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# Automated Street Light Controlling system using IOT Technology

M.Nirmala<sup>1</sup>, Dhivya G<sup>2</sup>, Suresh Kumar P<sup>3</sup>, Pavithra K<sup>4</sup>

Assistant Professor, Master of Computer Applications, Hindusthan College of Engineering and Technology,  
Coimbatore, India<sup>1</sup>

II MCA Students, Master of Computer Applications, Hindusthan College of Engineering and Technology,  
Coimbatore, India<sup>2,4</sup>

Assistant Professor, Department of Electronics and Communications Engineering, Hindusthan College of Engineering  
and Technology, Coimbatore, India<sup>3</sup>

**ABSTRACT:** Energy consumption in a variety of ways is a constantly growing demand across the nation. It is necessary to use a variety of techniques and procedures to properly control how much energy different types of people consume. This paper examines the energy savings techniques using Automatic Street Light Controlling System Using IOT Technology. Smart lighting is a technology employed for effective energy savings (ASLCSIOT). The system's main goal is to develop a smart street light controller system using an electronic prototyping platform that enables users to design interactive electrical items using Arduino. The street lights automatically turn on in the dark and turn out in the light thanks to the ASLCSIOT system's clever design. It facilitates effective lighting energy savings. The Uno board, LDR sensor, and IR sensor are all used with the Arduino IDE (Integrated Development Environment). To write code and upload it to our board, we use the open-source and user-friendly programming platform Arduino. The two sensors that are employed in this system are an IR sensor and an LDR sensor. The IR sensor is used to control the brightness of the infrared sensor and the LDR sensor is used to detect the presence of any moving objects, such as vehicles, obstructions, or physical objects. The LED light will turn ON if the system detects a physical object moving, and it will turn OFF when the movement stops.

**KEYWORDS:** Arduino, Home Automation, Smart Light, Energy Savings, Sensors.

## I. INTRODUCTION

The ASLCSIOT system's primary goal is to use Arduino to build a smart street controller device. The major goal of the device, which is used to save energy, is to prevent power wasting. LDR (Light Dependent Resistor) and IR are the system's 2 primary sensor components (Infrared Sensor). Undoubtedly, the LDR sensor, which turns off loads dependent on the amount of light shining on it, serves as the primary controller. The usage of an IR sensor allows for the detection of nearby barriers by sensing infrared radiations in the environment. In many places, street light control is often done by hand. The light will be manually turned on and off by the government-deployed staff. Both in the morning and the evening, this procedure must be manually completed. Thus, someone must turn on the lights in the evening and turn them off in the morning. This manual technique of operating the lamp post comes with some drawbacks, too. The failure to switch on the street lights may result in accidents. Also, if the street lights are not switched off in the morning, electricity is wasted. Also, since the evening start time varies between the winter and the summer, if we build a time-based street light controlling system, it will be problematic. To get around all these issues resolved the automatic street light control system was modelled. Because the light intensity is so low at night, the street lights are turned on. The street lights are also turned off during the daytime because there is enough light in daytime.

## II. RELATED WORK

B. A. Muthu, Z. Chen, and C. B. Sivaparthipan [1] The goal of this article is to improve the city's energy efficiency by introducing a smart street light control system. The solution suggested in this study involves turning

on the street lights in the evening before sunset and turning them off in the morning after sunrise when there is enough light for driving. As a result, energy usage is decreased. This technology detects human and vehicle movement on highways and turns on the street lights in front of the moving object while turning off the trailing lights. By processing the image of the object and communicating control commands to the street light block, this is accomplished. Using appropriate sensors to detect a failing street light and sending an SMS to the controlling authority using GSM mode to take the proper action in response to the failure are additional features of the system.

I. Moreno, X. H. Lee, C. Sun, and others [2] in this project, we want to suggest a technique for detecting traffic in real time and basing traffic light control on that traffic. The goal of this project is to create and implement cutting-edge embedded technologies for street light energy conservation and traffic light control based on traffic fate. By using solar panels to supply the lamps with electricity, we hope to reduce the amount of energy used in this project. In order to prevent streetlights from being lit up unnecessarily and to reduce electricity waste, we also want to automate the streetlight's on and off switches. Using an Arduino Uno, a Light Dependent Resistor (LDR), and Real Time Check, we are automating the streetlight system (RTC).

