

Vehicle Accident Alerting System based on IOT

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Abstract— In daily walks of life, automobiles are gaining more prominence as their usage is rapidly increasing. These days numerous mishaps happen on streets due to escalation in traffic or reckless driving. In most of the circumstances, delay in informing family members or the emergency authorities' outcomes in a deferral of clinical guide to the victim, which may on occasion end up being fatal. The main objective of this system is to intercept such contretemps. It ensures security by alerting the passengers in the vehicle in case of any possible vulnerabilities inside the vehicle detected using various sensors. In case any accident occurs, the system sends accident alert notification to the designated authorities by which they immediately track the vehicle through location of the vehicle sent by system using GPS sensor. The system also captures and detects the vehicle ID on the number plate of the vehicle which caused the accident to the victim's vehicle which is notified to the authorities using which they can track the vehicle and investigate regarding the accident. This automatic number plate detection (ANPR) functionality utilizes Optical Character Recognition in identifying the characters in Vehicle ID of number plate which is implemented through MATLAB. The notifications are sent to mobile as an SMS using GSM embedded Arduino shield immediately reducing the possibility of loss of life due to delayed medical assistance. **This is hence a vehicular safety monitoring and alerting system.**

Keywords— Sensors, OCR, Automatic Number Plate Recognition, Arduino GSM Shield

I. INTRODUCTION

In recent days traffic injuries are increasing annually, inflicting a big quantity of death and disability instances. According to the World Health Organization (WHO), 1.35 million loss of life cases occur worldwide every year, representing 2.2% of the full quantity of deaths. The important motives of these traffic injuries are speeding, rash driving, driver's enervation, obstacles on roads, and terrible infrastructure. Most of the fatalities in these injuries occur due to the late response from emergency clinical assistance. The time after the stressful damage is called golden hour, wherein offering essential scientific and surgical resource at that point increases the possibility of saving human lives through one-third on average. Thus, sizeable efforts have been allocated inside the recent beyond with the purpose of supplying green and prompt rescue operations. IoT is one of the gears that has been utilized to attain this goal.

The IoT become offered again in vehicle industries to offer unique facts and amusement packages with the intention of presenting a comfortable riding experience and comfort journey. Recently, the IoT has been hired to growth the protection of drivers and passengers. Several studies have

offered IoT structures to hit upon, localize, report, model, and analyze avenue accidents.

Automatic Number Plate Recognition (ANPR) technology [1] reads the vehicle number on the license plate of the vehicle supported by Optical Character Recognition. This technology is contributing towards uprising the autonomous

transportation systems making them intelligent from a long time. Earlier this technology which was just used in traffic signals, tolls and vehicle parking areas is now being used as mobile technology in handheld smart devices. ANPR framework perceives the enrolled number plate with no extra transponder prerequisites.

The proposed system aims at providing immediate support to any unintended casualties which may result in accidents. This framework uses Arduino microcontroller as an agent to read and report the sensed data. Sensors like flame detection sensor, speed detection sensor, alcohol detection sensor are used to detect any corresponding vulnerabilities in the vehicle. Piezo disc sensor triggers when there is a collision when accident occurs. GPS tracks the location of the accident-prone vehicle. The system also contains automatic number plate recognition functionality to capture and detect vehicle ID of vehicle that caused accident to the victim vehicle. It uses Optical Character Recognition to recognize the characters on number plate. This detected vehicle number will be sent to the controller. All these notifications are sent using GSM module via SMS to the concerned authorities and family members of the accident victim.

II. RELATED WORK

The postponement in protecting an individual during mishap is overcome through constructing a gadget using Arduino Uno, GSM, and GPS to apprise the emergency facilities quickly due to prevalence of the injury caused [2]. Further, GPS is used to obtain latitude and longitude of the mishap occurred region.

A concise review on few techniques on avoiding accidents and detection of accidents due to discrete criterions [3]. It incorporates two scenarios i.e., Pre- accident alert where the accidents can be avoided before their occurrence using V2V and VANET vehicular communication methodologies. Post-accident alert mechanisms utilize a few strategies to recognize the mishap cause and affirms the event of mishap and later cautions the salvage groups to give clinical assistance to victims.

