IoT Based Vehicle Accident Detection, Tracking and License Plate Recognition

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Abstract— The title itself notes that this research is all about a system capable of primarily three models 1) accident detection and tracking, 2) license plate identification, and 3) license plate segmentation. This is accomplished by a framework developed with the help of IoT and Machine learning algorithms. In the current scenario where a car accident happens, it is not communicated to the ambulance in the immediate future and another concern is that the risks of hitting and running cases are very possible. It is vital for the closest ambulance to be alerted as a response to that when a vehicle mishap happens so that it can locate it as quickly as possible. It is therefore necessary to track down the vehicle information that caused the accident, hence a camera model is incorporated in this program that records the picture of the vehicle that caused the accident. After all these the image will be pre-processed and translated to character and delivered to the smartphone application of the user. The main objective of the program is accomplished by submitting the location coordinates to the closest hospital and the registered number in the system alongside the information of the characters in the license plate.

Keywords: Location, License Plate Recognition, IoT, Accident, Character Division

I. INTRODUCTION

Of many causes, and under many conditions, an accident will happen. While accidents are not intended to do harm to the other person or their property. Accidents occur due to lack of focus on road or failure to comply with traffic rules and regulations, there can be many more reasons too.

When the user experienced an accident and the car hit the ground, the vibration sensor and ultrasonic sensor embedded in the car detects the frequency of vibration along with a buzzer with is turned on when the ultrasonic sensor senses a object near it and transfers the value to the raspberry pi module which is interfaced with it. While vibration threshold frequency and ultrasonic threshold frequency reaches the configured maximum limit, GPS data is collected from the GPS model and the message with all the required information is transmitted quickly to the user's registered emergency contacts and nearest ambulance using GSM module. The program ensures the survivor of the incident is given prompt assistance. The findings give specific incident locations.

License Plate Recognition (LPR) is a technique for extracting the number of the license plate from a still picture or a video of a moving or stationary vehicle. It's a very useful vehicle surveillance strategy. Detection and identification of license plates is a challenging problem due to issues such as noisy image inputs, occlusion, vehicle orientations, and various types of license plates, extra images on number plates, non-standard sizes, and poor camera quality among others. Most of the current solutions allow unrealistic assumptions compared to actual situations, i.e. operating for stationary cameras, with a limited view. The proposed LPR model addresses these challenges to a certain extent.

Using the KNN algorithm, the image captured will be countered and pre-processed. The next move was to enlarge the pictures and convert the contrast to greyscale and enhance the image as well. Applying the algorithm with given condition the image with license plate is recognized. Adaptive thresholding is then applied to transform the entire picture black and white. You can do binary reversal to get black characters on white background. The comparison has helped to understand the limits of character. The characters leaving the 36 characters (0-9 and A-Z) were omitted from the plate, and the license plate split individual characters. Each cropped character is increased in height and width by factor.

Once all these steps are finished the characters of license plate is sent to the registered numbers of user's mobile application.

II. LITERATURE SURVEY

This segment overlooks a few existing frameworks like our work. Mishap salvage framework naturally utilizing IoT[1] is a current gadget wherein crash sensors are utilized so when the mishap happens the sensor distinguishes the mishap and imparts the sign to the microcontroller, the genuine scope and longitude directions of the casualty are found and sent to the closest rescue vehicle for help with the guide of the GPS module.

IoT way to deal with mishap recognition, revealing and navigation [2] is a current framework that utilizations shock sensors along with GPS module, NFC per user, and cell IoT. This current framework assists in recognizing the casualty with the assistance of existing information. At the point when a mishap happens, the area of the mishap is sent to the server utilizing an HTTP demand. When the solicitation is sent the essential clinical help is sent as the individual is as of now distinguished.

Vehicle mishap programmed discovery and remote admonition device[3]is a current framework that utilizes ARM7LPC214 control board, three accelerometer sensors, a message sending module, and an LCD screen. In this framework when the mishap happens the vibration sensors distinguish the crash and afterward the signal is sent if the set reference esteem is not exactly the moving edge of the vehicle.

