no vehicle movement. This proposed system provides a solution for energy saving. This is achieved by sensing an approaching vehicle and then switches ON a block of street lights ahead of the vehicle. As the vehicle passes by, the trailing lights switch OFF automatically. Thus, we save a lot of energy. So when there are no vehicles on the highway, then all the lights remain OFF. White Light Emitting Diode (LED) based lamps are soon replacing the HID lamps in street light. Sensors used on either side of the road senses vehicle movement and sends logic commands to microcontroller to switch ON/OFF the LEDs. Thus this way of dynamically changing intensity ON/OFF helps in saving a lot of energy.

1.2 Problem Statement

What we therefore seek to achieve is to produce a street light system that would solve the problems of the existing street light system. To reduce the power consumption of street light by avoiding inefficient lighting this wastes significant.Financial resources. It clearly tackles the two problems that world is facing today, saving of energy and also disposal of incandescent lamps, very efficiently. According to statistical data we can save more that 40 % of electrical energy that is now consumed by the highways.

1.3 Objective

We seek to develop a street light system that

- Would be fully automated to turn on at night when a vehicle or pedestrian approaches and stays on a few seconds
- Would use minimum amount of energy and by so doing reduce the amount of money spent on lighting the street drastically.
- Would not require human effort to turn on but would automatically turn on when needed and would be off when not needed.
- Would be able to withstand the atmospheric conditions such as sunshine and rainfall so that it can last for a long time.

1.4 Scope and Limitation Project

This project is to reduce power consumption of street light. IR sensor which detects any movement is used. For the software requirements, we have used the MP lab for programme the microcontroller. We also used the resistor to reduce current flow, capacitor to store the electric charge and for blocking direct current while allowing alternating current to pass. A photodiode is a type of photo detector capable of converting light into either current or voltage, depending upon the mode of operation while the IR LED, also known as IR transmitter, is a special purpose LED that transmits infrared rays.This street light glow based on IR sensor. IR sensor is a sensor measure infrared light radiating from object in its field.

When a warm body like a human or animal passes by, it first intercepts one half of the IR sensor, which cause a positive differential between the two halves.

1.5 Significant of Project

This project is to develop a street light system that fully automated to turn on at night when vehicle move. It would use minimum amount of energy and by so doing to reduce the amount of money spent on lighting the street drastically. And also this project could not require human effort to turn on.

1.6 Summary of Chapter

As a conclusion for the chapter 1, we understand about the Street Light Project.. The purpose is to increase the knowledge of street lighting and to create a useful source in the area, where it will be possible to find references for deeper studies. The purpose of road lighting is to create a safe journey for road users in vehicles, for pedestrians to be able to discover risks, to orient themselves and to feel secure and to promote the appearance of the surroundings in the dark. And also to save energy.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In this project we discuss about articles that are related to the project. There have been many projects or researches on the automation of street lights and from there, some related details of our project will be known and can be understood. An electric light is a converter which produces light energy when electric current passes through it. The main purpose of road lighting is to make people, vehicles and objects on the road visible. The main advantage of the street light is the extension of human life quality for the dark period of the day. Life quality includes the crime prevention, traffic safety on road, aesthetic impact, behaviour of human and many more. However, most of the projects as well as the aforementioned project will employ the latest technology, which is used globally in these days is light emitting diode based system, it is treated as energy efficient and reliable lighting technology, which reduced the public lighting cost as well as energy consumption up to 80% and also responsible for the reduction of carbon dioxide emissions.

Constant lighting is the best solution in busy areas; however, it is definitely not in rural residential areas. In former cases, many people are walking around midnight when they come from, their shops, cinemas and restaurants etc. But in the latter case, only a few numbers of people using the streets during night. So, there is a temporary need for lighting streets or road, in relation to a continuous illumination of streets or road in urban areas.

