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SMART VEHICLE SECURITY AND SAFETY BASED ON INTERNET OF THINGS

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Abstract:

In this modern era, transportation is emerging as one of the important need of human. Though it has numerous needs, we face lot of problem in it which might cost human life. This paper deals with problem which cause accident and also to ensure safety and security of the person present in the vehicle or is driving the vehicle. It deals with vibration sensor to detect the accident. If the vibration sensor detects the accident, an alert message is sent to the official person which give GPS location. A mechanism involves confirming the assurance of locked seat belt and ensures that until the seat belts are not locked, the vehicle engine would not start. And it also ensure the driver is not drunk through an alcohol sensor. The alcohol senor is used to found the drunken driver only if driver is not drunk then only the ignition will start. The eye blink sensor detects the drowsiness of the driver and give alert using the buzzer. It also deploys a proximity sensor in order to avoid the collision. The automotive proximity sensor are deployed inside the car to find out the interruption in path. All these status will be updated on the internet using the concept of Internet of Things and the same will also be deployed on an app. Through this, driver safety is ensured through the automotive mechanism.

Keywords: GPS, Location, IoT, Proximity Sensor, Vehicle Security, Vibration Sensor.

I. Introduction

In this modern era, transportation is indeed one of the important need of human. Though it has numerous needs, we face lot of problem in it which might cost human life.

Factually, there are 1.34 lakhs deaths in India every year due to road accident. The Community against Drunken Driving (CADD) said 70%of these accidents are due to consumption of alcohol. The figure is less in smaller cities running between 44%-67%. Drunken driving accidents have increased by seven times in Delhi and about sixteen times in

Mumbai since 2001. [1]

The National Highway Traffic Safety Administration of America conservatively estimates that 100,000 police-reported crashes are the direct result of driver's drowsiness each year. This results in an estimated 1,550 deaths, 71,000 injuries, and $12.5 billion in monetary losses. [2]

In 2002, 43,005 people died in traffic accidents. Seat belt data was available for 32,598 of those involved in fatal car crashes. Of that number, 19,103 were not wearing seat belts. 4,200 lives could be saved each year if 90% of the U.S. population wore seat belts. [3]

II. Literature Survey

Dr. Khalifa A. Salimbrahim, Mohammed Idrees et al present an integrated cost effective web based GPS-GPRS vehicle tracking system. The system enables enterprises owners to view the present and past positions recorded of the target vehicle on Google Map through purpose designed web site. The current position of the vehicle was acquired by GPS device which is integrated in the target vehicle and the location coordinates are sent through GPRS service provided by the GSM network. [4] Khaled Hossain, Sayed Samial Haq et al present a method for detection of Car Pre-Crash with Human, Avoidance System and Localizing it through GSM. [5] Khondker Shajadul Hasan, Mashiur Rahman, Abul L. Haque, M Abdur Rahman, Tanzil Rahman, M Mahbubur Rasheed et al propose a system that reads the current position of the object using GPS, the data is sent via GPRS service from the GSM network towards a web server using the POST method of the HTTP protocol. The object's position data is then stored in the database for live and past tracking. A web application is developed using PHP, JavaScript, Ajax and My SQL. [6].

III. Proposed System

The proposed system makes use of an embedded system based on GSM Technology and Internet of Things. To avoid the accident, the automotive proximity sensor are deployed inside the car to find out the interruption in path [7]. And to ensure safety even after the accident an alert mechanism is governed which uses a GPS system to get position of the vehicle[8] and it sends to authorized person when the vehicle face the accident which is sensed by a vibration sensor. A gas senor is used to found the drunken driver only if driver is not get dunked then only the ignition get start, the eye blink sensor detects the drowsiness of the driver and give alert using the buzzer. All these status will be updated on the portal using Internet of Things.

