Automatic Accident Alert System

***Abstract*—We want to use GPS, GSM, and shock sensors to create an embedded system-based vehicle accident alert system in this project. Collision and heavy vibration are detected using a Piezo Electric Sensor. As a result, if an accident occurs, this sensor will be activated. The data is then sent to the microcontroller. At the same time, a GSM module connected to the same microcontroller will be operational. The exact site of the accident will be determined using GPS; the latitude and longitude of the GPS module should be encoded using the appropriate technique; and an alert message will be sent over GSM to Police Stations, Ambulance Service family members, and friends.**

Keywords*— *Accident, GMaps, SOS, Sensor.

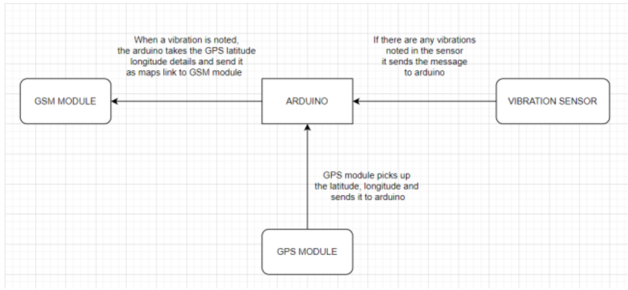
I. Introduction

According to Wikipedia, Tamil Nadu has had the largest number of road collisions for the past ten years, and its capital, Chennai, has had more collisions than any other Indian city. Many traffic crashes go unreported, according to road traffic safety experts, therefore the actual number of casualties may be larger than what is documented. Furthermore, victims who die a short period after the incident, ranging from a few hours to many days. The number of deaths could be lowered if we had faster emergency services. The graph to the right shows that the vast majority of accidents occur in rural areas. Because most hospitals are in remote settings, it is doubtful that the person will be saved if prompt action is not taken. In today's environment, vehicular accidents are a major source of concern. The driver's and co-passengers' safety may be jeopardised due to a variety of factors that contribute to an accident, and there is also a significant time lag between the time of the accident and the arrival of emergency services at the scene. Many lives can be saved if emergency services arrive at the scene of the accident in a timely manner. As a result, we propose an Automatic Accident Alert System that employs a Piezo Electric Sensor to detect an accident, a GPS module to pinpoint the exact location of the accident, and a GSM module to send an encoded message to Ambulance services, Police officials, and family and friends via a direct GMaps link. By providing fast reaction to family members and ambulances, our project could help reduce the number of deaths caused by accidents in all places.

II. Methodology

The entire embedded system can be broken down into separate methodologies based on their functions, such as the GPS module returning coordinates, the GSM module sending messages to the registered phone number, and the vibration sensor detecting whether or not there was an accident based on the vibration produced, as shown in Figure 1.

The concept behind this project is automated alert message, which should accept the latitude and longitude coordinates from the GPS module and build a GMaps link that redirects to Google Maps with the position acquired from the GPS module when an accident is detected. The message should include an SOS message about the accident as well as a link to GMaps.



We placed the vibration sensor on a table and slammed it hard on the table to demonstrate our concept. The sensor that detects the vibration informs the Arduino that the car has been involved in an accident. The Arduino then requests the GPS module's coordinates and encodes them into a GMaps connection. This GMaps URL is then included in the message, along with an SOS message to the Arduino's phone number.

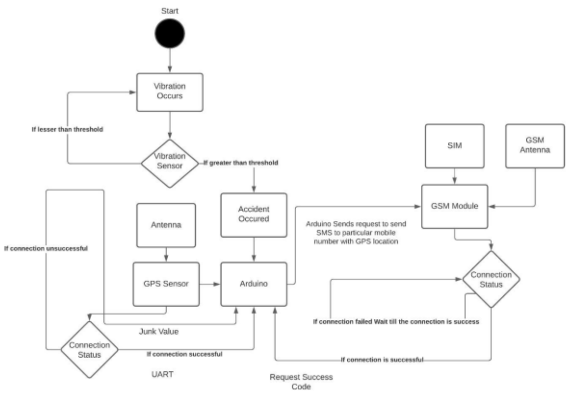


Figure 2. Automatic Accident Alert System Block Diagram

GSM

A. Rules for the GSM900-GSM1800 protocol layer:

The GSM900-GSM1800 signalling standard is based on ITU regulations. MTP, SCCP, and TCAP, the three lower-level layers, are based on ITU-T guidelines Q.700 to Q.795. The top layer, MAP, is based on the GSM 09.02 ETSI standard.