S.Padmadevi and K. Sheela [3] Automatic street light control systems are not only the simplest but also the most intelligent systems. For even greater energy efficiency, this street light system also features a time cut-out feature and an automatic control pattern. When vehicles pass by, the light will automatically turn on and then switch off. Compared to nighttime streetlamps, this design can save a significant amount of electricity. The design makes it easier to collect data on the state of the transportation system by implementing traffic flow magnitude statistics without the need for additional hardware. Additionally, this system has an auto-alarm feature that activates if any light is damaged and displays the serial number of the offending light, making it simple to locate and repair the offending light. The system can be widely used in all locations that require prompt control, including roadways, stations, mines, schools, and the electrical industry, among other places. The device also incorporates a digital temperature and humidity sensor, which monitors temperature and humidity in addition to streetlights.

Princymol Joseph, Dr. A. Senthil Kumar, K. Vignesh, M. Sakthivel, and K. Priya [4] The street lights will be set to 100% intensity when the IR sensor notices movement of the car. The technology uses LDR to distinguish between day and night. All of the street lights will be in the OFF position once daytime is detected. The system is controlled by an Arduino microcontroller. While the current sensor serves as the current detector LED bulb, the IR sensor serves as a vehicle detector and sends a signal to the Arduino to adjust the LED's brightness. The prototype for the energy-saving street lighting management system also has safety features in that it merely dims the light so that users can still see it clearly from a distance and fully turns on the light if it detects movement. It has been noted that if a street light is damaged, it will never be restored to operation unless it is manually reported. When it is night, an LDR sensor is installed underneath the street light to determine appropriate operation. As all the lights should be on and glowing at 40% of their maximum intensity, if the LDR value does not change, the street light is not functioning properly, and this information is displayed on the LCD.

A. Paventhan, G. I. Manoigaran, G. Suriya, P. T. V. Bhuvanawari, S. Sabarna, and This paper reviews numerous studies in the area of smart street lighting systems and compares and contrasts the benefits and drawbacks of each system in terms of response time and energy-saving efficiency. The three different categories of smart systems—centralized, noncentralized, and hybrid—that are currently available were outlined in the article. The hybrid system, according to the scientists, is more practical because it combines the advantages of the other two systems in terms of response time, remote light diagnosis, and weather information transmission.

P. Dupuis, L. Canale, N. Pigenet, G. Zissis, and others [6] Internet of Things (IoT) plays a significant role in automating a variety of fields, including health monitoring, traffic management, agricultural irrigation, street lights, classrooms, etc., with the help of cutting-edge innovations. In this survey, we looked at the application of IoT in creating smart street lights for the modern day. It is crucial to address the global energy crisis and expand the use of street lighting. We also examined and explained several sensors and IoT components that were employed in the study on smart street lighting systems.

A. Marouskova, T. Winiewski, E. Puzio, K. H. Bachanek, B. Tundys [7] The goal of the intelligent street lighting system is to develop and apply cutting-edge embedded technology for efficient street lighting. The answer to energy usage is provided in this publication. The AVR microcontroller, LED lights, Ultrasonic sensors, LDRs,



solar panels, and short-range communication networks make up the smart street light system. The ultrasonic sensors are used to detect the object under the street pole, and the LDR sensor is used to measure light intensity. When an object is found beneath the pole, the light will glow brightly; otherwise, it will remain dull. This is accomplished by using a real-time ultrasonic transmitter and receiver combination to detect and approach a vehicle.

P. L. Sikdar, P. K. G. Thakurta, and K. A. Kabir [8] By adjusting the automatic approach, the device also provides an energy-efficient operating option. The lights turn on and off automatically in response to vehicle movement or day/night sensors, as well as to lower management costs and keep track of each street lighting unit's status information. In this study, two sensors—a Light Dependent Resistor (LDR) sensor to indicate day or night and an Infrared Obstacle (IR) sensor to detect roadway activity—are used. The street lighting system is managed by an Arduino microcontroller, which serves as its brain. On the other hand, after being sent by Arduino UNO, sensor data is evaluated and stored in the Thingspeak cloud.