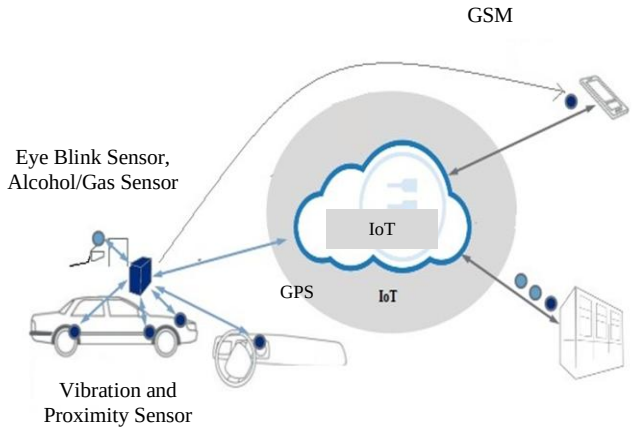

Fig. 1. System Design.

IV. Methodology

The embedded technology is the prime technology used here under the wireless as main domain; to achieve the concept here we are using ARDUINO UNO as the prime controller which uses ATMEGA-328 controller which is driven by 5V DC supply, the coding is done through the ARDUINO IDE and it is also dumped to the controller through the same IDE, the Embedded C language is used as the coding language, Arduino comprises of 12 digital pins, 6 analog pins, 1 5v, 3 ground pins and one serial pin. The digital pins can be used as the serial pins using the software serial communication, here we are using totally 5 sensor in which the alcohol and vibration sensors are used as the analog sensors while the eye blink, proximity, and the seatbelt/helmet sensors are used as digital sensor. Each and every sensor consists of a 5V and ground pin which is given to the Arduino's 5V and ground pin, the input pin is given to the corresponding Arduino's input pin which is declared in the coding, since the alcohol sensor and the vibration sensor must met certain threshold so we are using that sensors as analog sensors which is connected to the corresponding analog as such like declared in the code.

Here the eye blink sensor is used to detect the drowsiness of the driver; the proximity sensor is used to detect a very close obstacle present in from of the vehicle, the alcohol sensor senses whether the driver consumes the alcohol[9], the seat belt/helmet sensor detect whether the driver is wearing the seat belt/helmet, the vibration sensor detects the accident of the vehicle. Here the 5V DC motor is used to indicate the vehicle's wheel is running or not, the buzzer is used for alarm indication, the GPS is used to get the location, the GSM is used to send the message the IOT is used to publish the data in cloud.

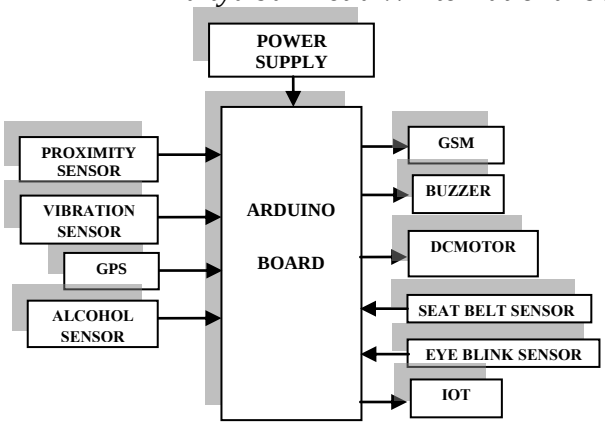

Fig. 2. Block Diagram.

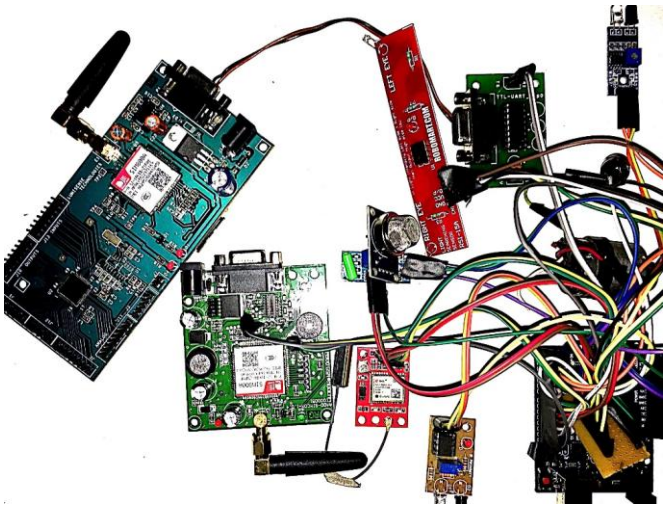

Fig. 3. Hardware Prototype.