This project basically seeks to find a way to use embedded design to conserve energy by switching the lights off temporarily and on when another vehicle is detected and in so doing uses environmental friendly approaches to reduce the release of CO2 and conserve energy as well.

2.2 Existing Street Light System

We took it upon ourselves to study the existing street light system we have now and found some shortfalls we seek to correct.For one we found out that the street light is not on when needed. In most cases the street lights are on during the mornings and sunny afternoons when they are not needed. This is a waste of electricity which is a scarce resource especially during this time of energy crisis. Moreover, it was also found that some of the street lights are also found out to be off at night when they need to be turned on. This poses a great risk to motorist and pedestrians who on roads and also encourage burglary since thieves find darkness the perfect setting for their nefarious activities.

Furthermore we found out that the street lights here are made up of the high intensity discharge lamps which function by means of charge discharge. The disadvantage of the HID lamp is that it consumes more power and has a short life time of about five months.

The better alternative we found to this is the light emitting diode(LED) light which consumes very little power and has a life time ranging from 5 to 20 years.

FIGURE 2.0: Existing Street Light System

2.3 Development Tools

2.3.1 Software Requirement

a) Proteus

The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB layout design. It can be purchased in many configurations, depending on the size of designs being produced and the requirements for microcontroller simulation. We use this software to draw our circuit and do the simulation. Along with ISIS there's also another package named as Proteus ARES. This Proteus ARES is used for PCB designing.

