A project report on

ACCIDENT DETECTION AND ALERT SYSTEM

Submitted in partial fulfillment for the course

Technical Answers for Real World Problems (CSE1901)

by

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ABSTRACT

An analysis of the accident rate in India is published by the Transport Research Wing (TRW) of the Ministry of Road Transport and Highways (MoRTH) every year. According to the most recent report published for the year 2021, there are 47 accidents and 18 deaths per hour, or an average of 1130 accidents and 422 deaths per day. All of the aforementioned information has been gathered and understood from the Section 4 of the study, which highlights the fatalities due to traffic accidents in India.

As the population increases and the standard of living of the people increases day by day, the average number of vehicles on the road worldwide has increased as cars and other vehicles become more and more accessible. Our lives are now easier because of the technology and infrastructure that are developing swiftly. Due to inadequate emergency facilities, frequent road accidents that entail significant loss of life and property also result from the introduction of technology. It has been determined via considerable research that the majority of accidents result in fatalities as a result of poor communication with the relevant authorities and the ensuing dearth of prompt medical assistance.

The existing system mostly focuses on the safety of the passenger but not on the immediate help after an accident. The system implemented by us aims at automatically detecting an accident and alerting the nearest hospital or medical services about the exact location of the accident. The proposed system could be used to deal with accidents in remote areas where no one is available to report them as well. It could also ensure quick accident response saving lives due to delayed response to the accident to the concerned authorities. The system detects the accident occurrence via a computer vision model and the serial number of the camera could be sent to the rescue & response authorities. The serial number of the camera being unique could be matched with the database and the response authorities could navigate to the incident zone accordingly. In future, the model could be upgraded to use GSM and GPS modules. Henceforth, it will alert the GSM and GPS modules, which will further detect the location and send a message indicating the accident with the location where it has occurred.

INTRODUCTION

An analysis of the accident rate in India is published by the Transport Research Wing (TRW) of the Ministry of Road Transport and Highways (MoRTH). According to the most recent report published for the year 2021, there are 47 accidents and 18 deaths per hour, or an average of 1130 accidents and 422 deaths per day. All of the aforementioned information has been gathered and understood from the Section 4 of the study, which highlights the fatalities due to traffic accidents in India.

As the population increases and the standard of living of the people increases day by day, the average number of vehicles on the road worldwide has increased as cars and other vehicles become more and more accessible. Our lives are now easier because of the technology and infrastructure that are developing swiftly. Due to inadequate emergency facilities, frequent road accidents that entail significant loss of life and property also result from the introduction of technology.

It has been determined via considerable research that the majority of accidents result in fatalities as a result of poor communication with the relevant authorities and the ensuing dearth of prompt medical assistance.

OBJECTIVE

To reduce the number of fatalities due to road accidents

To have safer highway roads by using traffic surveillance

Making emergency accident response accessible on highways

Making emergency accident response accessible in places with no human activity

Automating the process of calling/ dialing the emergency accident response ambulance of 102 or 108 depending on the availability in the states

To reduce the average medical response time for ambulances

SCOPE OF THE PROJECT

It can aid the overall healthcare system in reducing the medical response time for accident victims reducing fatalities.

It could aid in reducing the fatalities that occur due to road accidents where there was no one to alert about the occurrence of the accident.

It could help in improving the overall security of the roadways around the nation

It could be used multi-purpose to find the person causing the accident and bring them to justice.

STATEMENT OF THE PROBLEM/ OPPORTUNITY

The existing system mostly focuses on the safety of the passenger but not on the immediate help after an accident. The system implemented by us aims at automatically detecting an accident and alerting the nearest hospital or medical services about the exact location of the accident.

The proposed system could be used to deal with accidents in remote areas where no one is available to report them as well. It could also ensure quick accident response saving lives due to delayed response to the accident to the concerned authorities.

The system detects the accident occurrence via a computer vision model and the serial number of the camera could be sent to the rescue & response authorities. The serial number of the camera being unique could be matched with the database and the response authorities could navigate to the incident zone accordingly. In future, the model could be upgraded to use GSM and GPS modules. Henceforth, it will alert the GSM and GPS modules, which will further detect the location and send a message indicating the accident with the location where it has occurred.