IoT Based Vehicle Tracking and Accident Detection System[4] is utilized and associated through ATMEGA 162 microcontroller with buzzer and switch in this current arrangement of ultrasonic sensors, accelerometers, GPS, and GSM modules. At the point when the mishap happens the buzzer is set ON with the help of

switch if the accident is minor then the switch is ON and messaging process will be terminated.

An IoT and Mobile Incident Warning System [5] is a current framework wherein collision sensors are utilized to recognize mishaps in every conceivable situation, gyro sensors are additionally used to identify the tilt caused because of the mishap. This gyro sensor triggers an alert, in particular, if a specific tilt edge is crossed. GPS module is utilized in this current framework for giving the area where the mishap has happened with the assistance of an android application.

A Next-Generation Protected Cloud-based Deep Learning License Plate Recognition for Smart Cities[6] is an existing program that utilizes a heuristic-based image manipulation technique to detect license plate. First pre-processing of the license plate takes place, then the identification and retrieval of the license plate is performed using plate clipping. Finally, with the help of binarization and with the assistance of CNN license plate identification of characters can be achieved.

An effective license plate recognition system that uses convolution neural networks[7] is a current framework that utilizes four stages to identify license plate: vehicle identification, license plate location, character segmentation, character recognition. In this current framework, RCNN and quick RCNN can be utilized to recognize vehicles with the end goal that misidentifying different articles can be prevented. When the picture of the vehicle is caught then SVM is utilized for identifying the vehicle's license plate, SVM OAR engineering with HOG estimations of a picture is utilized to train a classifier. When the license plate images are captured the character segmentation happens in which first the picture captured will be changed over to grayscale and to dispense with commotion, binarization is done and even and vertical projection is performed, In character acknowledgment, stage LPRCNN model is utilized to recognize slanted and obscured characters lastly the complete license plate characters are obtained. Recognition of license plate from still images and video sequences: A survey[8] in which different strategies are clarified for perceiving and preparing license plate pictures.

License plate detection and recognition using Deeply Trained Convolutional Neural Networks[9] is a built-up technique using pipeline structure for the identification and acknowledgment of license plate with a progression of profound CNN's. With the assistance of this pipeline engineering preparing and testing of the permit, plate pictures are done through the given arrangements of information.

Effective License Plate Detection By Unique Edge Detection Algorithm and Smarter Interpretation Through IoT [10] in this current framework IoT is joined with Digital Image Processing to such an extent that the tag pictures can be recognized proficiently.

An Intelligent programmed vehicle mishap recognition framework Using Wireless Communication [11] ARM is intended for mishap discovery and observing in this framework. Utilizations LPC2148 as a processor. At the point when an incident occurs, MEMS gets disrupted and a output signal is sent to the processor and GPS recognizes the area. On account of fire mishaps place, there will be fire sensors utilized for identification. Correspondingly, alcoholic sensors can likewise be utilized for distinguishing the driver's alcoholic rate to such an extent that the start of the vehicle can be controlled.

IoT Based Vehicle Accident Detection and Tracking System utilizing GPS modem [12] is a current framework wherein Raspberry Pi is utilized. LED is utilized to make a framework that is ON. At the point when a mishap happens GPS module sends the mishap location to the portable number utilizing WhatsApp message.

III. METHODOLOGY

The fundamental and remarkable feature of the framework is to locate the victim and report the accident with related data to emergency contacts and his concerned individuals. The framework design appears in figure 1.

