# IMPLEMENTING A STREET LIGHT CONTROL SYSTEM BASED ON VEHICLE MOVEMENT

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**ABSTRACT :**
This paper proposes a smart street lighting system based on Arduino and Wi-Fi, which uses vehicle movement detection to control street light illumination. The system is designed to conserve energy by automatically turning off lights in areas with no vehicle or pedestrian activity, and turning them back on when needed. Additionally, the system includes anti-theft measures to prevent unauthorized removal of the streetlights, as well as accident detection capabilities using a mercury vibration sensor. The proposed system is composed of two main components: the street light controller and the anti-theft and accident detection module. The street light controller uses a Wi-Fi module to receive vehicle movement data from nearby sensors, and turns the lights on or off accordingly. The anti-theft and accident detection module consists of a vibration sensor that detects any tampering or damage to the street light pole. If the sensor detects any abnormal activity, an alarm is triggered and the authorities are notified

*Keywords: vibration sensor, Arduino and Wi-Fi, lighting system*

## INTRODUCTION

In today's modern world the development in transportation system plays a vital role. It consists of roads, streets, highways etc., these pathways must be illuminated brightly with the help of several types of glowing bulbs or LEDs. The main purpose of providing the light to these highways, roads or street is to provide safety to the vehicle and number of persons crossing these paths and prevent them from any mis happening or accident. Another purpose of providing lighting to these places is that during the night times when a smaller number of vehicles passes the road, the pedestrian can easy crosses the roads without feeling any darkness on the road. But, for providing large amount of illumination, huge amount of electricity is required which causes high cost.

## 1.1 PROPOSED SYSTEM

Nowadays, street lights are one of the major requirements in today's life for safety purposes and avoiding accidents during the night. The security of our environment which includes the protection of life and property is part of the priorities of every nation. A street lighting is any electrical lighting that is fixed outside the house for the illumination of the environment or a raised source of light on the edge of a road . certain time every night. Street lighting is very important as it aids in the illumination of our streets and serves for beautification of the environment at night-time. Failure and irregularities in power supply hinder the continuous illumination of our streets due to manual operation of the streetlights results in increasing crime on our streets and support for evil activities. The streetlight ensures safe, fast, and efficient movement of people and goods from one place to another. Street lighting in particular is one of the critical concerns for both public authorities and places like Barangay Calunasan, Calape, Bohol.

## LITERATURE SURVEY

Automation plays an increasingly very important role in the world economy and in daily life. Automatic systems are being preferred over any kind of manual system. We can also call it an "SMART STREET LIGHT SENSING". Intelligent light sensing refers to public street lighting that adapts to movement by pedestrians, cyclists and cars. Intelligent street lighting, also referred to as adaptive street lighting, offs when no activity is detected, but brightens when movement is detected. This type of lighting is different from traditional, stationary and illumination, or dimmable street lighting that offs at pre-determined times. The research work shows automatic control of streetlights as a result of which power is saved to some extent. In the scope of industrialization, automation is a step beyond mechanization

## INTRODUCTION TO EMBEDDED SYSTEM

# EMBEDDED SYSTEM

An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result.

**OVERVIEW OF EMBEDDED SYSTEM** Every embedded system consists of custom-built hardware built around a Central Processing Unit (CPU). This hardware also contains memory chips onto which the software is loaded. The software residing on the memory chip is also called the 'firmware'.
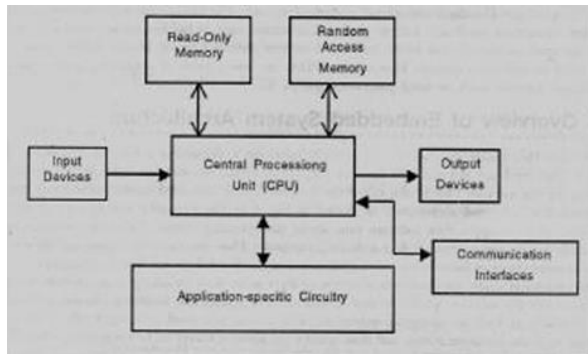


Fig: 1 Building blocks of the hardware of an embedded system

# DESIGN OF HARDWARE
## ARDUINO UNO

The most common version of Arduino is the Arduino Uno. This board is what most people are talking about when they refer to an Arduino. The Uno is one of the more popular boards in the Arduino family and a great choice for beginners. There are different revisions of Arduino Uno, below detail is the most recent revision (Rev3 or R3).