B. GSM SCCP addressing:

The network layer uses the AODV routing protocol. The SCCP layer encapsulates the TCAP and MAP levels and corresponds to the transport level in the OSI protocol stack. It's vital to go further into SCCP to have a better understanding of message routing in a GSM900-GSM1800 network.

III. Proposed Idea

When a mobile customer connects to a GSM network (for example, to update its own location), the only information provided is the IMSI (International Mobile Subscriber

Identity), which is structured according to the ITU-T E.212 recommendation: in other words, this number unambiguously identifies the mobile subscriber.

The IMSI information is then utilized to request more data from the HLR in order to reconstruct the entire profile of the discovered mobile client. This data will be transferred via C7 signaling, which is contained in the MAP protocol, however transit in current C7 networks will need a change in SCCP addressing, as existing networks can only take ITU-T E.164 addressing (the same used for basic telephony).

Individual E.164 addresses, which are now completely equal to fixed network entities, are used for further communication between network entities such as HLR, VLR, MSC, and so on. Global Title is the address that is used to route SCCP communications.

A. *E.214 SCCP Derivation of Global Titles Rule:*

Change the MCC (Mobile Country Code) to the E.164 CC (Country Code) and the MNC (Mobile Network Code) to the E.164 NC (National Code) to get an E.214 address from an E.212 one, as illustrated in figure 2. The MSIN field, which identifies a consumer based on their country and mobile network, is unaffected. E.214 is obviously a compromise between pre-existing numbering (E. 212) and addressing (E.164) techniques, as shown by the derivation rule.

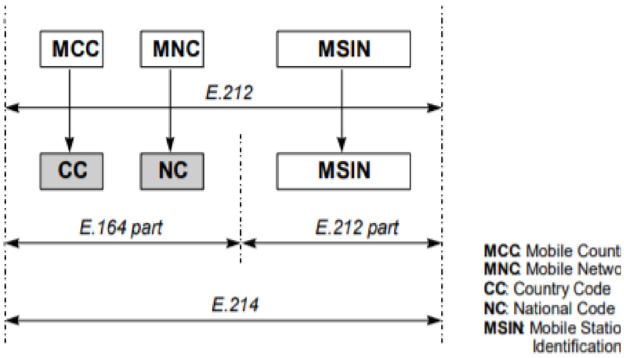


Figure 4. SCCP Derivation of Global Titles Rule

Identify applicable funding agency here. If none, delete this text box.

IV. HARDWARE SPECIFICATIONS

A. *Vibration Sensor SW-420*

To detect vibrations, a vibration sensor module based on the vibration sensor SW-420 and the comparator LM393 is utilized. An on-board potentiometer may be used to modify the threshold. When there is no vibration, the sensor outputs Logic Low, and when vibration is detected, it outputs Logic High.

B. *GSM Module – SIM900*

The SIM900 is a Quad-band GSM/GPRS solution in an SMT module that can be incorporated in client applications. The SIM900 has an industry-standard interface and provides GSM/GPRS 850/900/1800/1900MHz voice, SMS, data, and fax capability in a tiny form factor with minimal power consumption. SIM900 can satisfy practically all space needs in your M2M application, especially for slender and compact design demands, with its small configuration of 24mm x 24mm x 3mm**.**

C. *GPS Module*

A GPS is a global navigation satellite system that provides geolocation and time data to a GPS receiver anywhere on or near the Earth with an unobstructed visible path to at least four GPS satellites. The GPS framework does not need the client transmitting any information, and it operates independently of any telephonic or online collecting; nevertheless, these advancements have the potential to increase the worth of GPS positioning data. The GPS system provides fundamental positioning capabilities to military, civilian, and corporate clients all around the world.