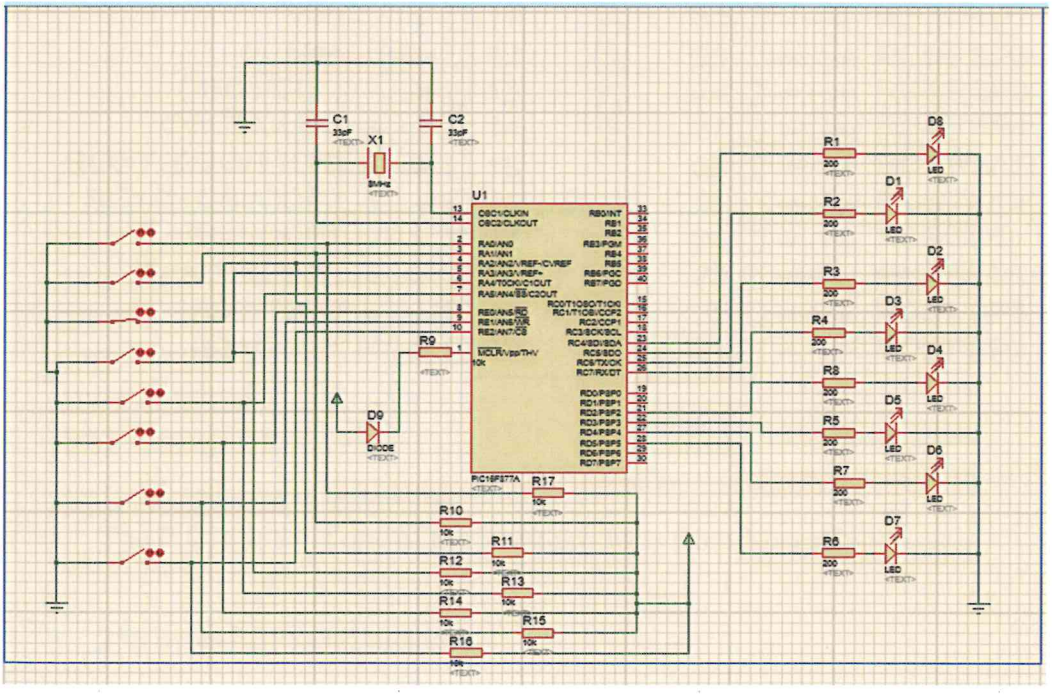
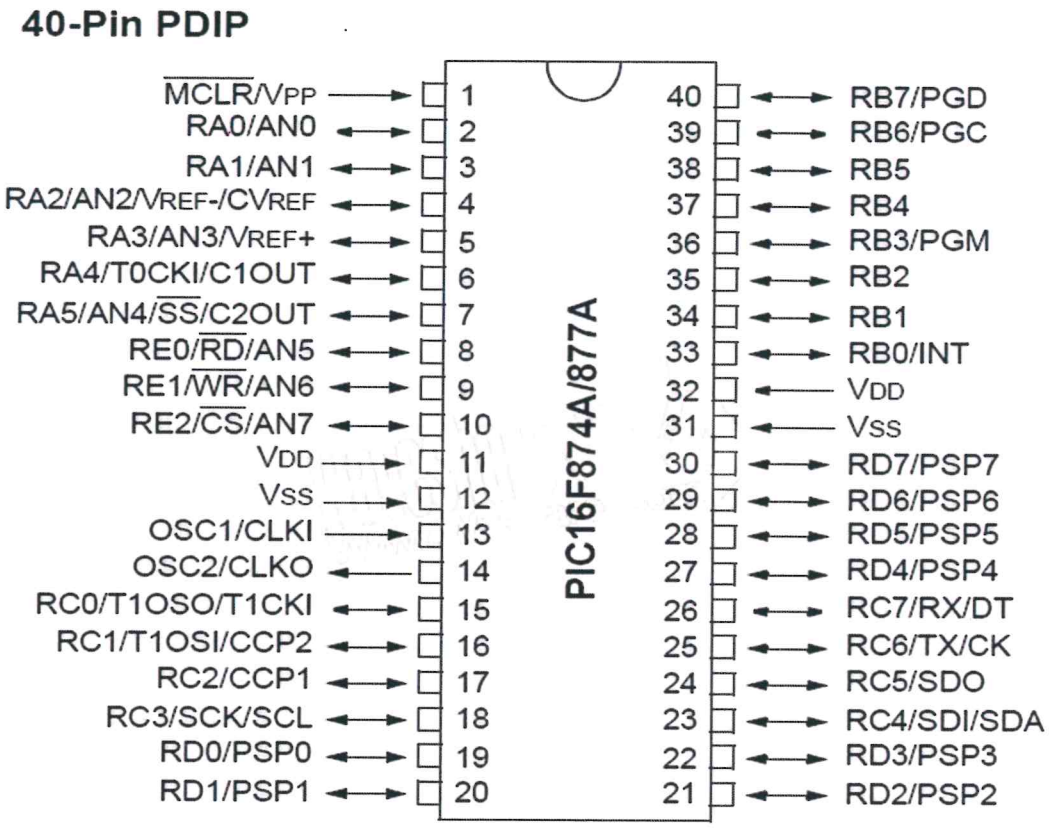


FIGURE 2.1: Proteus ISIS

2.3.2 Hardware Requirement

PIC16F877A Flash 40-pin 4MHz 8kB Microcontroller



- The PIC16F887 is one of the latest products from Microchip
- 256 bytes EEPROM memory
- 368 bytes RAM memory
- 35 input/output pins
- High-Performance RISC CPU:
  - ✓ Only 35 single-word instructions to learn

- ✓ All single-cycle instructions except for program branches, which are two-cycle
- ✓ Operating speed: DC – 20 MHz clock input DC – 200 ns instruction cycle

• Up to 8K x 14 words of Flash Program Memory, Up to 368 x 8 bytes of Data Memory (RAM), Up to 256 x 8 bytes of EEPROM Data Memory

• Pinout compatible to other 28-pin or 40/44-pin PIC16CXXX and PIC16FXXX microcontrollers.