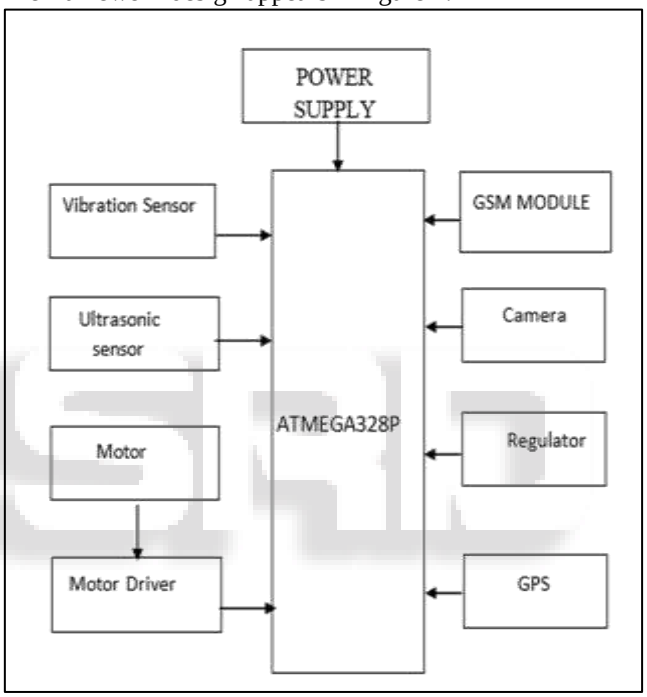

Fig1: System Architecture

The ATMEGA328P is a microcontroller module that is utilized and a remarkable code is modified to accomplish this usefulness.

The vibration sensors and ultrasonic sensors are interfaced with the Pi3 module. The most extreme pressure limit the vibration is programmed in the MC. The GPS module is additionally associated with the MC that is utilized to track the victim's location.

At the point when the mishap happens, the threshold frequency is detected by the vibration sensors and ultrasonic sensor, if the value surpasses as far as the limit, the GPS module is initiated and the specific scope and longitude position is sent to the contacts. As appeared in Figure 2 the GSM module is utilized to send the specific area to the contacts.

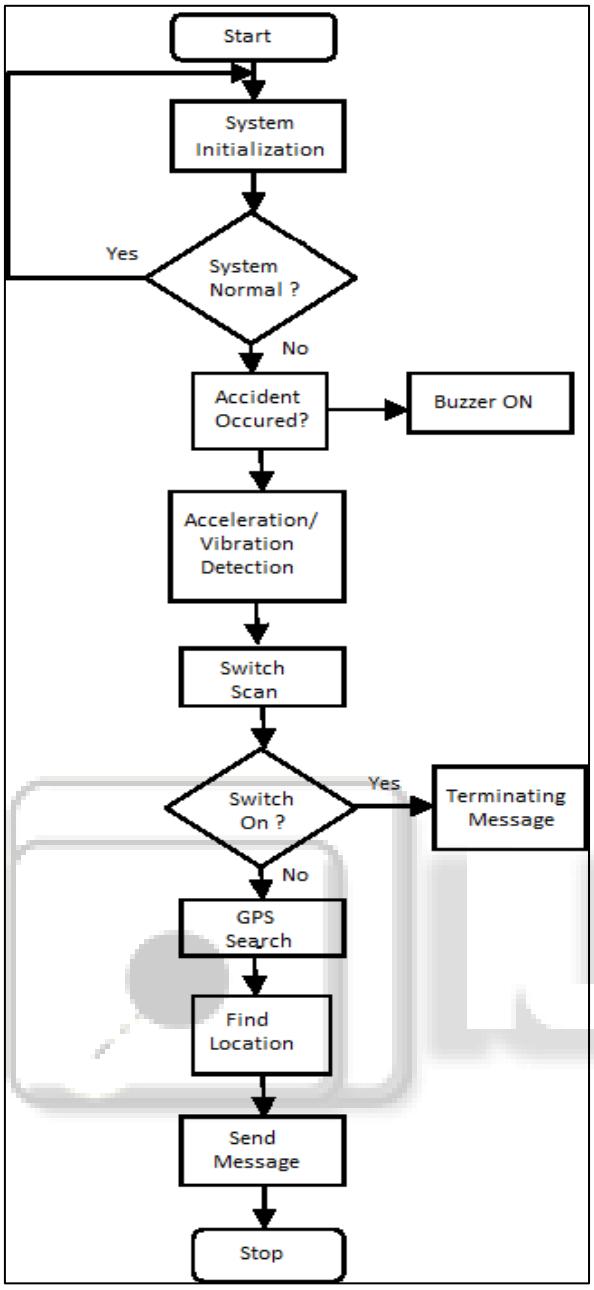

Fig. 2: Flowchart of GPS module

The progressive elements of this framework are the identification of the license plate, character recognition, and segmentation, and sending the same to the victim's crisis contacts utilizing the GSM module. To achieve this undertaking we utilize the KNN (K-Nearest Neighbour) calculation.