D. *Arduino Uno*

The Arduino Uno is an open-source microcontroller board designed by Arduino.cc and based on the Microchip ATmega328P microprocessor. The board has a number of digital and analogue input/output (I/O) pins that may be used to connect to other expansion boards (shields) and other circuits. The board features 14 digital I/O pins (six of which are capable of PWM output), 6 analogue I/O pins, and is programmable through a type B USB cable using the Arduino IDE (Integrated Development Environment). It may be powered by a USB cable or an external 9-volt battery, with voltages ranging from 7 to 20 volts.

V. IMPLEMENTATION

When the vehicle is started, the Accident Alert Detection System is activated. A vibration sensor is utilized in this project to detect vibrations in the event of an accident. As a result, if an accident happens, vibration occurs, which is detected by the vibration sensor. If the vibration observed is less than the threshold value, it returns to its starting state; if the vibration detected is larger than the threshold value, it detects an accident and communicates the information to the microcontroller.

In the event of an accident, a Global Positioning System (GPS) sensor is utilized to determine the position of the accident. As a result, the GPS sensor uses the antenna to collect position data, and the antenna determines whether or not the connection is successful. If the connection is successful, the GPS sensor delivers location information (Latitude and Longitude) to the Arduino over UART; if the connection is failed, the Arduino receives the GPS sensor's invalid position information.

In the event of an accident, the Global System for Mobile Communication (GSM) sensor is utilized to send an alarm message to the police, ambulance, family, and friends of the victim. The GSM module is first fitted with a SIM card and then connected through GSM Antenna. The GSM module then tries to connect, and if it fails, it tries again until the connection is successful. If the connection is successful, Arduino asks a success code, which is returned by the GSM module. The message with location information (Latitude and Longitude) is then sent to the GSM module, which then transmits the message to the appropriate cell phones.

The functioning of the integrated embedded system is such that if an accident is detected, an alarm message is delivered to the phone number entered. The vibration sensor is first intended to detect high vibration generated by an accident. If the vibration sensor detects an accident, the GPS module gets the latitude and longitude coordinates of the vehicle involved in the accident. The coordinates are then converted into a GMaps link, which pins the position in Google Maps and sends an SOS message to the phone number given in the Arduino.

