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LI-FI BASED COMMUNICATION SYSTEM BETWEEN VEHICLES TO AVOID ACCIDENTS ON ROAD

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Abstract - Intelligent vehicles can assist the drivers to improve the safety, comfort, sustainability and efficiency. Intelligent vehicles use emerging technologies in modeling, localization, motion control, and machine learning, which have become a research focus for many worldwide academy and industry institutes. However, there is still much open research challenge in technologies as well as collision detection and obstacles avoidance. In this work, we investigate how to effectively help drivers overcome the fatigue driving and avoid collisions. By leveraging the existing, Ultrasonic Sensor, Infrared (IR) Sensor and **Li-Fi,** Vehicle-to-Vehicle (V2V) Communication and machine learning technologies, we develop the Anti-Fatigue **Decision Tree**, **Anti-Fatigue Detection and Enhanced Collision Avoidance Systems** to accurately evaluate the current situation of the drivers and vehicles, and make timely response. Our prototype testing and analysis show that the proposed techniques are feasible and cost-effective.

1. INTRODUCTION

Automobiles have become an inevitable part of our daily life. In recent years, with the improvement of residents' living standards, greater attention has been paid to the safety features of automobiles. The enhanced features make the vehicle equipping with the intelligent environment perception ability, which can analyze the safety and dangerous state of the vehicle and correspondingly suggest actions or signal warning messages to the drivers. These features and related techniques are widely experimented in the intelligent driving system, life service system, safety protection system, location service system and so on. The Collision Detection System contained in the safety protection system can effectively deal with problems of rear-end collision that cause the most frequent traffic accidents. In this work, we propose framework for anti-fatigue driving and Collision Avoidance Systems by using technologies such as Ultrasonic Sensor and Li-Fi Sensors to collect data.

1.1 LITERATURE SURVEY

[1] The work in investigates a hybrid design based on Li-Fi(Light Fidelity) and shows the accuracy of using light to transmit data and position information between vehicles. However, the existing techniques in detecting collisions are still expensive and largely ignore the consideration of how to help drivers overcome fatigue driving. In fact, fatigue driving takes the account for about 20% traffic.

[2] The study in investigates a novel method for vehicle speed estimation from a camera in motion. The system utilizes the smart phone camera mounted behind the windshield to capture consecutive frames of the street ahead and estimates the distance to the front vehicle in the range of centimeters accuracy. A large amount of point cloud data measured by 3D LiDAR sensor can be efficiently processed by a new method of objects classification based on the feature NoPP in, which can further help detection and ranging.

In [3], the work proposes an improved WiFi-Fingerprinting method to replace GPS behavior for the indoor environment. In addition, there are many studies attempting to connect all the intelligent vehicles into a dynamic ad-hoc network. As a result, much road condition and traffic information can be disseminated and shared among drivers. The work in presents an overtaking decision algorithm for networked intelligent vehicles, which can calculate the risks and make the corresponding overtaking decisions according to the estimated distance and speed between the front and the oncoming vehicles.

1.2 SYSTEM MODEL

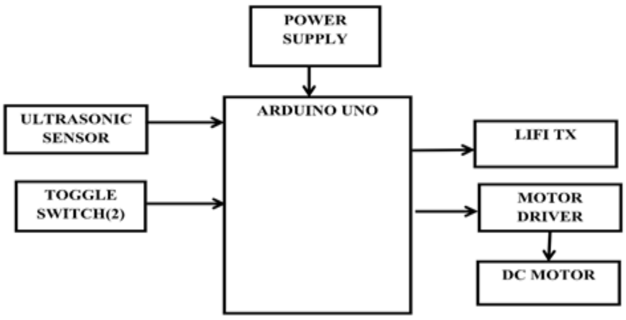
The consequences of fatigue driving are extremely serious. It is necessary for an intelligent vehicle to have the ability to detect fatigue and have a better sense of what is going on around the vehicle to avoid collisions. This is not trivial, on the contrary, it has many challenges and need take advantages of a series of emerging technologies. This section begins with our system model that assumes the primary cost-effective technologies used and their roles in collision prevention.