For character recognition and segmentation, we utilize the OCR (Optical Character Recognition). The First step is to select the image having the license plate amongst the other images. The image is made noise free which includes perceiving characters like [A-Z] and [0-9]. The Next advance is to change over the picture to greyscale and apply various tasks to improved edges and differentiation.

This is trailed by versatile thresholding to expel characters aside from [A-Z] and [0-9]. These means are done to guarantee that the contribution to the CNN model for OCR is reliable with its preparation set. We utilize the OCR (Optical Character Recognition) for character acknowledgment.

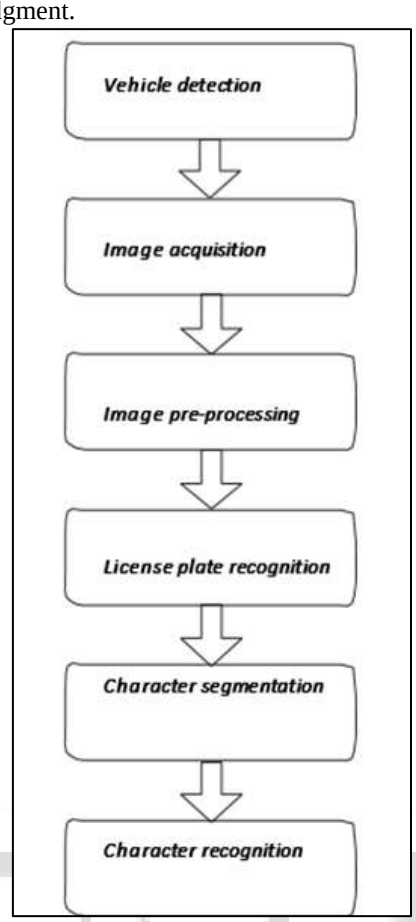

Fig. 3: Flowchart of LPR and character segmentation

This picture consisting of the license plate is pre-prepared dependent on its geometric boundaries to locate the necessary shape, dismiss the superfluous ones, and gathering the fitting ones.

The thresholding will be applied to the picture's specific character shape, which is additionally given as a contribution to the character model to anticipate what character this form is and to append it to the string of the license plate.

On the off chance that we get the individual character pictures from a picture with a license plate, the subsequent step is to apply OCR. The OCR has two methodologies, in particular KNN (neighbor to K-closest) and CNN (Convolutional Neural Network).

A. Hardware Components:

1) NodeMCU:

It is firmware based on Lua which is an open-source for ESP32. It makes use of a SPIFFS module based flash. This NodeMcu is implemented in C language.

2) Ultrasonic sensor:

It is an electronic device that emits ultrasonic sound waves, utilizing which it measures the target distance.

3) Vibration sensor:

Vibration sensors are piezoelectric vibration-sensing accelerometers. They are used for measuring fluctuating accelerations or velocities, or for measuring natural vibration.

4) GPS module:
It is a satellite-based gadget that screens and figures its area on Earth utilizing satellites and ground stations.
5) GSM module sim900:
The SIM900 is a complete GSM / GPRS Quad-band solution in an SMT module that can be embedded in client applications.
6) Motor:
The L298N Motor Driver Unit is a Dual H-Bridge high voltage, manufactured by ST. It is designed to accept standard levels of TTL tension.
7) L293D Motor Driver:
L293D is a 16 pin IC; four information and four yield pins. The info pins take in the control signals from the Arduino board.

B. Algorithm:

K-Nearest Neighbors (KNN) is one of the simplest algorithms for regression and classification problems used in Machine Learning. KNN algorithms use data and classify new data points, based on measurements of similarity (e.g. distance). Classification to its neighbors is done by majority vote. The data is assigned to the nearest neighboring class.

As you increase the number of neighbors closest to you, the value of k may increase the accuracy. The implementation of KNN has these steps: Import the necessary libraries, fetch the required data, define the predictor variable, define the target variables, split the dataset, instantiate the KNN model, create the trading strategy using the model and Sharpe ratio.