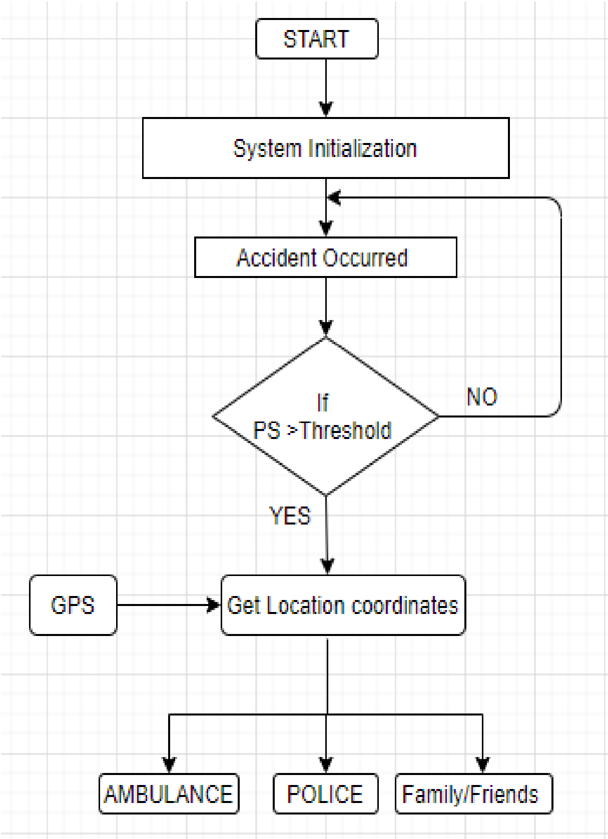


Figure 5. Flow Diagram of the Accident Alert System Functionality

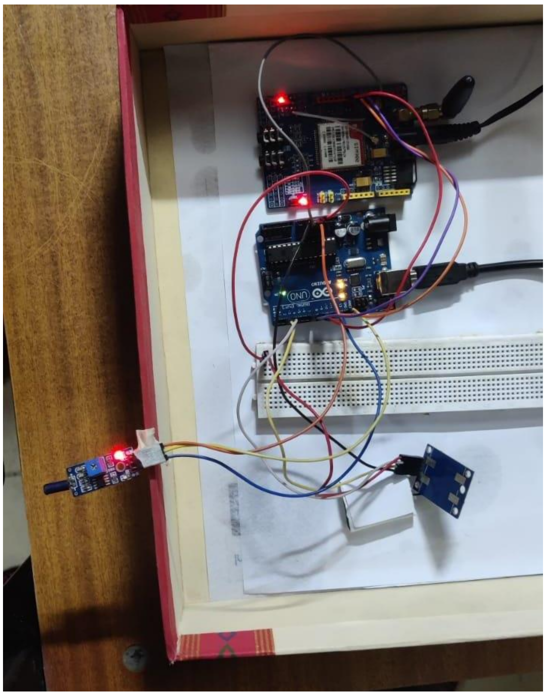


Figure 6. Fully Embedded Automatic Accident Alert System

VI. INFERENCE

Figure 6 depicts the total implementation of sensors and modules used to identify the accident, obtain the latitude and longitude coordinates, and send a message to the phone number provided, along with a GMaps link to the coordinates acquired.

VII. SOFTWARE MODEL

This section explains how to construct a system based on Machine Learning algorithms for detecting traffic accidents in real-time with the help of traffic cameras. Because a timely medical reaction after an accident might mean the difference between life and death, early accident detection systems can save lives. Furthermore, by eliminating bottlenecks and the possibility of additional events, these technologies might reduce the economic burden of accidents.

This notebook implements forward and backward improve anomaly detection utilizing GAN-based future prediction and backward tracking of a totally halted vehicle or an abrupt change of direction, respectively.

VIII. RESULTS

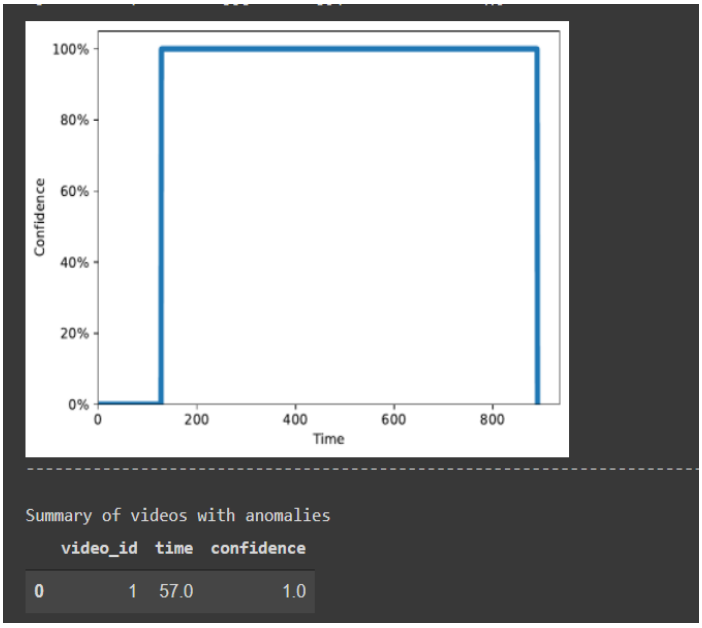


Figure 7. This graph depicts the Confidence vs Time output which is observed in the video.