V. Component Design

A. Multi-Purpose Optical Sensor (MPOS)

In order to use this sensor as an Obstacle sensor, the optical sensor is mounted on side of the vehicle facing them horizontally with the ground surface. Place any obstacle in front of your prototype. When your sensor detects the obstacle it will send a data of logic-0 through the data pin and when the obstacle is absent, it will send a data of logic-1 through the data pin.

TABLE I: COMPARISON

Existing System	Proposed System
• Here the accidents and control of vehicle is noted manually • Automatic control is not possible	• In proposed system, we can design a new system to control and avoid the accidents automatically. • Fully automatic system
Drawbacks of existing system: • Human intervention is needed. • Automatic alarm indication is not possible	**Advantage of proposed system:** • There is no Human intervention. • Intimation will be sent automatically.

B. Vibration Sensor

The vibration sensor detects shock intensity caused by sudden knocks or hits and continuous vibration due to faulty ball-bearings on fans and other equipment. Vibration sensor usually

at any angle switch is ON state, by the vibration or movement, the rollers of the conduction current in the switch will produce a movement or vibration, causing the current through the disconnect or the rise of the resistance and trigger circuit. The characteristics of this switch is usually general in the conduction state briefly disconnected resistant to vibration, so it's high sensitivity settings by IC, customers according to their sensitivity requirements for adjustments.

C. Global Positioning System (GPS)

The GPS concept is based on time and the known position of specialized satellites. GPS satellites continuously transmit their current time and position. A GPS receiver monitors multiple satellites and solves equations to determine the precise position of the receiver and its deviation from true time. At a minimum, four satellites must be in view of the receiver for it to compute 4 unknown quantities. [10]

Fig. 4. GPS Module.

D. Alcohol/ Gas Sensor

MQ-4 gas sensor detects the concentration of methane gas in the environmental air and output the reading as an analog voltage. The concentration sensing range of 300 ppm to 10,000 ppm is suitable for leak detection. Signal conditioning circuit is used to convert the change of conductivity to correspond output signal with the input gas concentration. MQ-4 gas sensor has high sensitivity to Methane, also to Propane and Butane. The sensor could be used to detect different combustible gas, especially Methane; it is with low cost and suitable for different application.[11] The MQ-4 gas module is mounted on a pcb board which has an operating voltage of 5V DC. The sensor output values can be get by means of both analog and digital. [12]

Fig. 5. Gas Sensor.

TABLE II: LEVEL OF DRUNKENNESS

Output	***Level of Drunkenness***	
	<345 ppm	***>350 ppm***
Status	*Low*	*High*
Ignition	*Enable*	*Disable*

E. GSM Modem

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem but receives data through radio waves.[13] There are various AT commands which are used to provide communication (i.e. sending message) via GSM.

- Send the message command - AT+CMGF=1
- Modem will then send the text – OK
- Then send - AT+CMGS="NUM" (where NUM is service provider's number)

F. DC Motor

A DC motor converts direct current electrical power into mechanical power. DC or direct current motor works on the principal, when a current carrying conductor is placed in a magnetic field, it experiences a torque and has a tendency to move. This is known as motoring action quantities.

Fig. 6. DC Motor.

G. Eye Blink Sensor

The eye is illuminated by an IR led, which is powered by the +5v power supply and the reflected light is recorded by an IR photo diode. This eye blink sensor is IR based; the variation across the eye will vary as per eye blink. [14] The exact functionality depends greatly on the positioning and aiming of the emitter and detector with respect to the eye.[15] If the eye is closed means the output is high otherwise output is low. This to know the eye is closing or opening position. This output is given to logic circuit to indicate the alarm. [16]

Fig. 7. Eye Blink Sensor.

H. Buzzer

The buzzer, an audio signaling device generates consistent single tone sound just by applying D.C voltage. Using a suitably designed resonant system, this type can be used where large sound volumes are needed. At Future Electronics we stock many of the most common types categorized by Type, Sound Level, Frequency, Rated Voltage, Dimension and Packaging Type.