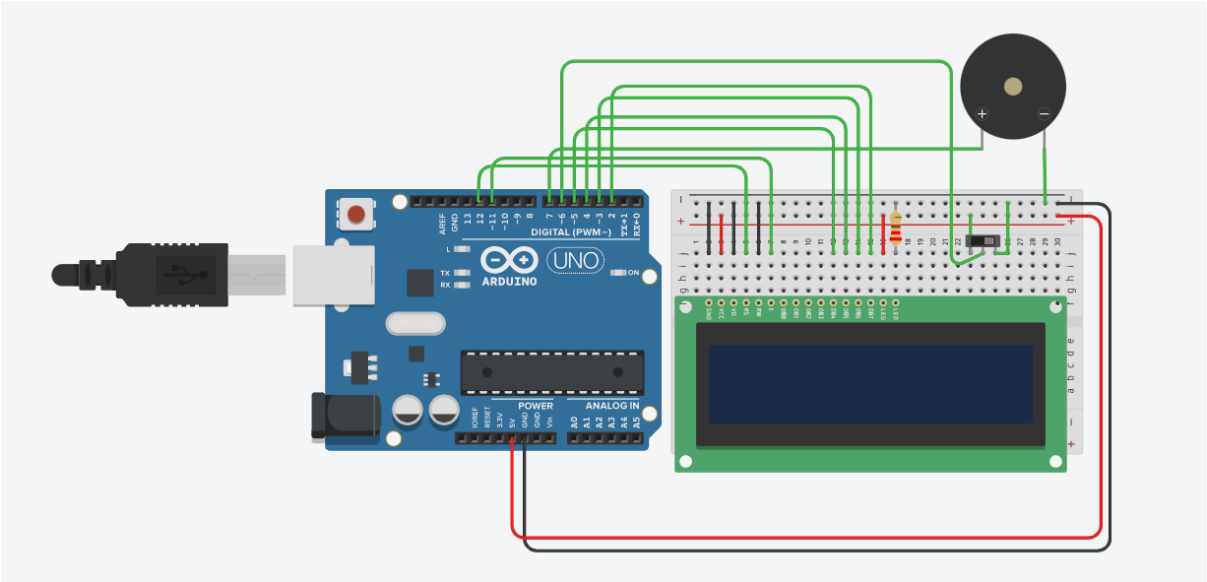
The major advantages of this system are cost effective, assured safety, victim life can be saved quickly, low power consumption, better accuracy, efficient time consumption, and reduced chance of human error.

It then sends the alert message through the GSM Module, including the latitude and longitude data provided by the GPS module, to the police control room, any rescue team, or to the car owners. So, the police can immediately trace the location where the accident has occurred and necessary action can be taken after receiving the emergency message. This system can prove to be a lifesaver in isolated areas where an accident has occurred and no one is around in order to report the accident.

SYSTEM IMPLEMENTATION

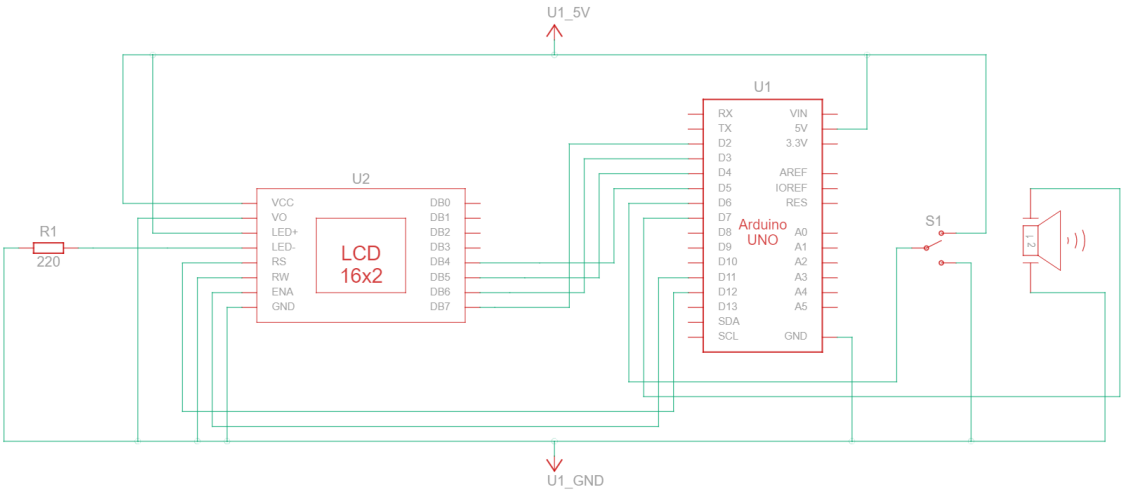
When an accident occurs, it is detected with the help of a sensor that activates the device. The sensor gives its output to the microcontroller. The microcontroller sends the alert.

In this system, the Arduino Uno is used as a microcontroller that controls the whole research. It also includes components like infrared sensors and LEDs. It uses two IR sensors placed on the side of the road. These sensors are mutually exclusive and are connected to microcontrollers (ATmega328P) through wires. Based on the output of sensors, the position of the vehicle is detected, which is provided as an input to the microcontroller. It also includes components like the GSM module and GPS module.



Tinkercad simulation link is attached [here]