2. WORKING PRINCIPLE

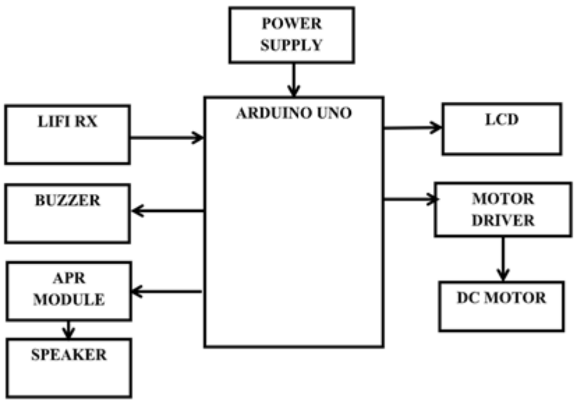
In this project we have Arduino UNO microcontroller which acts as brain of our system. Hence entire system program is stored in it. Here, we have two units 1. Transmitter unit, 2. Receiver unit. Both units act as Transceiver based on concept. Both Units consist of LCD which shows each status and whatever sensor data. DC motor is set at each unit to show the vehicles speed. If one unit motor slow down means the motor at other end automatically slows as because data communicates via Visual Light. Toggle switch is at the vehicles are placed as an indicator.it will intimate other vehicles about the way its going to turn. In this project we have Arduino UNO microcontroller which acts as brain of our system. Hence entire system program is stored in it. Here, we have two units 1. Transmitter unit, 2. Receiver unit. Both units act as Transceiver based on concept. Both Units consist of LCD which shows each status and whatever sensor data. DC motor is set at each unit to show the vehicles speed. If one unit motor slow down means the motor at other end automatically slows as because data communicates via Visual Light. Toggle switch is at the vehicles are placed as an indicator.it will intimate other vehicles about the way its going to turn.

BLOCK DIAGRAM:

TRANSMITTER



RECEIVER:



Programming
Transmitter

```
unsigned int trig=5;
unsigned int echo=6;
long dur;
unsigned int distance;
unsigned int MF=A0;
unsigned int MR=A1;
unsigned int L=2;
unsigned int R=3;
void ultra();
void indicator();

void setup() {

 Serial.begin(9600);
pinMode(A0,OUTPUT);
pinMode(A1,OUTPUT);
pinMode(trig,OUTPUT);
pinMode(echo,INPUT);
pinMode(A2,INPUT);
pinMode(A3,INPUT);
digitalWrite(MF,LOW);
digitalWrite(MR,LOW);
}
void loop() {
 // put your main code here, to run repeatedly:
 digitalWrite(MF,HIGH);
 digitalWrite(MR,LOW);
 ultra();
 indicator();
 while (Serial.available()>0)
 {
 char c=Serial.read();
 if(c=='B'){
 Serial.print('B');
 digitalWrite(MF,LOW);
 digitalWrite(MR,LOW);
 delay(3000);
 }
 }
}
void ultra()
{
 distance = 0;
 dur = 0;
 digitalWrite(trig, LOW);
 delay(10);
 digitalWrite(trig, HIGH);
 delay(10);
 digitalWrite(trig, LOW);
 dur = pulseIn(echo, HIGH);
 distance = ((dur * 0.034 ) / 2); //cm
 //Serial.println(distance);
 delay(200);
 if(distance < 20)
 {
 Serial.print('S');

 digitalWrite(MF,LOW);
 delay(4000);
 }
}
void indicator()
{
```

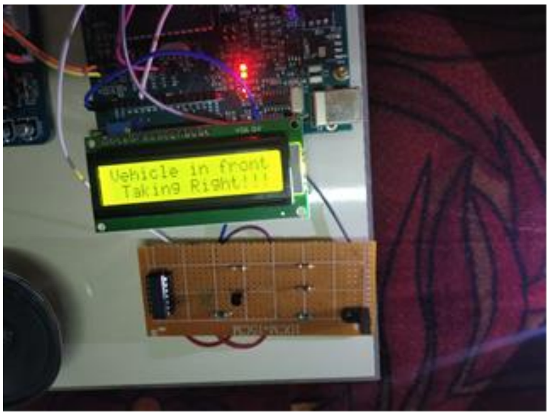
```
if(digitalRead(2)==1)
{
Serial.print('L');
delay(4000);
}
if(digitalRead(3)==1)
{
Serial.print('R');
delay(4000);
}
```