Fig. 8. Buzzer.

I. Internet of Things

Internet of Things (IoT) is an environment in which objects, animals or people are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. IoT board featured with SIM800A GPRS modem to activate internet connection also equipped with a controller to process all input UART data to GPRS based online data. Data may be updated to a specific site or a social network by which the user can able to access the data.

J. ArduinoUno R3

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

Fig. 9. Arduino Uno R3.

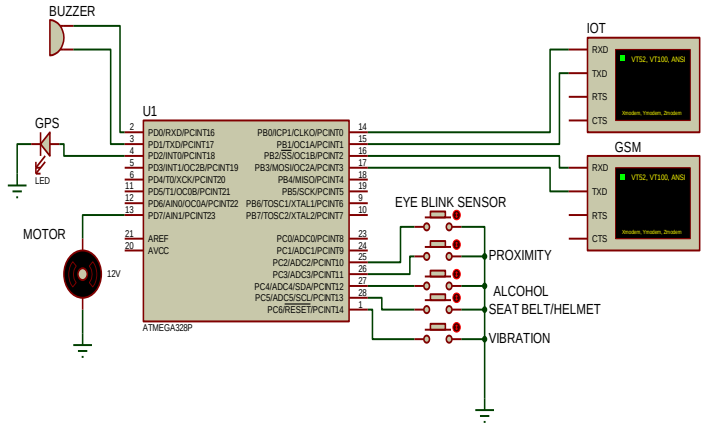

Fig. 10. Circuit Diagram.

VI. Software Design

The Integrated development environment is Arduino Uno with Embedded C Programming Language. PHP is used as HTML-embedded, server-side scripting language for sending the sensor data on the Internet and App using the concept of Internet of Things. [17,18]

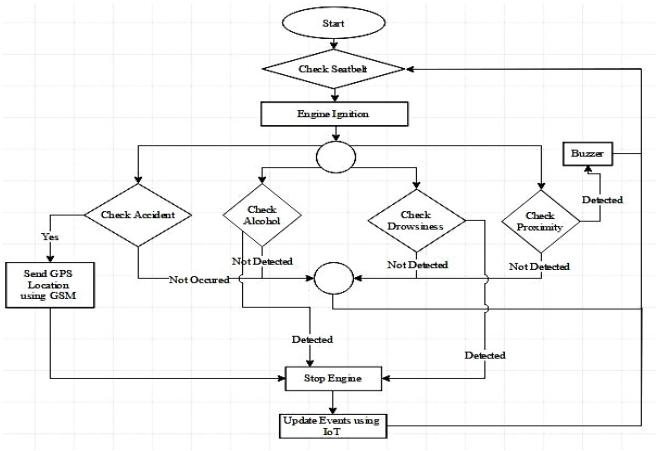

Fig. 11. Mechanism Flowchart.

LogID	DATA	Logdate	LogTime
1	ACCIDENT_OCCURED_LAT:_12.960671_LON:_79.140281	03/16/2017	19:48:36
2	ACCIDENT_OCCURED_LAT:_12.960671_LON:_79.140281	03/16/2017	19:49:10
3	DRIVER_FEELING_SLEEPY	03/16/2017	19:49:44
4	ACCIDENT_OCCURED_LAT:_12.960730_LON:_79.140327	03/16/2017	19:50:19
5	ACCIDENT_OCCURED_LAT:_12.960710_LON:_79.140258	03/17/2017	09:20:14
6	ACCIDENT_OCCURED_LAT:_12.960741_LON:_79.140296	03/17/2017	09:20:43
7	ACCIDENT_OCCURED_LAT:_12.960741_LON:_79.140296	03/17/2017	09:21:18
8	ACCIDENT_OCCURED_LAT:_12.960741_LON:_79.140296	03/17/2017	09:21:53
9	DRIVER_FEELING_SLEEPY	03/17/2017	09:22:26
10	ACCIDENT_OCCURED_LAT:_12.960721_LON:_79.140312	03/17/2017	09:23:00
11		03/17/2017	09:25:21
12	ACCIDENT_OCCURED_LAT:_0.000000_LON:_0.000000	03/17/2017	09:25:51
13	ACCIDENT_OCCURED_LAT:_12.960660_LON:_79.140289	03/17/2017	09:26:25
14	DRIVER_FEELING_SLEEPY	03/17/2017	09:26:59
15	ACCIDENT_OCCURED_LAT:_12.960640_LON:_79.140266	03/17/2017	09:27:34
16	ACCIDENT_OCCURED_LAT:_12.960640_LON:_79.140266	03/17/2017	09:28:08
17		03/21/2017	13:02:29
18		03/21/2017	13:02:58
19	ACCIDENT_OCCURED_LAT:_0.000000_LON:_0.000000	03/21/2017	13:03:32
20	ACCIDENT_OCCURED_LAT:_12.960710_LON:_79.140327	03/21/2017	13:04:04