## TECHNICAL SPECIFICATIONS

Microcontroller : ATmega328 Operating
Voltage : 5V Input Voltage (recommended)
:7-12V InputVoltage (limits)
:6-20V
Digital I/O Pins : 14 (of which 6 provide PWM output)Analog Input Pins :
6
DC Current per I/O Pin : 40 mA DC
Current for 3.3V Pin : 50 mA
Flash Memory : 32 KB (ATmega328) of which

0.5 KB used by bootloaderSRAM : 2 KB (ATmega328)
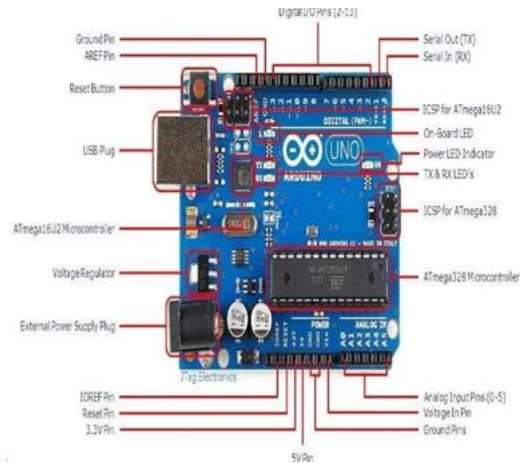EEPROM : 1 KB (ATmega328)



Fig.2 Arduino Uno R3 Board

## POWER PIN

Voltage In Pin – The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). .

## POWER SUPPLY

The power supplies are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each ofwhich performs a particular function.
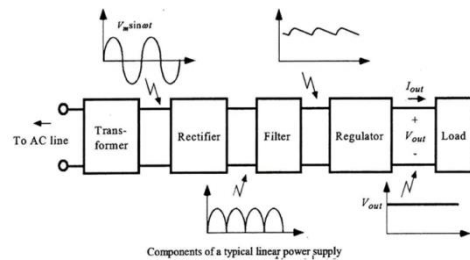


Fig:3. Block Diagram of Power Supply

## RECTIFIER

A circuit which is used to convert A.C to dc is known as RECTIFIER. The process of conversion A.C to D.Cis called "rectification.
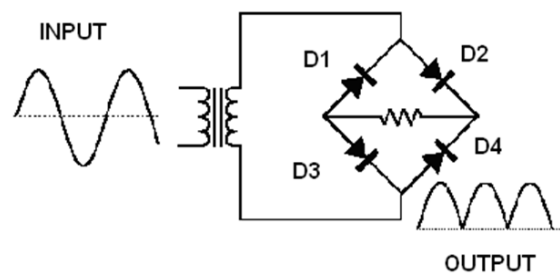
Bridge Rectifier:



Fig: 4. Bridge Rectifier

## PINS FUNCTIONS

There are pins along one side of the small printed board used for connection to the microcontroller. There are total of 14 pins marked with numbers (16 in case the background light is built in). Their function is describe in the table below:

Fig: 4.4 2x16 Line Alphanumeric Lcd Display

## WORKING OF LED

A P-N junction can convert absorbed light energy into a proportional electric current. The same process is reversed here (i.e., the P-N junction emits light when electrical energy is applied to it). This phenomenon is generally called electroluminescence, which can be defined as the emission of light from a semiconductor under the influence of an electric field.

## LDR (Light Dependent Resistor)

LDR stands for Light Dependent Resistor. It is also known as a photoresistor, which is a type of resistor that changes its resistance based on the amount of light falling on it. LDRs are made up of a semiconductor material that exhibits the photoconductive effect.

LDRs are usually made of cadmium sulfide or lead sulfide, and they are commonly used in combination with other components such as transistors, amplifiers, or microcontrollers to form more complex circuits fo.
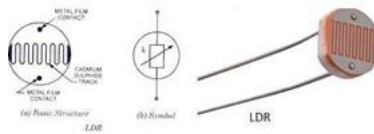


Fig:5  Light Dependent Resistor

When the light level is low the resistance of the LDR is high. This prevents current from flowing to the base of the transistors .The preset resistor can be turned up or down to increase or decrease resistance, in this way it can make the circuit more or less sensitive.