CIRCUIT DIAGRAM

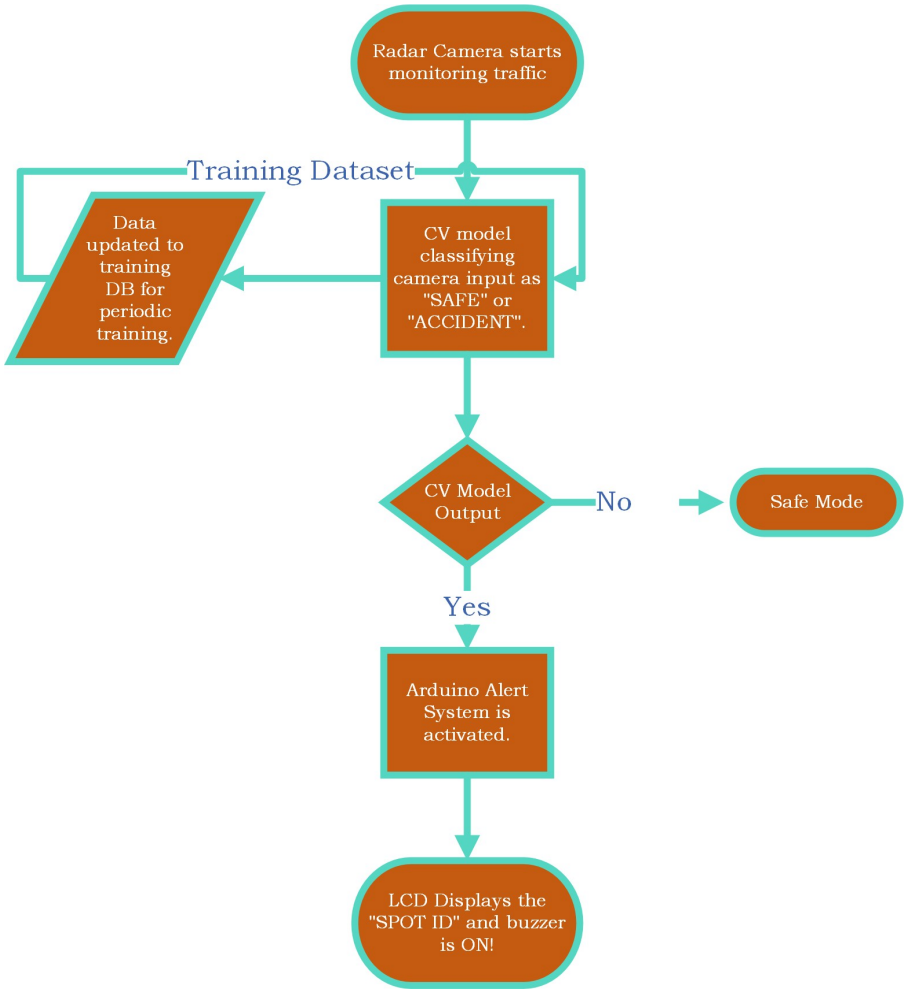


HARDWARE AND SOFTWARE REQUIREMENTS

- Arduino
- Buzzer
- LCD display
- Potentiometer
- Jumper wires
- Breadboard
- ESP8266 wifi module

- Camera

WORKING FLOWCHART



The system starts its working with a camera (CCTV traffic surveillance camera). This input is fed into the computer vision model which detects for accidents. If it detects an accident, it will send a signal of 1 to the Arduino system, else its default will be 0. Once the Arduido alert system receives a value of 1, it will switch on the buzzer and the LED (assumed to be the miniature of the alert systems available in hospitals, police stations, ambulance service places and much more). The LCD display will also display the location of the accident helping in quick response.The proposed system could be used to deal with accidents in remote areas where no one is available to report them

as well. It could also ensure quick accident response saving lives due to delayed response to the accident to the concerned authorities.The system detects the accident occurrence via a computer vision model and the serial number of the camera could be sent to the rescue & response authorities. The serial number of the camera being unique could be matched with the database and the response authorities could navigate to the incident zone accordingly. In future, the model could be upgraded to use GSM and GPS modules. Henceforth, it will alert the GSM and GPS modules, which will further detect the location and send a message indicating the accident with the location where it has occurred.The major advantages of this system are cost effective, assured safety, victim life can be save quickly, low power consumption, better accuracy, efficient time consumption, reduce the chance of human error.It then sends the alert message through the GSM Module, including the latitude and longitude data provided by the GPS module, to the police control room, any rescue team, or to the car owners. So, the police can immediately trace the location where the accident has occurred and necessary action can be taken after receiving the emergency message. This system can prove to be a lifesaver in isolated areas where an accident has occurred and no one is around in order to report the accident.

ADVANTAGES OF THE SYSTEM IMPLEMENTED

1. They are cost-effective in implementation.
2. They have a high tendency to assure safety.
3. The victim's life can be saved quickly involved in the accident.
4. It has low power consumption.
5. It has better accuracy.
6. There is efficient time consumption.
7. It reduces the chance of human error.

LITERATURE SURVEY

[1] In this study, the authors present a thorough assessment of current studies on deep learning-based traffic accident detection and prediction. The writers stress the value of road safety as well as the contribution of cutting-edge technology to accident prevention. Convolutional neural networks (CNNs), recurrent neural networks (RNNs), and hybrid models, as well as other deep learning models that have been presented in the literature, are all covered in length in this study. The authors examine each model's performance using real-world datasets and highlight its benefits and drawbacks. The authors also examine the many kinds of data sources, such as traffic camera photos, data on traffic flow, and social media data, that have been employed for the detection and prediction of traffic accidents. They go over the benefits and drawbacks of every data source and offer tips on how to integrate several data sources for greater accuracy. The need for large-scale, diverse datasets, the creation of real-time detection and prediction systems, and the incorporation of various technologies like sensors, communication networks, and autonomous vehicles are just a few of the challenges and future directions of research in this area that are covered in the paper.

Overall, by summarizing the most recent developments and outlining crucial topics for further investigation, this article offers an invaluable resource for scholars and practitioners in the fields of traffic safety and deep learning.

[2] In this research, the authors suggest a deep learning-based real-time traffic accident detection and prediction system. The authors stress the value of in-the-moment detection and forecasting for raising traffic safety and lessening the effects of accidents. The suggested system, which is made up of two primary parts—a deep learning model for accident detection and a prediction model for accident prediction—is thoroughly discussed in the study. The authors employ a

long short-term memory (LSTM) model for accident prediction based on historical data and a convolutional neural network (CNN) for accident detection from traffic camera pictures. The capacity of the proposed system to effectively detect and anticipate accidents in real-time is demonstrated by the authors when they assess its performance on real-world datasets. Moreover, they emphasize the suggested system's advantages in terms of accuracy and speed by contrasting it with other cutting-edge methods. The suggested system's integration with smart city infrastructure and possible applications for increasing traffic efficiency and safety are also covered in the study.