The framework identifies [4] and orders vehicle mishaps in view of seriousness level and reports the fundamental data about the mishap to crisis administrations suppliers. The framework comprises of a microcontroller, accelerometer, GPS, a gathering of sensors to decide different actual boundaries connected with vehicle movement. Vibration sensor determines vibration within vehicle and ultrasonic sensors reduces speed of vehicle when there is any obstacle ahead. GSM message alerts are sent to emergency contacts.

Mechanisms to capture the number plate of vehicles that cross the threshold speed avoid the mishaps caused by over speeding vehicles [5]. The vehicle with speed greater than that of restricted is caught automatically with assistance of sign communicated to camera from microcontroller that relates to the speed detection sensor. Later, at that point, license plate is elicited from the whole picture utilizing picture capturing device. When the area of interest is distinguished the person are perceived and refreshed in the information base.

A framework [6] that advises concerned individuals about occurred disaster utilizes GPS-GSM modules and accelerometer is interacted with Arduino uno which goes about as regulator was developed. Accelerometer identifies mishap by an adjustment of preset worth of the vehicle direction and sends location co-ordinates tracked by GPS to enlisted contacts by means of GSM with next to no extravagance of the driver or travelers.

The accelerometer works in distinguishing area and assuming upsides of three-dimensional boundaries are greater than characterized measurements by the code composed for starting insinuation and message alert gets implemented. With this strategy [7] mishap area is identified effectively, and the data of mishap area can be sent by means of the GPS to the crisis contributions for help.

Differing structures of characters on license plate portrays extra challenges. To resolve this issue, inception v-3 model is utilized for classification of license plate's structure defined pictures [8]. The concentrate then, at that point, utilizes single-shot recognition, which is one of the most mind-blowing accessible engineering to distinguish numerous items without a moment's delay, bringing about quicker and more exact location. Later every character in license plate is perceived by Tesseract OCR motor.

Image processing technology-based system like ANPR is used to capture and detect characters in the preprocessed images of vehicle's license plate [9]. The preprocessed image is segmented, and the individual characters are identified using Optical Character Recognition

III. OBJECTIVES OF PROPOSED SYSTEM

The major intent of this system is to monitor the vehicle for casualties to ensure safer transportation. Following are achieved by this system:

- SMS alerts to designated contacts when Flame is detected
- SMS alerts to designated contacts when Alcohol presence is detected
- SMS alerts to designated contacts when over speeding is detected
- SMS alerts to designated contacts when collision of vehicle to adjacent vehicle is detected.

- Live location of victim vehicle and vehicle license number of adjacent vehicle causing accident are also detected and notified through SMS alerts.

IV. METHODOLOGY

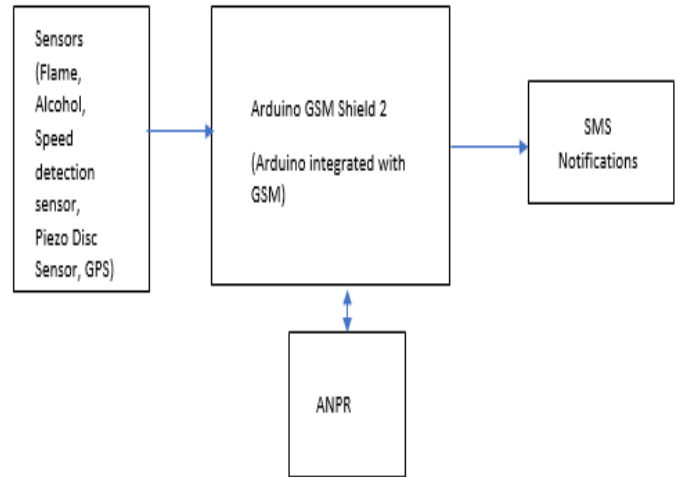


Figure 1: System Architecture of alerting framework

Figure 1 describes comprehensive system architecture of proposed alerting framework where various sensors embedded in this system will monitor any vulnerabilities occurring in the vehicle and sends the sensed data as input to the Arduino controller.