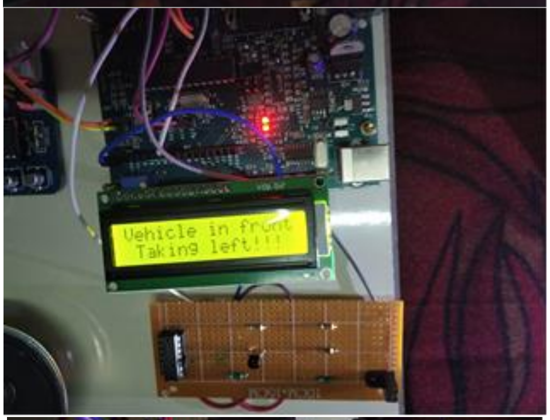
Receiver

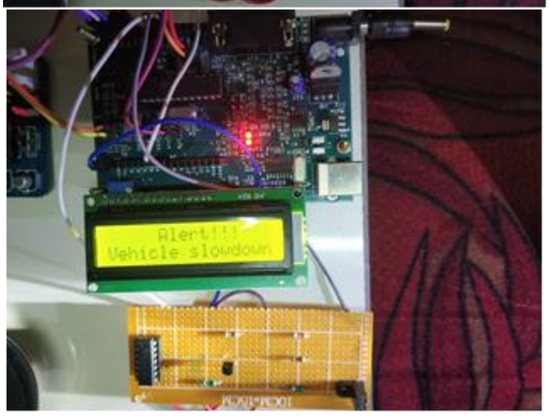
```
#include <LiquidCrystal.h>
LiquidCrystal lcd(13,12,11,10,9,8);
unsigned int MF = A0;
unsigned int MR = A1;
unsigned int V1 = A2;
unsigned int V2 = A3;
unsigned int V3 = A4;
unsigned int buz = 7;
char c,s;
void setup() {
 // put your setup code here, to run once:
 pinMode(MF, OUTPUT);
 pinMode(MR, OUTPUT);
 pinMode(V1, OUTPUT);
 pinMode(V2, OUTPUT);
 pinMode(V3, OUTPUT);
 pinMode(buz, OUTPUT);
 digitalWrite(V1, HIGH);
 digitalWrite(V2, HIGH);
 digitalWrite(V3, HIGH);
 lcd.begin(16, 2);
 Serial.begin(9600);
 lcd.setCursor(0, 0);
 lcd.print(" Coll Avoidance");
 lcd.setCursor(0, 1);
 lcd.print(" btw vehicles");
 delay(3000);
 lcd.clear();
 digitalWrite(MF, LOW);
 digitalWrite(MR, LOW);
 digitalWrite(buz, LOW);
}

void loop() {
 // put your main code here, to run repeatedly:
 while (Serial.available() > 0)
 {
 c = (char)Serial.read();
 Serial.print(c);
 if (c == 'S')
 {
 lcd.setCursor(0, 0);
 lcd.print(" Alert!!! ");
 lcd.setCursor(0, 1);
lcd.print("Vehicle slowdown");
digitalWrite(MF, LOW);
digitalWrite(buz,HIGH);
delay(1000);
digitalWrite(buz,LOW);
delay(1000);
//apr
digitalWrite(V1, LOW);
delay(500);
digitalWrite(V1, HIGH);
delay(3000);
lcd.clear();

}
else if(c=='B')
{
digitalWrite(buz,HIGH);
digitalWrite(MF,LOW);
delay(2000);
digitalWrite(buz,LOW);

}
else if (c == 'L')
{
lcd.setCursor(0, 0);
lcd.print("Vehicle in front");
lcd.setCursor(0, 1);
lcd.print(" Taking left!!!");
for(int i=250;i>50;i--){
analogWrite(MF,i );
delay(15);}
digitalWrite(buz,HIGH);
delay(500);
digitalWrite(buz,LOW);
delay(500);
digitalWrite(V2,LOW);
delay(500);
digitalWrite(V2,HIGH);
delay(2000);
lcd.clear();

}
else if (c == 'R')
{
lcd.setCursor(0, 0);
lcd.print("Vehicle in front");
lcd.setCursor(0, 1);
lcd.print(" Taking Right!!!");
for(int i=250;i>50;i--){
analogWrite(MF,i );
delay(15);}
digitalWrite(buz,HIGH);
delay(500);
digitalWrite(buz,LOW);
delay(500);
digitalWrite(V3,LOW);
delay(500);
```

```
digitalWrite(V3,HIGH);
delay(2000);
lcd.clear();

}
else;
}
digitalWrite(MF,HIGH);
digitalWrite(MR,LOW);
delay(500);
}
```

RESULT







3. CONCLUSION

In this work, we have investigated how to use the cost-effective technologies to detect fatigue driving and develop Enhanced Collision Avoidance System. We have presented the proposed Anti-Fatigue Detection System (AFDS) which is based on the machine learning model called Anti-Fatigue Decision Tree (AFDT) to effectively identify driver drowsiness and correspondingly trigger the alarm system. With the integration of the cost-effective Li-Fi, Ultrasonic Sensor, V2V communication and Infrared Sensor technologies, we have demonstrated an Enhanced Collision Avoidance System (ECAS), which greatly improves the interaction ability between the intelligent vehicle and the external environment, and reduces the probability of collision. In the future, we will explore effective schemes by incorporating more emerging deep learning and computer vision technologies to further improve the performance

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