Overall, by highlighting the potential of deep learning approaches for raising traffic safety and lessening the effects of accidents, this study makes a significant addition to the field of real-time traffic accident detection and prediction. The suggested system is a significant advancement in the creation of cutting-edge technology for intelligent transportation networks.

[3] The performance of various deep learning models for predicting traffic accidents is compared by the authors in this research. The authors stress the value of precise accident forecasting in raising road safety and lessening the effects of accidents. The study's deep learning models, such as feedforward neural networks (FNNs), convolutional neural networks (CNNs), and long short-term memory (LSTM) models, are covered in length in the report. The accuracy and computing efficiency of each model are compared by the authors as they assess each model's performance on a real-world dataset. The authors also suggest a brand-new feature extraction technique based on time series analysis to raise the deep learning models' accuracy. Using the same dataset, they assess the performance of the suggested technique, demonstrating its efficacy in raising model accuracy. The study discusses the benefits and drawbacks of each deep learning model for predicting traffic accidents, emphasizing the significance of taking the unique properties of the data into

account while choosing a model. The authors also go through possible uses for the suggested approach for predicting and preventing accidents in real time.

Overall, this study makes a significant addition to the field of deep learning-based traffic accident prediction, emphasizing the value of precise prediction for raising traffic safety. The comparative analysis of several deep learning models and the suggested feature extraction approach shed light on the effectiveness and constraints of these models and highlight important topics for further investigation.

[4] The authors of this research suggest a deep learning-based method for detecting traffic accidents. The authors stress the value of early accident detection in enhancing emergency response and lessening the effects of accidents. The suggested method, which employs a convolutional neural network (CNN) to identify accidents from traffic camera photos, is further discussed in the study. The scientists also suggest a unique data augmentation method, which entails changing the source pictures to create more training examples, for enhancing the CNN's accuracy. The suggested strategy outperforms other cutting-edge methods in the authors' evaluation of its performance on a real-world dataset, indicating its capacity to precisely detect accidents. They also emphasize the CNN's benefits in terms of accuracy and computing economy when comparing its performance to those of other classifiers. The research offers insights into the significance of feature selection and data pre-treatment for enhancing deep learning models' performance in detecting traffic accidents. The authors also go through possible uses for the suggested method for preventing and detecting accidents in real time.

Overall, by demonstrating the potential of these methods for raising road safety, this study makes a significant addition to the field of deep learning-based traffic

accident identification. The suggested strategy is a substantial advancement in the creation of cutting-edge technology for intelligent transportation systems.

[5] The authors of this research suggest a convolutional neural network (CNN)-based method for predicting traffic accidents. The authors stress the value of precise accident forecasting in raising road safety and lessening the effects of accidents. The suggested method, which employs a CNN to extract characteristics from traffic camera photos and forecast accidents based on the recovered features, is thoroughly discussed in the paper. In order to increase the CNN's accuracy, the authors also suggest a unique data augmentation strategy for creating more training examples. The authors test the suggested method's performance on a real-world dataset and show that it outperforms other cutting-edge methods in properly predicting accidents. They also emphasize the CNN's benefits in terms of accuracy and computing economy when comparing its performance to those of other classifiers. In order to increase the precision of deep learning models for predicting traffic accidents, the research offers insights into the significance of feature extraction and data augmentation. The authors also go through possible uses for the suggested method for predicting and preventing accidents in real time.

Overall, this research makes a significant addition to the area of deep learning-based traffic accident prediction by showing the potential of CNNs to increase road safety. The suggested strategy is a substantial advancement in the creation of cutting-edge technology for intelligent transportation systems.

[6] The authors of this research provide a deep learning framework for predicting traffic accidents. The authors stress the value of anticipating traffic accidents in order to take preventative action and lessen the effects of accidents. The suggested framework, which comprises two modules—a spatiotemporal feature extraction module and a prediction module—is thoroughly discussed in

the study. Convolutional neural networks (CNNs) are used in the feature extraction module to extract features from traffic camera pictures, and recurrent neural networks (RNNs) are used in the prediction module to forecast accidents based on the retrieved features. The suggested system outperforms previous cutting-edge methods according to the authors' evaluation of its performance on a real-world dataset, showing its capacity to forecast accidents with accuracy. Moreover, they emphasize the potential of the suggested framework for real-time accident prediction and examine the significance of various variables in accident prediction. The article sheds light on how crucial it is to combine geographical and temporal data in order to increase the precision of deep learning models for predicting traffic accidents. The authors also go through how the suggested framework may be used in emergency response and intelligent transportation systems.

Overall, this research makes a significant addition to the area of deep learning-based traffic accident prediction by demonstrating the possibility of combining CNNs and RNNs to increase traffic safety. The suggested framework is a major advancement in the creation of cutting-edge technology for intelligent transportation systems.