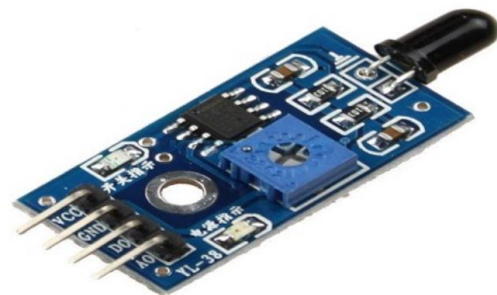


Figure 2: Flame Sensor

Flame sensor : It senses the occurrence of flame or fire in the vehicle and alerts immediately. It detects a wavelength range (760 nm – 1100 nm) from light source when it placed at a certain distance from the source. It gives analog or digital signals as output which is sent to the controller.

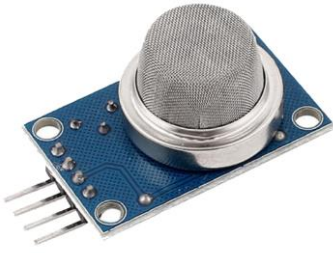


Figure 3: MQ2 Sensor

Alcohol Detection sensor: MQ2 sensor is used to detect the presence of alcohol. When the person driving the vehicle has consumed more alcohol, there is a risk of any mishaps to occur if he goes unstable to handle the vehicle. To prevent accidents due to this the alcohol detection sensor is used which senses the alcohol content in the person's breath and notifies it.



Figure 4: IR Sensor

Speed detection sensor: The IR sensors attached to the ends of the vehicle can be used to calculate the speed of the vehicle. After continuous monitoring of speed if it crosses the set-up threshold, the system is alerted as over speeding.

Figure 5: Piezo Disc Sensor



Piezo Disc sensor: This sensor works on the piezo electric principle. It measures the changes in acceleration, pressure, force, or temperature. This triggers when there is a collision due to accident and sends analog signals to the Arduino. The Arduino controller digitizes this information and alerts as accident occurred.



Figure 6: GPS Sensor

GPS (Global Positioning System) Sensor: It uses ground stations and satellites to gauge and compute location it is placed on the Earth. GPS module obtains location information in the form of NMEA String output in which the string contains parameters like latitude, longitude, time, etc. The GPS sensor sends the co-ordinates of the location where accident occurred to the nearby hospitals and concerned authorities so that quick action can be taken and rescue the injured victims.



Figure 7: Arduino with GSM shield

Arduino GSM shield: Arduino board establishes a connection to the net, remit and receive SMS, and to make voice rings utilizing the GSM library. These functionalities of GSM module are achieved by GPRS (General Packet Radio Service). To establish internet communication the GSM should have a registered SIM card with a subscribed data plan. The GSM module embedded in the system sends a quick SMS alert of accident occurrence and location to the concerned authorities and family of the victim so that they can reach the spot quickly.

ANPR MATLAB implementation: The system also consists of MATLAB program which captures the image of the vehicle ID on the number plate of the vehicle which caused the accident and detects the same. This detected vehicle ID is sent to the target audience through GSM as a text message. This eases the investigation process of the accident occurred. This functions and sends output to Arduino shield through the internet provided by embedded GPRS technology. MATLAB has Optical Character Recognition capabilities which follows Automatic Number Plate Recognition technology.

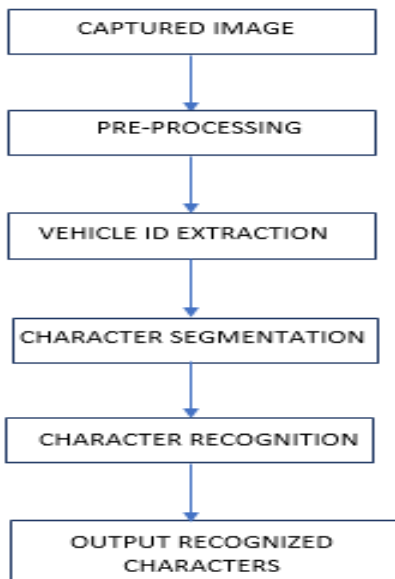


Figure 8: Workflow of ANPR system

As described in work process of ANPR (Figure 8) images are pre-processed to extract the vehicle ID on the number plate region. Pre-processing involves grey-scaling and tuning of images followed by binarization. Each character is segmented and identified through OCR. The combined character set is displayed as output which is the vehicle ID.