## WHAT IS INFRARED?

Infrared is a energy radiation with a frequency below our eyes sensitivity, so we cannot see it Even that we can not "see" sound frequencies, we know that it exist, we can listen them.



Fig: 6 Infrared Rey

Even that we can not see or hear infrared, we can feel it at our skin temperature sensors. When you approach your hand to fire or warm element, you will "feel" the heat, but you can't see it.

## INFRARED IN ELECTRONICS

Infra-Red is interesting, because it is easily generated and doesn't suffer electromagnetic interference, so it is nicely used to communication and control, but it is not perfect, some other light emissions could contains infrared as well, and that can interfere in this communication. The sun is an example, since it emits a wide spectrum.

## IR GENERATION

To generate a 36kHz pulsating infrared is quite easy, more difficult is to receive and identify this frequency.A square wave of approximately 27uS (microseconds) injected at the base of a transistor, can drive an infrared LED to transmit this pulsating light wave. Upon its presence, the commercial receiver will switch its output to high level (+5V).
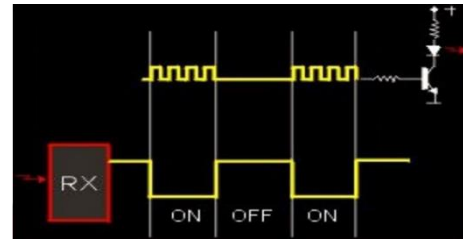


Fig: 7 IR Generation

Those IR demodulators have inverted logic at its output, when a burst of IR is sensed it drives its output to low level, meaning logic level = 1.

The TV, VCR, and Audio equipment manufacturers for long use infra-red at their remote controls.

RC-5

Various remote control systems are used in electronic equipment today. The RC5 control protocol is one of the most popular and is widely used to control numerous home appliances, entertainment systems and some industrial applications including utility consumption remote meter reading, contact-less apparatus control .

The next 5 bits are the address bits and select the destination device. A number of devices can use RC5 at the same time. To exclude possible interference, each must use a different address. The 6 command bits describe the actual command. As a result, a RC5 transmitter can send the 2048 unique commands.

The receiver performs the reverse function. The photo detector converts optical transmission into electric signals, filters it and executes amplitude demodulation. The receiver output bit stream can be used to decode the RC5 data word

## IR RECEIVER Description

The TSOP17 – series are miniaturized receivers for infrared remote control systems. PIN diode and

preamplifier are assembled on lead frame, the epoxy package is designed as IR filter.

**Features**

Photo detector and preamplifier in one package Internal filter for PCM frequency

The circuit of the TSOP17 is designed in that way that unexpected output pulses due to noise or disturbance signals are avoided. A band pass filter, an integrator stage and an automatic gain control are used to suppress such disturbances. The distinguishing mark between data signal and disturbance signal are carrier The SW- 420 vibration sensor module is a module that can detect vibrations and movement. It typically consists of a small metal ball that is free to move within a metal enclosure. When the module experiences a vibration, the ball inside the enclosure makes contact with two pins, completing an electrical circuit and sending a signal to the output pin of the module.
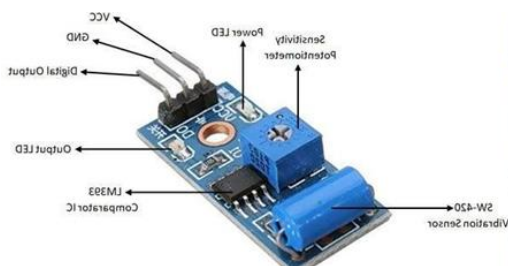


Fig: 8 SW – 400 Vibration Module Sensor

**DESIGN OF SOFTWARE**

**INTRODUCTION TO ARDUINO IDE SOFTWARE**

This is free software (evaluation version) which solves many of the pain points for an embedded system developer. Here is simple guide to start working with Arduino IDE Vision which can be used for:

Writing programs in Arduino IDE Compiling and assembling programsDebugging programs

PROJECT DESCRIPTION AND CONTROL DESIGN

**Project Description**: Vehicle Movement-Based Street Light Control System with Anti-Theft and AccidentDetection.The Vehicle Movement-Based Street Light Control System is a smart and efficient solution

designed to optimize energy consumption by controlling street lights based on the presence or absence of vehicles on the road. Additionally, the system incorporates anti-theft detection to prevent unauthorized removal of street lights and accident detection using a mercury lilt vibration sensor to

enhance safety on the roads.