[7] The authors of this research suggest a hybrid method that combines deep learning and Bayesian network approaches for the identification and prediction of traffic accidents. For increasing road safety and lessening the effects of accidents, the authors stress the need for precise accident detection and prediction. The suggested method, which has two stages—accident detection and accident prediction—is thoroughly discussed in the study. In the detection step, features from traffic camera pictures are retrieved using a convolutional neural network (CNN), and the correlations between the extracted characteristics and accident incidence are modeled using a Bayesian network. Based on previous data and the results of the detection stage, a recurrent neural

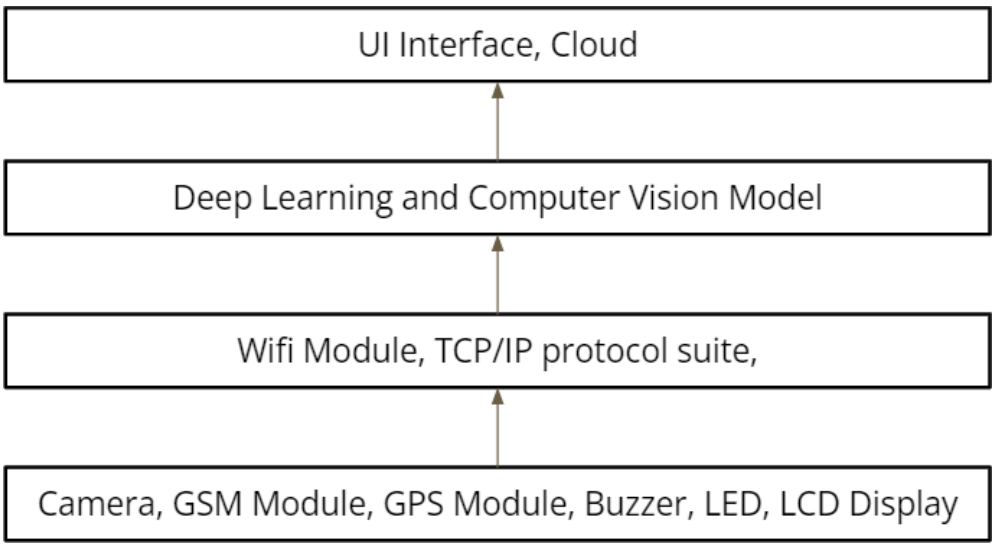
network (RNN) is employed in the prediction stage to forecast upcoming accidents. The suggested strategy is tested on a real-world dataset by the authors, who find that it outperforms existing cutting-edge methods and can effectively detect and forecast accidents. They emphasize the potential of the suggested technique for real-time accident detection and prediction and assess the significance of several variables in accident prediction. In order to increase the precision of accident detection and prediction models, the study discusses the significance of combining deep learning and Bayesian network approaches. The authors also go into how the suggested strategy may be used in emergency response and intelligent transportation systems.

Overall, this study makes a significant addition to the field of deep learning-based traffic accident detection and prediction, demonstrating the possibility of merging several models to increase traffic safety. The hybrid strategy that has been suggested is a significant leap in the creation of cutting-edge technology for intelligent transportation systems.

PROPOSED LAYER ARCHITECTURE

An accident detection and alerting system project aims to develop a system that can detect accidents, notify emergency services, and alert relevant authorities in real-time. The proposed work of such a project can involve the following steps:

1. Data Collection
2. Camera Integration
3. Computer Vision and Deep Learning Models
4. Alerting System
5. User Interface
6. Testing & Deployment



METHODOLGY

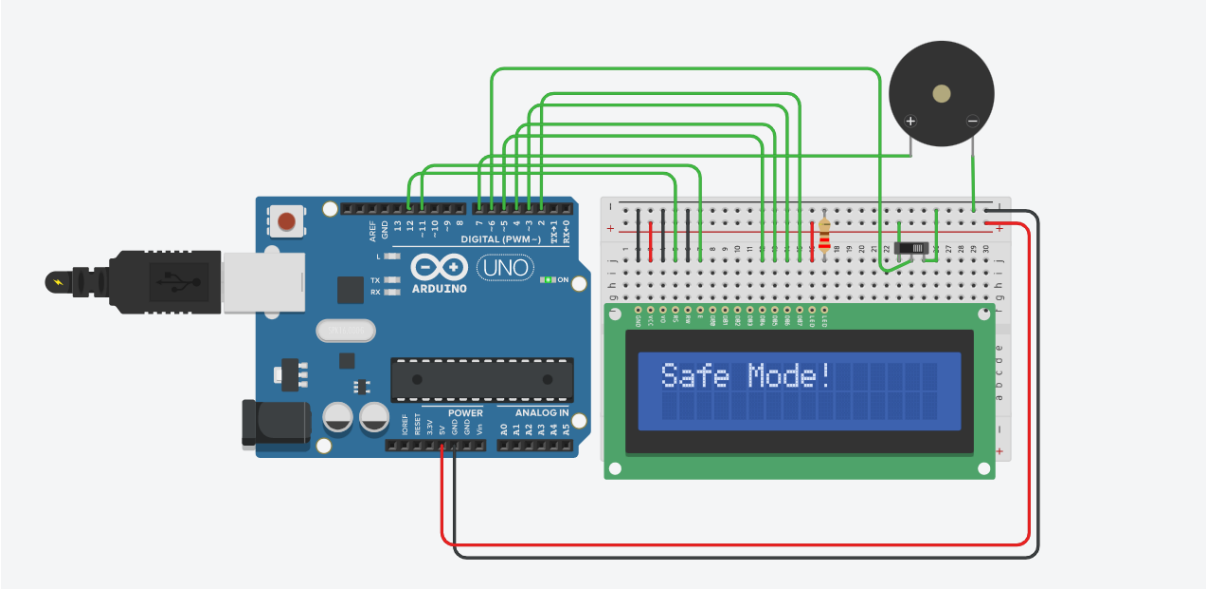
Gather a dataset of images or videos that show various types of accidents that can happen on roads. This dataset should be diverse and include different weather and lighting conditions, different types of roads and vehicles, and various severities of accidents. Label the dataset manually, indicating which images or frames contain accidents and which do not. This labeling can be done using software tools or by human annotators. Preprocess the dataset by normalizing the images or videos, removing noise, and resizing the images to a consistent size.