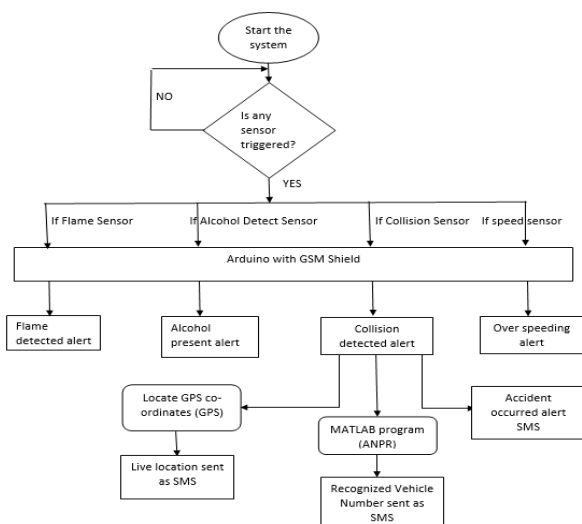


Figure 9: Workflow of alerting system

The system starts when the vehicle accelerates. It monitors for any triggering of sensors as described in workflow (Figure 9). If flame detection sensor is triggered due to the occurrence of fire inside the vehicle, an SMS alert is sent through Arduino GSM shield as Flame detected. If the alcohol detection sensor is triggered due to the presence of alcohol in the surrounding, an SMS alert stating Alcohol presence

detected is sent. If the IR sensors monitoring the speed of vehicle detect any hike in speed of the vehicle which has crossed the threshold, over speeding alert is sent. In case of accident occurrence, the collision detection sensor (Piezo Disc sensor) is triggered, and an alert is sent, followed by the location co-ordinates detected by GPS and the ANPR methodology is triggered to capture the image of the number plate of the vehicle causing accident using either the rear or front cameras and the corresponding Vehicle number is obtained through SMS. All the SMS is sent to the respective phone numbers of victim's family members and nearest medical AID providers and other legal authorities. In this way, the threat due to accidents can be controlled and risk of loss of lives can be prevented.

V. EXPERIMENTATION

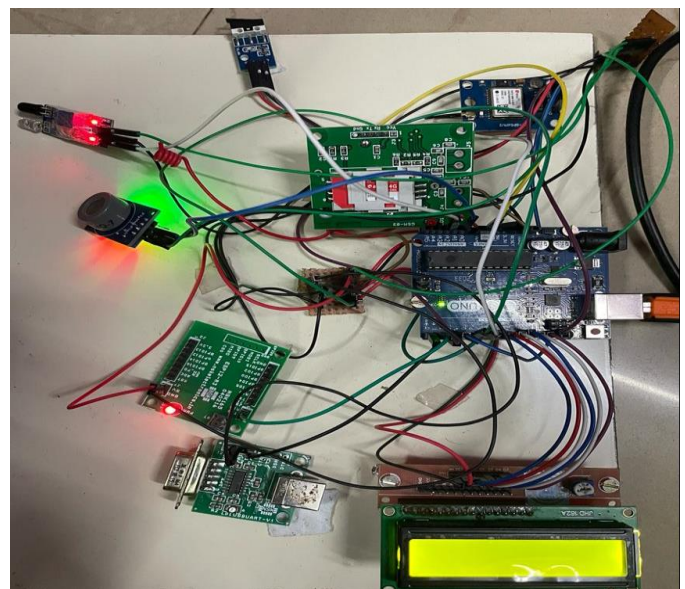


Figure 10: Experimental Setup

Experimental prototype is setup as in Figure 10 which will be embedded in the vehicle (car). System starts once the vehicle starts accelerating, activating all sensors connected to Arduino embedded with GSM module. Sensors monitor for any vulnerabilities in the surrounding as per their functionality. They get triggered respectively when following scenarios arise and corresponding results are obtained as illustrated on LCD.

Flame detection: Fire might occur due to accidental ignition of flame inside the vehicle, electrical malfunctioning, or mechanical breakdowns. They can be placed inside the car and can be embedded near engine. Flame Sensor connected to Arduino module monitors for presence of flame inside atmosphere of car and triggers once fire is detected and outputs displayed alert (Figure 11).