K Nearest Neighbours (KNN) (Cao et al., 2018) algorithm is a well-known algorithm for regression and classification problems which is a simple algorithm that stores the spatial information of all available cases and classifies new cases based on its similarity with available examples. The similarity matrix for the algorithm depends on the problem. KNN has been implemented in Scikit learn library K Nearest Neighbor class with K as 3. As KNN implementation takes a single vector as input but input for OCR was image of a character. So, the image of shape (h,w,3) was converted to a vector of shape (h*w*3,1) and then input to the classifier for training and testing. For predicting the class for a new example, KNN finds K most similar examples to the test cases and outputs most dominant ones. Since here the cropped image is not strictlysimilar to the training images, KNN has difficulty in prediction.
1) Algorithm: detectplatesInScene()
Info: picture document name as image original
Yield: a rundown of records where each rundown contains forms that together make a total tag.
/Algorithm to discover the tag in the given pictures.
1: imageGrey, imgThreshßPreprocess(imageOriginal)
2: shapes ßopencv.findContours(imageOriginal)
3: listofpossibleChars = [ ]
4: for c in shapes:
5: x,y,w,hßopencv.boundingRect(c)
6: if(h*w > 80 and w > 2 and h > 8 and 0.25 < (w/h) < 1.0):
7: listofpossibleChars.append(c)
8:listOfListsOfMatchingCharsInSceneß
GroupMatchingPlates(listofpossibleChars)
9:listOfPossiblePlate = [ ]
10: for plate in listOfListsOfMatchingCharsInScene:
11:possibleplateßextractplate(plate)
12: if possibleplate.imgplate not None:
13:listOfPossiblePlate.append(possibleplate)
14: return listOfPossiblePlate

The above calculation takes shapes from the pictures and distinguishes the part of the tag from it. There are several pictures gave to the calculation which fills in as preparing set for it. From these pictures, tag partition is distinguished by an evacuating commotion.
2) Algorithm: detectCharsInPlates()
Information: List of plate postings
Yield: List of plate postings with anticipated numbers on each plate.
/Algorithm to locate the number written in the tag.
1: for plates in listOfPossiblePlates:
2: plates.grayscale,plates.threshß
preprocess(plates.img)
3: plates.Threshßresize(plates.Thresh,1.6,1.6)
4: Apply Binary in addition to otsu thresholding to Thresh
5:listOfpossiblecharsßfindpossiblechars(plates.Thresh)
6:plates.strCharßrecognizeCharacterInPlate()
7: return listOfPossiblePlates

The above calculation serves to recognize the numbers and letters from the license plate detected. The algorithm inputs the output of the previous algorithm. It can recognize different sorts of letters and numbers present in the image.

IV. EXPERIMENTAL RESULTS

A. GPS Co-ordinates:

After testing the framework for GPS co-ordinates, we have obtained the underneath result, which is the latitude and longitude of the location.

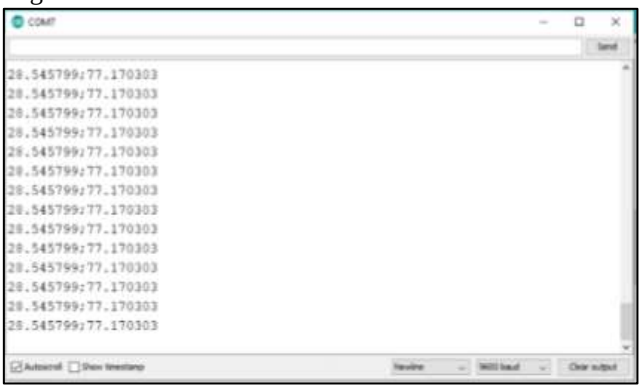

Fig. 4: GPS Co-ordinates

B. License Plate Detection:

We gave the framework feedback for LPR recognition, and verified the accuracy of the framework in recognizing the LPR and pre-preparing the image.