Fig. 12. Update on Internet Portal Using IoT.

VII. Arduino Coding

```
#include <SoftwareSerial.h>
#include <TinyGPS.h>
TinyGPS gps;
SoftwareSerial ss(9, 10); //gps
SoftwareSerial mySerial(7, 8);//gsm
SoftwareSerial iot(11, 12);//iot
float flat, flon;
unsigned long age;
int eye = 3;
int y;
int e1;
int b1;
int a = 1; //alc
int b;//alc
int c = 2; //vib
int d;//vib
int e = 3; //seat
```

```
int f;//seat
int h = 2; //prox
int j;//prox
int g = 1;
int buz = 5;
int led = 13;
int mot = 4;
void setup()
{
        pinMode(a, INPUT);
        pinMode(c, INPUT);
        pinMode(y, INPUT);
        pinMode(e, INPUT); //IR SEATBELT
        pinMode(h, INPUT);
        pinMode(led, OUTPUT);
        pinMode(mot, OUTPUT);
        pinMode(buz, OUTPUT);
        Serial.begin(9600); // put your setup code here, to run once:
        iot.begin(9600);
}
void loop()
{
        ss.begin(9600);
        delay(100);
        bool newData = false;
        unsigned long chars;
        unsigned short sentences, failed;
        for (unsigned long start = millis(); millis() - start < 1000;)
        {
                while (ss.available())
                {
                        char c = ss.read();
      if (gps.encode(c))
      {
        newData = true;
```

```
                    }
  }
}
if (newData)
{
  gps.f_get_position(&flat, &flon, &age);
}
b = analogRead(a);
      d = analogRead(c);
       f = digitalRead(e);
       j = digitalRead(h);
      y = analogRead(eye);
       //   Serial.println(distance);
      if (j == HIGH) //proximity
      {
            digitalWrite(mot, LOW);
      }
      if ((b < 345) && (f == LOW) && (g == 1) && (j == LOW))
      {
            digitalWrite(led, HIGH);
  digitalWrite(mot, HIGH);
}
if ((b > 350) || (f == HIGH) || (g == 2))
{
  digitalWrite(led, LOW);
  digitalWrite(mot, LOW);
}
      if (d < 210) //vibration
{
            digitalWrite(led, LOW);
            digitalWrite(mot, LOW);
            g = 2;
            Serial.println("ACCIDENT OCCURED");
            Serial.print("LAT ");
            Serial.println(flat, 6);
```

```
            Serial.print("LON ");
            Serial.println(flon, 6);
            Serial.println();
            iot.print("*");
            iot.print("ACCIDENT OCCURED");
            iot.print(" LAT: ");
            iot.print(flat, 6);
            iot.print(" LON: ");
            iot.print(flon, 6);
            iot.print("#");
            mySerial.begin(9600);
            mySerial.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
            delay(1000);  // Delay of 1000 milli seconds or 1 second
            mySerial.println("AT+CMGS=\"+91XXXXXXXXXX\"\r");
            delay(1000);
            mySerial.println("ACCIDENT OCCURED");
            mySerial.print("LAT ");
            mySerial.println(flat, 6);
            mySerial.print("LON ");
            mySerial.println(flon, 6);
            mySerial.println();
            delay(100);
            mySerial.println((char)26);// ASCII code of CTRL+Z
            delay(1000);
    }
    if ((y < 300) && (e1 == 1))
    {
            digitalWrite(buz, HIGH);
            delay(500);
            b1 = b1 + 1;
if (b1 > 2)
            {
                    digitalWrite(mot, LOW);
                    Serial.println("DRIVER FEELING SLEEPY");
                    iot.print("*DRIVER FEELING SLEEPY#");
```

```
                mySerial.begin(9600);
                mySerial.println("AT+CMGF=1");
                delay(1000);
                mySerial.println("AT+CMGS=\"+91XXXXXXXXXX\"\r");
                delay(1000);
                mySerial.println("DRIVER FEELING SLEEPY");
                delay(100);
                mySerial.println((char)26);
                delay(1000);
                e1 = 2;
                g = 2;
        }
    }
    if (y > 370)
    {
        b1 = 0;
        e1 = 1;
        digitalWrite(buz, LOW);
    }
}
```