Figure 11: Flame detection alert

- i. Alcohol presence detection: Alerting when driver of car has consumed alcohol will reduce risk of catastrophes due to unstable driving. MQ Sensor connected to Arduino module monitors for presence of alcohol inside the atmosphere of car which will be placed near driver's seat and triggers when alcohol is detected in driver's breath sending alert message to the concerned contact as displayed on LCD (Figure 12).



Figure 12: Alcohol presence detection alert

- ii. Over Speeding Detection: Over speeding results in tragic misfortunes due to collision of vehicles. IR sensors placed at front and rear end of car measures and monitors speed of it. Once it breaks threshold speed Sensors trigger an alert stating over speeding detected as displayed (Figure 13).



Figure 13: Over speeding Alert

- iii. Accident detection: Piezo Disc Sensor connected to Arduino module monitors for collision occurrence and triggers when our vehicle collides with adjacent vehicle conveying displayed alert message (Figure 14) to emergency contacts.



Figure 14: Accident Alert

Once accident is detected, GPS attached to car records the current live location and sends location co-ordinates of mishap location to emergency contacts of victim as displayed (Figure 15).



Figure 15: GPS live location co-ordinates

The MATLAB code for ANPR is also triggered. MATLAB implementation can be embedded inside front and rear ends of vehicle with cameras attached. This captures the image of adjacent vehicle (Figure 16), processes it (Figure 17 and Figure 18) and detects the Vehicle number present on license plate region using OCR (Figure 19). The Vehicle ID of adjacent vehicle causing accident to victim vehicle is then sent as SMS to emergency contacts which helps in easing investigation process by crime squad.



Figure 16: Captured Image of License Plate



Figure 17: Pre-processed Image of License Plate



Figure 18: Segmentation of characters

The system alerts and re-monitors again after flame, alcohol and speed sensors are triggered. The system stops when collision occurs.

All the displayed outputs on LCD are transferred as SMS to respective emergency contacts through GSM module.

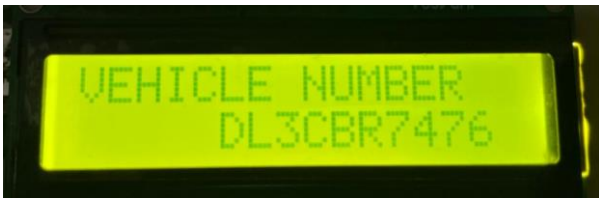


Figure 19: Resultant vehicle number recognized through OCR sent as alert

VI. RESULTS AND DISCUSSIONS



Figure 20: SMS Notifications received through GSM.

The Figure 14 depicts the SMS alerts received by the proposed system whenever a particular sensor is triggered due to the vulnerabilities caused in the surrounding. When Flame sensor, Alcohol detection sensor (MQ3), IR sensors monitoring the hamper in speed above the threshold, Piezo Disc sensor detecting collision are triggered, the respective alerts such as Flame detected, alcohol presence detected, over speeding detected, accident occurred are sent through the SIM number inserted in GSM to the designated mobile

numbers. Along with accident alert, live location of the vehicle along with location co-ordinates and vehicle number on the license plate of vehicle causing accident is detected and are sent as SMS notification. By this the family members and medical aid authorities can reach the spot where accident occurred to save the victim's lives and legal investigation can be eased as we have detected the vehicle causing accident.

VII. CONCLUSION AND FUTURE SCOPE

This paper discusses about anticipation of accidents caused by any unusuality in the vehicle like fire occurrence in the vehicle, over-speeding of vehicle and drunk driving which are sensed by various sensors embedded in the vehicle through immediate alerts. For scenarios where accident occurs unexpectedly, the collision detection sensor reports the accident and location of vehicle tracked by GPS is notified to the rescue authorities for clinical aid through SMS sent by GSM module. This system uses Optical Character Recognition to identify the vehicle number of the vehicle causing accident which is also sent via SMS immediately so that culprit responsible for the mishap is investigated and caught quickly. As a part of future enhancements, this framework can be improvised with other safety implementation sensors and enhanced image preprocessing and character recognition methodologies.

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