Fig. 5: Input image for LP detection

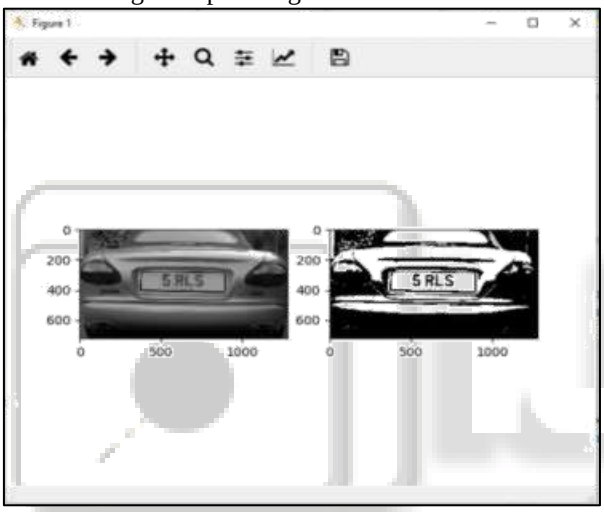

Fig. 6: Pre-Processing of image

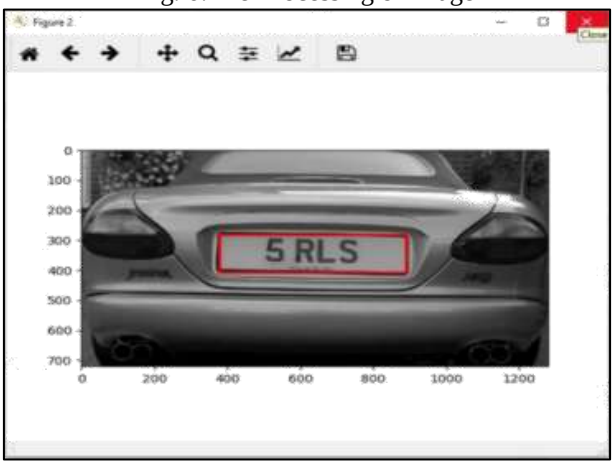

Fig. 7: Detected License Plate

There are three stages for the License Plate identification, first as appeared in Fig 5 we catch the vehicle's picture utilizing a high-goals camera like Infrared camera. To expand the framework's prosperity proportion, we need a decent quality camera.

The subsequent stage is picture pre-preparing as appeared in Fig 6, which incorporates picture arrangement, extraction of highlights, and extraction of characters. Mainly two steps are required, resizing the image and converting it to graysacle. Utilizing restriction we binarize the picture.

At last, it distinguishes the LPR as appeared in Figure 7. The License plate segment is the plot with a red rectangular line. This is additionally sent for character division, where each character is divided and perceived.

V. RESULTS

SMS of location co-ordinates and tracking

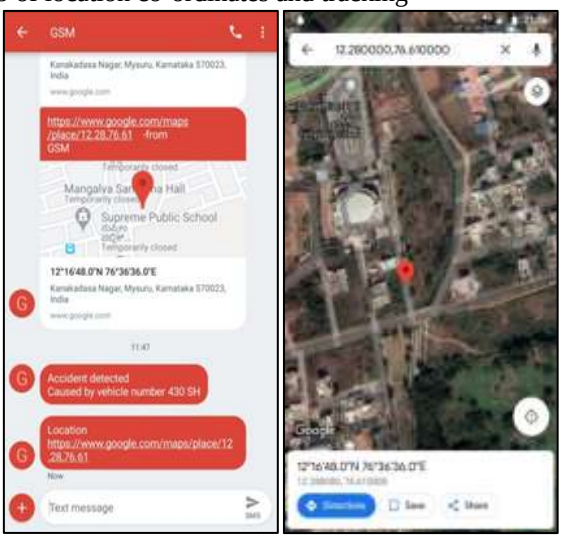

Fig. 8: SMS of the location along license plate number with location in Google maps

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VI. CONCLUSION

We have proposed a system in this paper to detect accidents and automate emergency assistance services to avoid hit and run cases. As a result, the framework sends SMS from the mishap area to the nearest crisis to assist specialist co-op and send live video, taking care of the occurrence. Automobile high demand has raised traffic dangers and street mishaps. The lives of individuals are under tremendous threat, due to delay in emergency facilities.

A programmed cautionary gadget is designed for vehicle mishaps. This program is a system that can detect mishaps and submit critical data in a substantially shorter period. The gadget capacities sufficiently for huge varieties in lighting conditions and various sorts of number plates normally found in India. While there are known confinements, it is surely a superior option in contrast to the current exclusive frameworks.

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