S. Ghosh, S. Chandra, S. Paul, S. K. Saha, and A. Mandal are among the authors. [9] Streetlight switching operations are not completed on time due to people's hectic lifestyles, wasting a significant quantity of electricity. With the current system, lamps are turned ON even before sundown and do not switch off even when there is plenty of light after sunrise. On sunny and wet days, the ON and OFF times differ substantially even with timer-based street light control systems. The project uses a microcontroller and light-dependent resistor to design an energy-efficient automatic streetlight controller in order to do away with manual processes.

E. Saint-Jacques, R. Bremond, and C. Villa [10] created a network of intelligent street lights. The street light system used in this project turns on when needed and turns off when not. A LED light, a brightness sensor, a motion sensor, and a short-range communication network make up our smart street light system. When no one is around, the lights turn off or reduce power before walkers and cars arrive. When all of our street lamps switch on before they arrive, it will be difficult for pedestrians and car drivers to tell our smart street lamps from from the traditional street lights. We will evaluate the current state and potential outcomes of our smart start light project.

### III. METHODOLOGY

The model representation and the concept of carrying out operations utilising IR and LDR sensors were described in this part. Both types of sensors are linked to the Arduino board. The sun's light output determines whether the infrared sensor's light intensity measurement indicates that the sun is bright or dim, and it also determines whether to activate or deactivate the system's LDR sensor. Saving electricity is made possible by this.

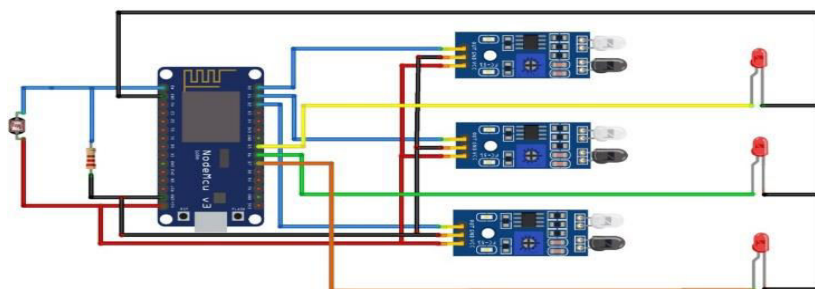


Figure 1 : Circuit Diagram of Automation Street Light

It is frequently known as the Arduino IDE (Integrated Development Environment). The LDR sensor, which regulates the brightness subjected to the infrared sensor, is unquestionably the primary controller employed. The vehicle or any obstructions are located using an Infrared sensor. The led will turn on when the system senses an obstruction or moving vehicle. With our system, certain lights are ON while others are OFF. Lights are ON when an obstruction or vehicle approaches. The light turns OFF when the car or obstruction is no longer present.

### 3.1 Block Diagram

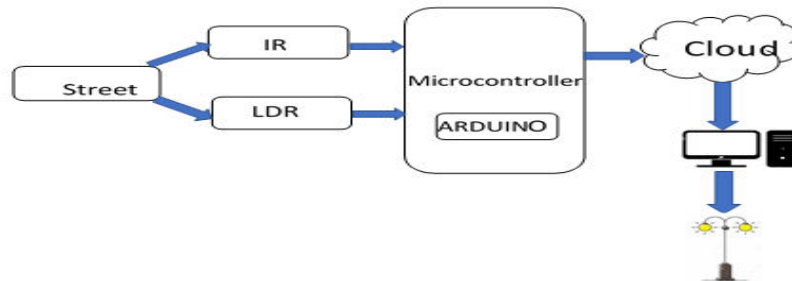


Figure 2 Block Diagram of Home Automation

There are three main parts of this home automation which is given below.

- Arduino Uno
- IR Sensor
- LDR Sensor

### 3.2 Hardware Description

#### ARDUINO UNO

One of Arduino's standard boards is the UNO. The Italian word UNO here is for "one." To identify the initial release of the Arduino Software, it was given the moniker UNO. It was also the first USB board that Arduino had ever released. It is regarded as a strong board that is employed in many projects. The Arduino UNO board was created by Arduino.cc. The ATmega328P microprocessor is the foundation of the Arduino UNO. Compared to other boards, like the Arduino Mega board, etc., it is simple to use. The board is made up of shields, various circuits, and digital and analogue Input/Output (I/O) pins. The Arduino UNO has 14 digital pins, a USB port, a power jack, and an ICSP (In-Circuit Serial Programming) header in addition to 6 analogue pin inputs.