**HARDWARE COMPONENTS**

To design the vehicle movement-based street light control system, the following hardware components arerequired:

Arduino UNO R3 board Wi Fi module (ESP8266) Infrared sensor (IR sensor) SW – 400 Vibration sensorMercury Tilt switch

LED lights Relay modulePower supply

**SOTWARE COMPONENTS**

To program the Arduino microcontroller and the Wi Fi module, the following components are required:Arduino **IDE**

ESP8266 library Relay module library

SW - 400 Vibration Sensor module

**WORKING**

IR sensor Microcontroller:

LED anti-theft feature:

SW-400 vibration sensor:

Alert system

**CODE IMPLEMENTATION**

**7.1 CODE IMPLEMENTATION**

```
#include<LiquidCrystal.h>              #include
<SoftwareSerial.h>      #include      <stdio.h>
LiquidCrystal lcd (13, 12, 11, 10, 9, 8);
unsigned char rcv, count, gchr, gchr1, robos = 's';
int ldr1=2; int led=4; int buz=7; int ldr2=5; int
ir1=3; int ir2=6; int sti = 0;
String inputString = "";   // a  string  to  hold
incoming data boolean stringComplete = false; //
whether thestring is complete
void okcheck() unsigned char rcr; do { rcr =
Serial.read();
} while (rcr != 'K');
}
void setup
lcd.begin(16,     2);     Serial.begin(115200);
pinMode(buz, OUTPUT); pinMode(ldr1, INPUT);
pinMode(ir1,  INPUT);  pinMode(ir2,  INPUT);
pinMode(ldr2, INPUT); pinMode(buz, OUTPUT);
pinMode(led, OUTPUT); digitalWrite(buz, LOW);
lcd.setCursor(0, 0);
lcd.print("SOLAR STREET LIGHT");
lcd.setCursor(4, 1); lcd.print(" In Highways ");
delay(1000);lcd.clear();
lcd.print("Wifi init");
```
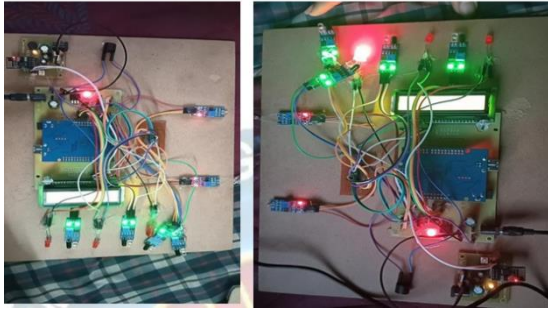
**RESULTS**



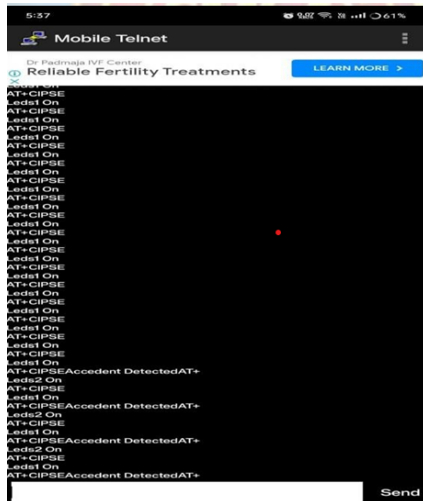Fig: 9 Street Light Control System is ON



Fig: 10 Notification in Control Room

**CONCLUSION**

In conclusion, the vehicle movement based street light control system using Arduino and WiFi module, along with LED anti-theft detection using IR sensor and accident detection using mercury vibration sensor, is an innovative and efficient solution for modern street lighting systems. By using this system, we can save a significant amount of energy and reduce carbon footprint by lighting up only the areas where vehicles are present. Moreover, the anti-theft feature adds an additional layer of security to the street lights, preventing unauthorized access to the valuable components of the system. The accident detection feature also ensures timely assistance to those involved in a road accident, which can save lives and reduce the number of fatalitieson the roads

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