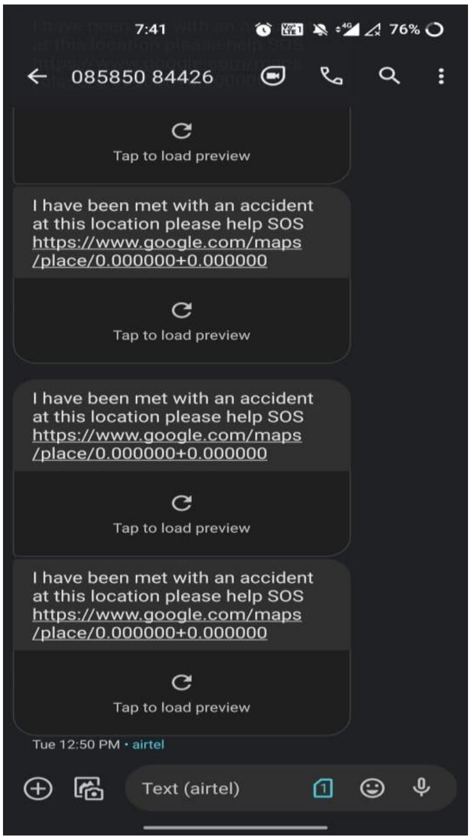
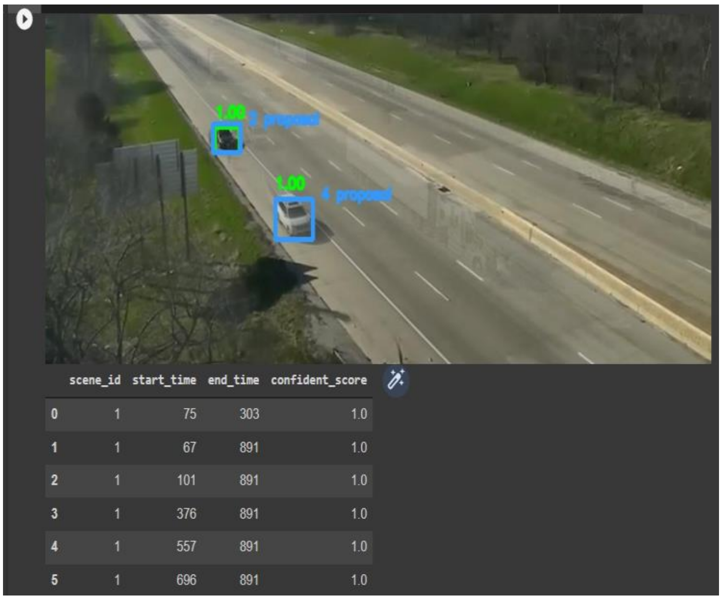


Figure 8. The message received from the Automatic Accident Alert System

Figure 8 depicts the message received by the person whose phone number was entered into the Arduino together with the GMaps link indicating the location of the vehicle's collision.



	scene_id	start_time	end_time	confident_score
0	1	75	303	1.0
1	1	67	891	1.0
2	1	101	891	1.0
3	1	376	891	1.0
4	1	557	891	1.0
5	1	696	891	1.0

Figure 9. This depicts the RCNN masking and Object Tracking of the vehicles within the given frame

Figure 9, The table depicts the start time, end time and the confidence score, which was inferred from the input video dataset, and we observed the tracking of vehicles(object) using RCNN masking.

IX. CONCLUSION

For efficiency and low power consumption, this system incorporates an embedded system-based car accident alarm system employing GPS, GSM, and Piezo Electric Sensors.
The technology is intended for use in rural and high-accident locations. The created prototype can potentially serve as a GPS tracking device.
Installing sensors in automobiles improves the accuracy of collision detection.

Within seconds of the occurrence, the accident information reached the emergency services, which is a significant improvement over the present scenario.

X. FUTURE WORKS

A voice-activated system can be used as an extension.
For speedier communication, police and ambulance services might use specialized software.
Manual shutdown can be performed even to avoid unusual system faults.
The system may also communicate the final speed before the accident, which can aid in determining the severity of the collision.
Development and integration of a web-based control panel.

XI. REFERENCE

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