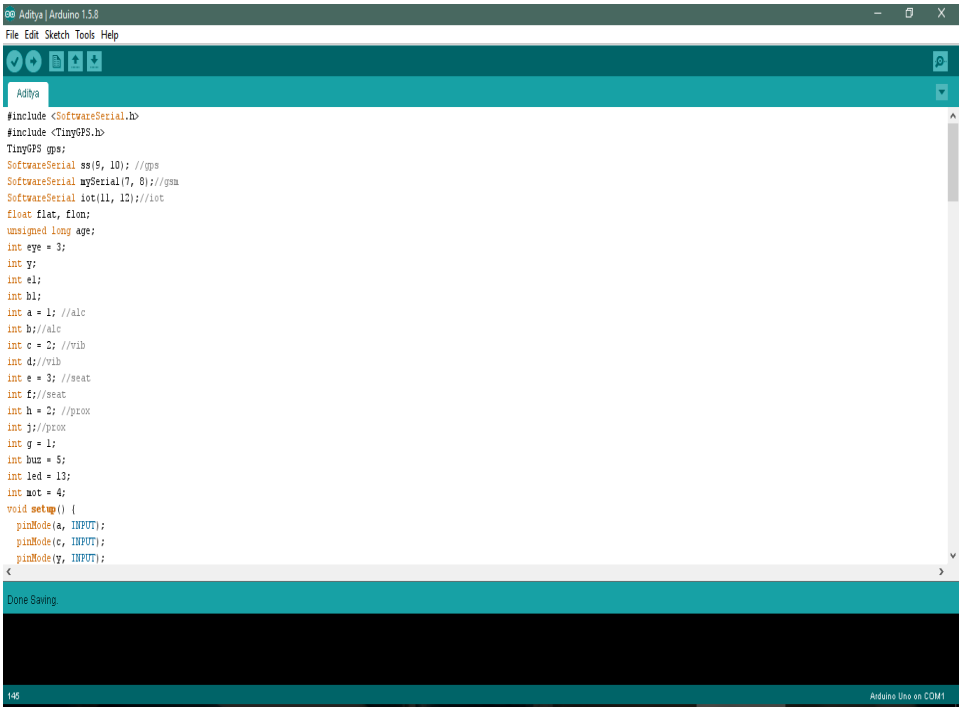

Fig. 13. Arduino IDE.

VIII. Conclusion and Future Scope

K. Conclusion

An efficient smart vehicle safety and security system embedded with proximity sensor, vibration sensor, alcohol and drowsiness detector using the concept of Global Positioning System, GSM and Internet of things has been proposed. This system helps the driver to avoid accident and in case of accident, aims to provide security to the driver by sending the location of the accident to the authorized phone number via the GSM system installed in the car.

1) Advantages

- The MQ-4 Gas Sensor gives a relatively faster analysis of presence of Alcohol in breath and thus helps in faster detection of Alcohol.
- The system is completely automated and not dependent on anyone.
- In case the person is Drowsy or ha has met with an accident, SMS will be sent to an authorized person and then he/she can accompany the person.

L. Future Scope

The Proposed System can be modified by making use of concept of Big data and GPS for seeking help from nearest Remote Station in case of Accident.

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