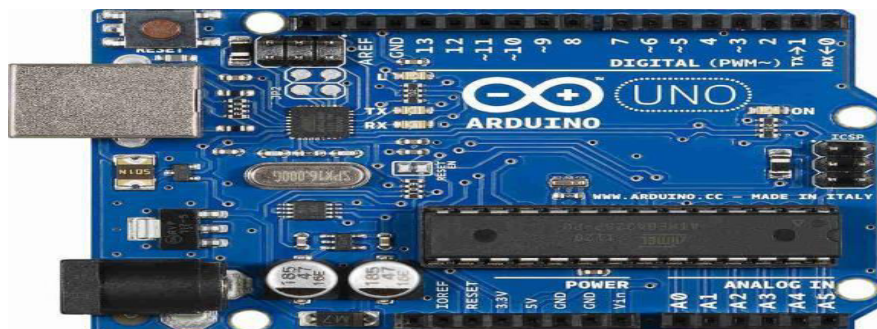


Figure 3 Arduino UNO Board

The programming language used is called IDE, or integrated development environment. It is compatible with offline and online platforms. The breadboard version of the module can be constructed by even relatively inexperienced users in order to comprehend its operation and save money. Beginners may use the Arduino programme with ease, while skilled users can customise it to their own.

#### IR SENSOR

An electrical device known as an infrared sensor uses infrared radiation to detect and/or emit specific features of its environment. Moreover, it has the ability to detect motion and gauge an object's surface temperature. The human eye is unable to see infrared waves. Infrared is a portion of the electromagnetic spectrum with wavelengths longer than those of visible light but shorter than those of microwaves. The infrared spectrum roughly stretches from 0.75 to 1000 m. Several items we use every day use infrared technology. For instance, a television features an Infrared detector that decodes the remote control signal. The portability and low consumption of electricity of infrared sensors are three of their main advantages. Infrared light is picked up by IR (infrared) sensors. A voltage or amperage detector detects the

electric current created when the IR light is converted into it. A characteristic of light-emitting diodes (LEDs) is that if an electric current is supplied, they create a particular wavelength of light, but they also produce a current when exposed to the same wavelength of light.

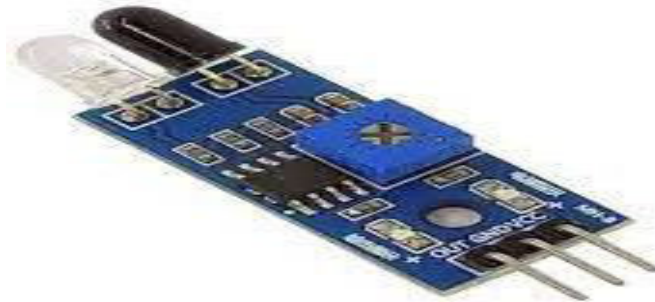


Figure 4 IR Sensor

Motion detectors can be created using a pair of IR LEDs. The second IR LED is wired to transmit a signal when it detects an IR input and the first IR LED is wired to produce IR waves. The object reflects the IR back to the receiving LED and generates a signal when it is in range of the generating LED. The LED light can be turned on with this signal.

Pin 1: Out - The signal pin emits the sequence in response to the detected IR signal.

Pin 2: Ground - Attached to the circuit's Ground

Vcc (Pin 3): Normally connected to +5V, 2.5V to 5.5V.

### Types of IR Sensor

There are two types of IR sensors are available and they are,

- Active Infrared Sensor
- Passive Infrared Sensor

### LDR SENSOR

A device whose resistance depends on the electromagnetic waves that is incident is known as an LDR or photo resistor. They are therefore light-sensitive gadgets. They may also be referred to as photocells, photoconductors, or simply photoconductive materials. They are constructed of highly resistant semiconductor materials. There are many various ways to represent an LDR; one of the most popular is depicted in the figure below. The arrow denotes that it is receiving light. The electrons hit the object when light hits it, or when the photons hit it. A light dependent resistor, commonly referred to as a photo resistor or LDR, is a component whose resistance depends on the electromagnetic radiation that strikes it. They are therefore light-sensitive gadgets. Other names for them include photoconductors, photoconductive cells, and just plain old photocells.