Train a deep learning model, such as a convolutional neural network (CNN), using the labeled dataset. The model should be designed to classify images or frames as either containing an accident or not. Fine-tune the model using transfer learning techniques to improve its performance on the specific task of accident detection. Validate the performance of the model using a separate dataset that was not used during training. This validation set should also be labeled and contain diverse examples of accidents and non-accidents. Deploy the model in a real-time system that can process video streams from traffic

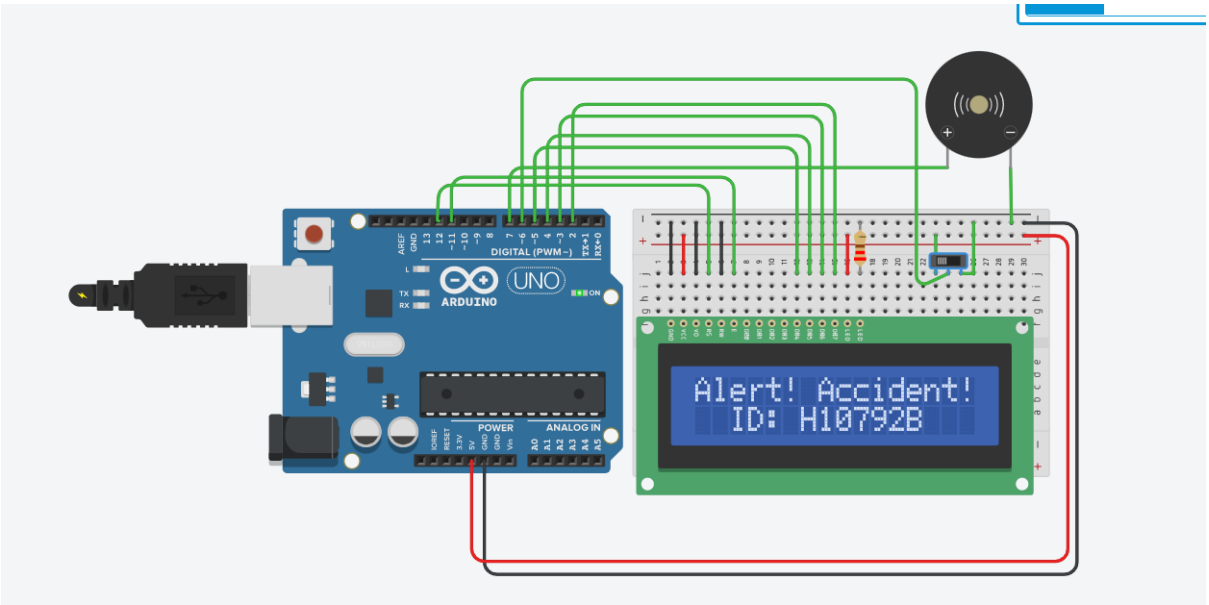
cameras or other sources in real-time, and alert authorities or emergency services when an accident is detected. Continuously monitor the model's performance and refine it as needed, using feedback from the system and additional labeled data to improve accuracy and reduce false positives.

OUTPUT

SYSTEM WHEN NO ACCIDENT



SYSTEM WHEN THERE IS ACCIDENT



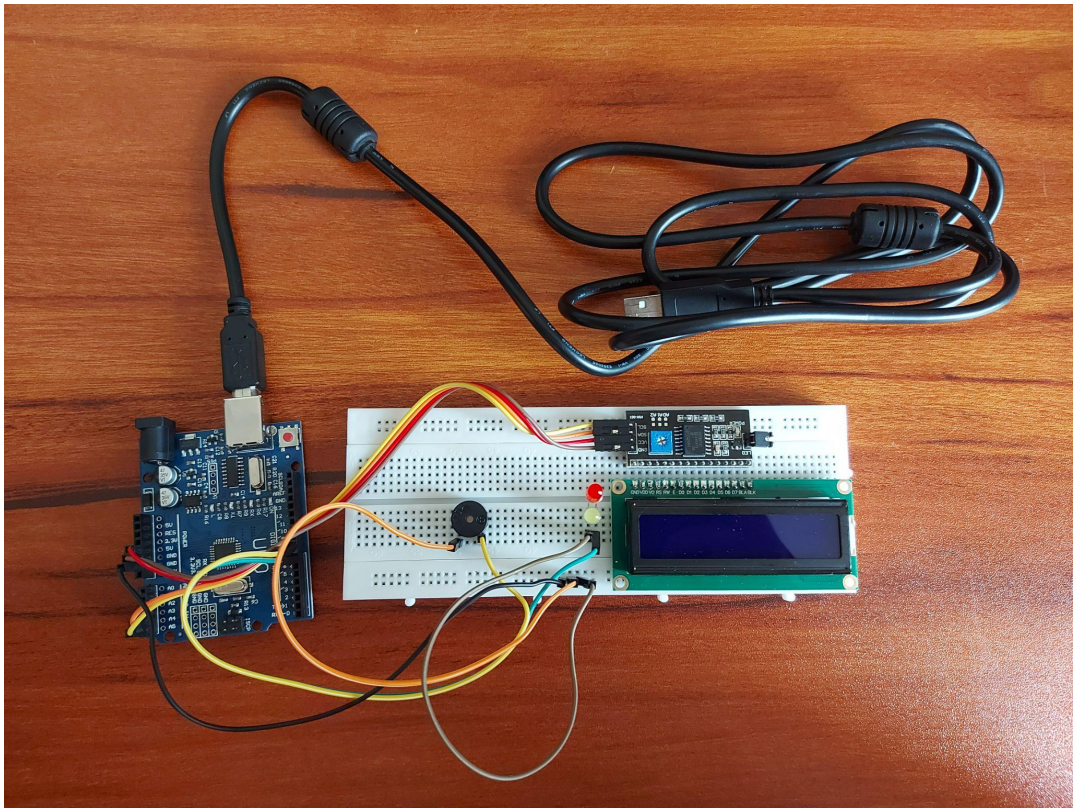
CODE FOR TINKERCAD SIMULATION:

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
void setup()
{
 lcd.begin(16, 2);
 pinMode(6,INPUT);
 pinMode(7, OUTPUT);
}

void loop()
{
  lcd.clear();
  int accident = digitalRead(6);
  if(accident == true)
  {
    digitalWrite(7, HIGH);
    lcd.setCursor(0,0);
```

```
  lcd.print("Alert! Accident!!");
  lcd.setCursor(2,1);
  lcd.print("ID: H10792B");
 }
 else
 {
  lcd.setCursor(0,0);
  lcd.print("Safe Mode!");
 }
 delay(2000);
 digitalWrite(7, LOW);
 }
```

HARDWARE MODEL



ARDUINO CODE:

```
#include<Wire.h>
```

```
#include<LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27,16,2);
int led=8;
int buzzer =7;
int i=0;
void setup()
{
  Serial.begin(9600);
  lcd.begin();
  lcd.backlight();
  pinMode(buzzer,OUTPUT);
  pinMode(led,OUTPUT);
  // put your setup code here, to run once:

}

void loop()
{
  if(i==1)
  {
    lcd.setCursor(0,0);
    lcd.print("Accident !!!!");
    digitalWrite(buzzer,HIGH);
    digitalWrite(led,HIGH);
    delay(100);
    digitalWrite(buzzer,LOW);
    digitalWrite(led,LOW);
    delay(100);

  }
  else
  {
    lcd.setCursor(0,0);
    lcd.print("Safe");
    digitalWrite(buzzer,LOW);
    digitalWrite(led,LOW);
  }
  // put your main code here, to run repeatedly:

}
```

FUTURE WORKS

Real-time accident detection: Current accident detection systems often rely on post-accident analysis of footage, which can be too late for emergency services to respond. Future research could focus on developing real-time accident detection systems that can alert emergency services immediately, potentially reducing response times and saving lives.

Improved accuracy: While current systems have made great strides in accuracy, there is still room for improvement. Future research could focus on developing more accurate algorithms that can better detect accidents and distinguish them from other types of events, such as normal traffic or weather-related disturbances.

Integration with other sensors: Accident detection systems could be enhanced by integrating with other sensors, such as GPS, accelerometers, or LIDAR, which can provide additional information about the location, speed, and direction of vehicles involved in an accident.

Predictive analysis: Instead of just detecting accidents after they have happened, future research could focus on predicting accidents before they occur. This could involve analyzing driver behavior, road conditions, and other factors to identify potential hazards and alert drivers or automated systems to take precautions.

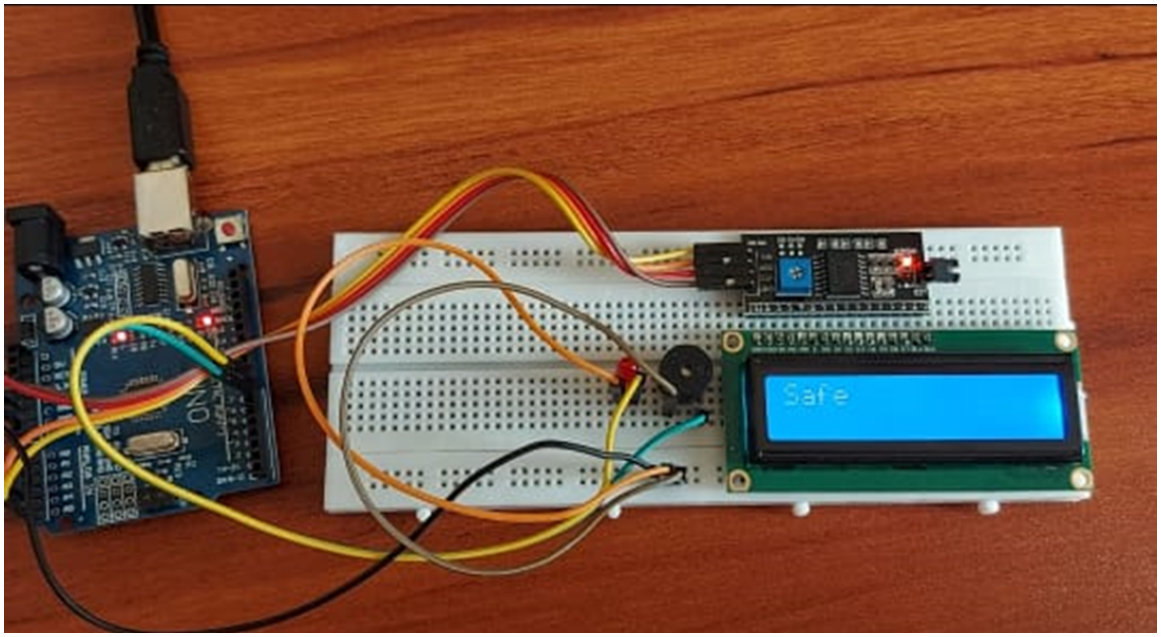
Collaborative systems: Accident detection systems could be improved by enabling collaboration between multiple vehicles, traffic cameras, and other sources of data. By sharing information in real-time, these systems could better identify and respond to accidents, potentially reducing the severity of accidents or preventing them altogether.

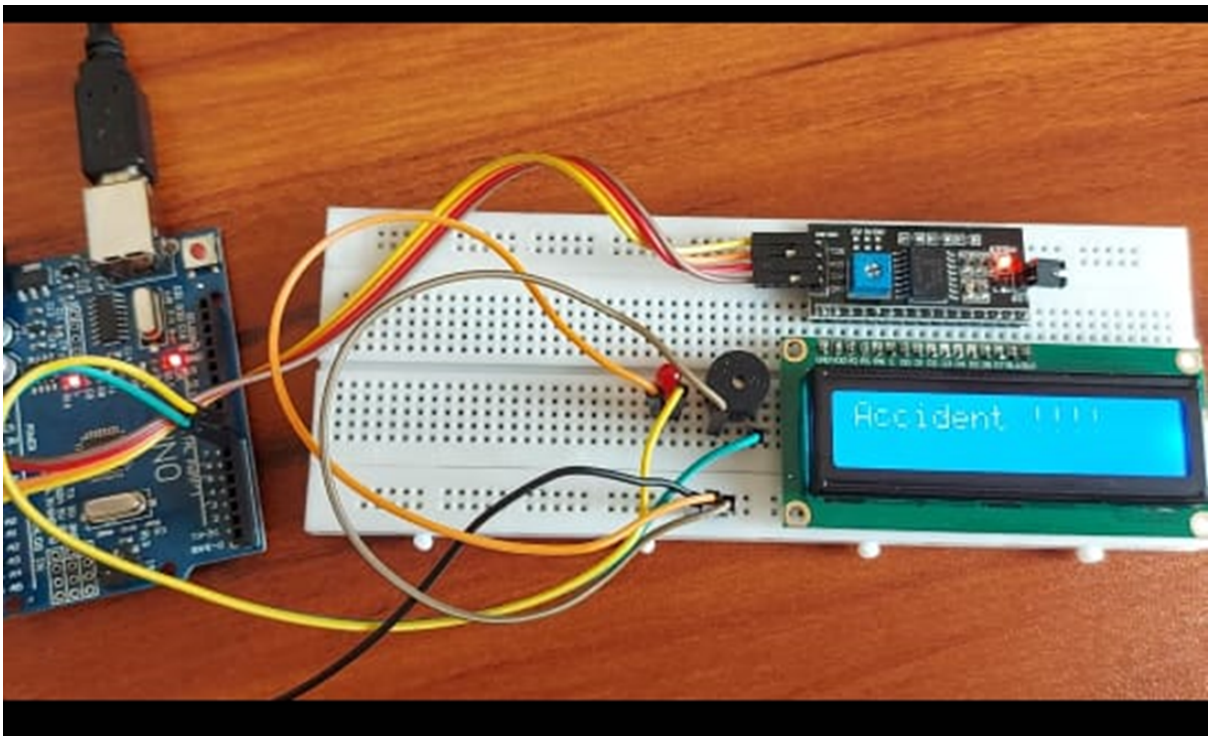
Privacy and ethical considerations: As with any technology that involves monitoring individuals, there are privacy and ethical considerations to be taken into account. Future research could focus on developing accident detection

systems that respect individuals' privacy while still providing the necessary information to emergency services and other stakeholders.

RESULTS & DISCUSSION

The below pictures show the working of the accident detection model. The left side pictures show the algorithm working and the right side pictures show the IoT components working during an accident as the LED display shows “ACCIDENT” and when there is no accident AS “SAFE”.





The referred papers suggest implementing a vibration sensor in the car and connecting it to the mobile numbers of the victim's close relatives which can't work if the accident happens in a remote location where there is no service for the message to be sent. But in the case of using a centralized system like the model proposed in this paper, it could be more efficient and also could ensure no loss of privacy and reduce user security concerns tremendously.

CONCLUSION

In conclusion, accident detection using computer vision is an important area of research that has the potential to improve road safety and save lives. Current systems have made significant progress in detecting accidents and alerting emergency services, but there is still room for improvement in terms of accuracy, real-time detection, integration with other sensors, predictive analysis, collaborative systems, and ethical considerations. Future research should focus on addressing these challenges to further enhance the effectiveness and reliability of accident detection systems. Ultimately, the development of advanced accident detection systems could play a critical role in preventing accidents, reducing their severity, and improving the overall safety of our roads.

WORKING OF THE CV MODEL

The link for the simulation of the working CV model is given here and the hardware model is given here.

CODE OF IMPLEMENTATION

The link for the implementation of the code is given here.

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