- Peripheral Features:
  - ✓ Timer0: 8-bit timer/counter with 8-bit prescaler
  - ✓ Timer1: 16-bit timer/counter with prescaler, can be incremented during Sleep via external crystal/clock
  - ✓ Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
  - ✓ Two Capture, Compare, PWM modules - Capture is 16-bit, max. Resolution is 12.5 ns - Compare is 16-bit, max. Resolution is 200 ns - PWM max. Resolution is 10-bit
  - ✓ Synchronous Serial Port (SSP) with SPI (Master mode) and I2C™ (Master/Slave)
  - ✓ Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with 9-bit address detection
  - ✓ Parallel Slave Port (PSP) – 8 bits wide with external RD, WR and CS controls (40/44-pin only)
  - ✓ Brown-out detection circuitry for Brown-out Reset (BOR)

- Analog Features:
  - ✓ 10-bit, up to 8-channel Analog-to-Digital Converter (A/D)
  - ✓ Brown-out Reset (BOR)
  - ✓ Analog Comparator module with: - Two analog comparators - Programmable on-chip voltage reference (VREF) module - Programmable input multiplexing from device inputs and internal voltage reference - Comparator outputs are externally accessible
- Special Microcontroller Features:
  - ✓ 100,000 erase/write cycle Enhanced Flash program memory typical
  - ✓ 1,000,000 erase/write cycle Data EEPROM memory typical
  - ✓ Data EEPROM Retention > 40 years
  - ✓ Self-reprogrammable under software control
  - ✓ In-Circuit Serial Programming™ (ICSP™) via two pins
  - ✓ Single-supply 5V In-Circuit Serial Programming
  - ✓ Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation
  - ✓ Programmable code protection
  - ✓ Power saving Sleep mode
  - ✓ Selectable oscillator options
  - ✓ In-Circuit Debug (ICD) via two pins

IR Led

An IR LED, also known as IR transmitter, is a special purpose LED that transmits infrared rays in the range of 760 nm wavelength. Such LEDs are usually made of gallium arsenide or aluminium gallium arsenide. They, along with IR receivers, are commonly used as sensors. The appearance is same as a common LED. Since the human eye cannot see the infrared radiations, it is not possible for a person to identify whether the IR LED is working or not, unlike a common LED. To overcome this problem, the camera on a cell phone can be used. The camera can show us the IR rays being emanated from the IR LED in a circuit.

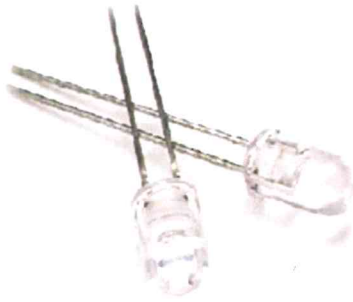


FIGURE 2.2: IR Led

Photodiodes

A photodiode is a type of photo detector capable of converting light into either current or voltage, depending upon the mode of operation. Photodiodes are similar to regular semiconductor diodes except that they may be either exposed (to detect vacuum UV or X-rays) or packaged with a window or optical fibre connection to allow light to reach the sensitive part of the device.Many diodes designed for use specifically as a photodiode will also use a PIN junction rather than the typical PN junction.

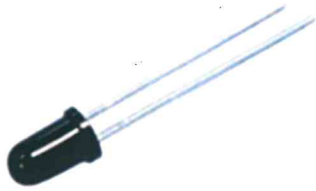


FIGURE 2.3: Photodiode

LED

LEDs are semiconductor devices. Like transistors, and other diodes, LEDs are made out of silicon. What makes an LED give off light are the small amounts of chemical impurities that are added to the silicon, such as gallium, arsenide, indium, and nitride. When current passes through the LED, it emits photons as a by-product. Normal light bulbs produce light by heating a metal filament until it is white hot. LEDs produce photons directly and not via heat, they are far more efficient than incandescent bulbs.

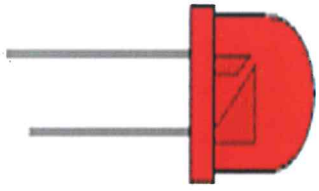


FIGURE 2.3.1: LED