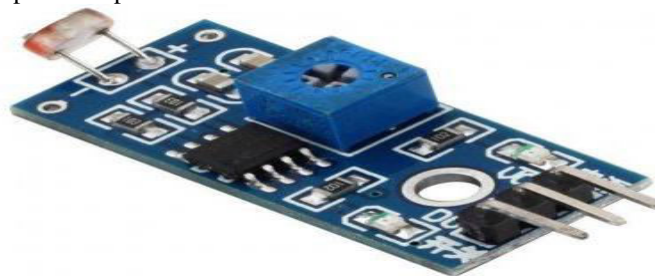


Figure 5 LDR Sensor

### Types of Light Dependent Resistors (LDRs or Photoresistors)

Depending on the materials used to make them, photoresistors (LDRs) can be divided into two types. These are two examples of photoresistors:

Undoped semiconductor materials such as silicon or germanium are used to create intrinsic photoresistors. When enough energetic photons strike an electron and the number of charge carriers rises, the electron is stimulated from the valence band to the conduction band.

Extrinsic photoresistors are semiconductor materials that have had impurities, or "dopants," added. Above the electron-filled valence band, these dopants produce new energy bands. As a result, the bandgap is narrowed and less energy is required to excite them. For extended wavelengths, extrinsic photo resistors are typically used.

### CIRCUIT DIAGRAM

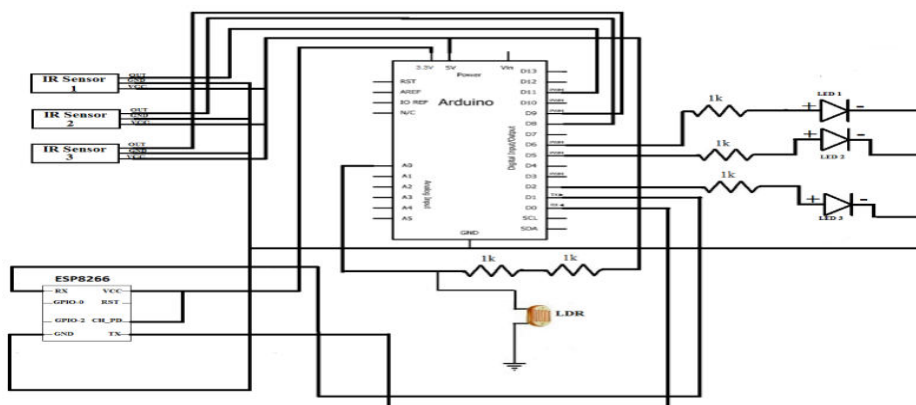


Figure 6 CIRCUIT Diagram

### IV. EXPERIMENTAL SETUP

#### STEPS TO CONNECT

##### Infrared Sensor and Arduino connected

- Connect pin 1 of the IR sensor to pin 2 of the Arduino.
- Attach the IR sensor's GND pin to the Arduino's GND pin.
- Join the IR Sensor's VCC pin to the Arduino's 5.5 V supply.

##### LDR Sensor Arduino Connection

- Attach the pin 1 of the LDR sensor to the Arduino A0 pin;
- Attach the pin 1 of the LDR sensor to the Arduino A0 pin;
- Connect the pin 2 of the LDR sensor to the GND pin;
- Connect the pin 3 of the LDR sensor to the Arduino +5V pin.

##### Link the LED to the ARDUINO.

- Attach the two wires of the lightbulb to the ARDUINO Board's two pins.

#### Sample Source Code

```
intIRSensor = 2;
int LED = 13;
constintldrPin = A0;
void setup()
{pinMode(ldrPin, INPUT);
pinMode (IRSensor, INPUT);
INPUT pinMode (LED, OUTPUT);}
void loop()
{
{
digitalWrite(LED, HIGH);
}
intldrStatus = analogRead(ldrPin);
if (ldrStatus<= 200) {
digitalWrite(LED, LOW);
Serial.print("Darkness over here,turn on the LED :");
Serial.println(ldrStatus);
}
}
```

```

intstatusSensor = digitalRead (IRSensor);
if (statusSensor == 1) {
digitalWrite(LED, LOW);
} else
else {
digitalWrite(LED, HIGH);
Serial.print("There is sufficient light , turn off the
LED : "); Serial.println(ldrStatus);}
    
```

V. RESULTS

Table 1 Power Consumption Chart

Sl. No.	Parameter	Conventional Method	Automated Method
1	Power Consumed per day	1.1 kiloWatt hour	0.8 kiloWatt hour
2	Ideal Power	Nil	0.1 Watt hour
3	Manpower	Required	Not Required

Here the data is given as per average with on and off time. The unwanted on time is 2 hours/day in average.

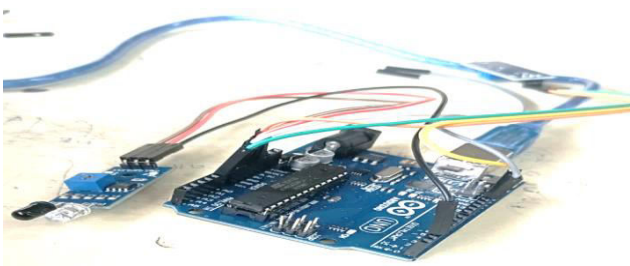


Figure 7 Sensor Connection

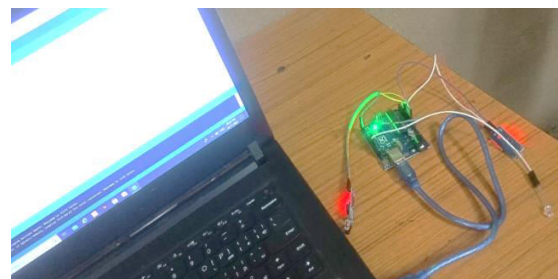


Figure 8 Arduino Code Upload In Board

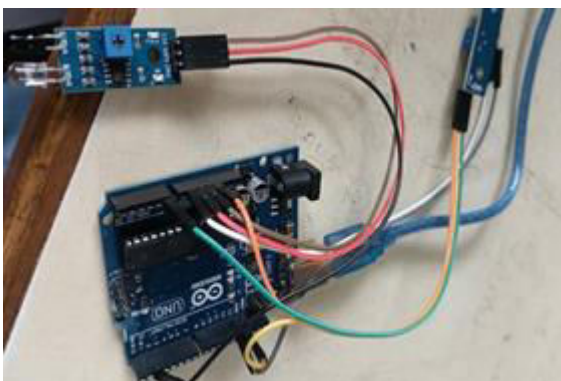


Figure 9 Connection of LDR Sensor



Figure 10 Working LED ON



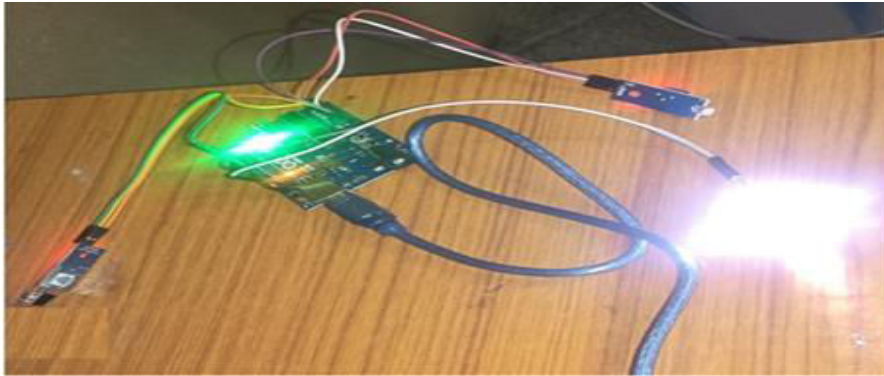


Figure 11 Working LDR Sensor

## VI. CONCLUSION

The planned system installation required minimal additional setup effort and was simple to complete. By using an ASLCSIOT system, the initiative aids in reducing the energy consumption of street lighting. The notion is carried out utilising IR and LDR sensors in this model representation. The system can be further improved by connecting temperature and weather sensors to the present setup, as well as a clock timer, to automate the operation even on cloudy or wet days. The ASLCSIOT system has been fully deployed, but there is still room for advancements that will be beneficial to the system in the long run. Future improvements to this system could include

- Adding a GUI environment
- It is necessary to gauge how much energy each light uses.
- There is a need to determine whether any broken lighting is present online.

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