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Post Accident Mitigation System using Finger Print Sensor

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Abstract - *In this paper, a car based post accident mitigation system based on Arduino is being introduced to take necessary actions to reduce the alarming death rates caused by road accidents across the world. When an accident occur, the system will identify the location and it will automatically inform those people who can take immediate actions. This is done by using Global Positioning System (GPS) and Global System for Mobile Communication (GSM) technology. IR sensors are used to detect the accident with high probability. A finger print sensor is used to verify the identity of the persons before entering the vehicle. The critical details of the corresponding person is stored in a cloud server. When an accident take place, camera recorded evidence of the cause of accident and the critical medical details of the users along with GPS located geographical coordinates for that particular place will be sent to the nearest police station, nearest hospital and an emergency contact. The medical details of the corresponding person is fetched from a cloud server. Thus, immediate medical assistance can be provided to the victims. This will reduce the death rates to a greater extent.*

Key Words: Finger print sensor, GPS, Cloud server, GSM, Arduino, IR sensor

1. INTRODUCTION

One serious road accident occurs in our country every minute and around 17 people die on the Indian roads every hour. Most of the road users are quite aware of the general rules and safety measures while using roads but it is often the laxity on part of the road users, which cause accidents and crashes. Road traffic crashes (RTC) are responsible for a substantial fraction of morbidity and mortality in our country.

Some of the common behaviour of humans which results in accidents are:

1. **Over Speeding**: Many drivers ignore the speed limit and drive 10, 20 and sometimes 30 mph over the limit. Speed kills, and traveling above the speed limit is an easy way to cause a car accident. The faster a person drives, the slower the reaction time will be to prevent an accident.
2. **Drunken Driving**: The ability to focus and function properly is compromised by drinking and is very dangerous while driving a vehicle. Driving under the influence of alcohol causes car accidents every day, even when it is one of the top causes that can be avoided.
3. **Distracted Driving**: A distracted driver is a motorist that diverts his or her attention from the road, usually to talk on a cell phone, send a text message or eat food.
4. **Red Light Jumping**: Drivers that run red lights, run the risk of causing wrongful death because they often cause side-impact collisions at high speeds. Also stop signs should never be ignored, as they result in serious car accidents.
5. **Unsafe Lane Changes**: When drivers don't make safe lane changes properly, it often leads to a car accident.

The proposed system helps in preventing unnecessary deaths in remote places due to the lack of immediate medical assistance. When an accident occur, an alert message along with geographical coordinates for the exact location of accident will be sent to the nearby police station and the nearest hospital. An emergency contact will also be informed. The cloud server can store the critical details and the medical history of the individuals. This system will help in decreasing the time required for the treatment to begin, thus increasing the chances of survival of the victims. In addition, the system has a camera module that can capture the live visuals from the location of accident. This visuals can also be sent to the nearest police station as a crucial evidence.

2. MODEL OF THE SYSTEM

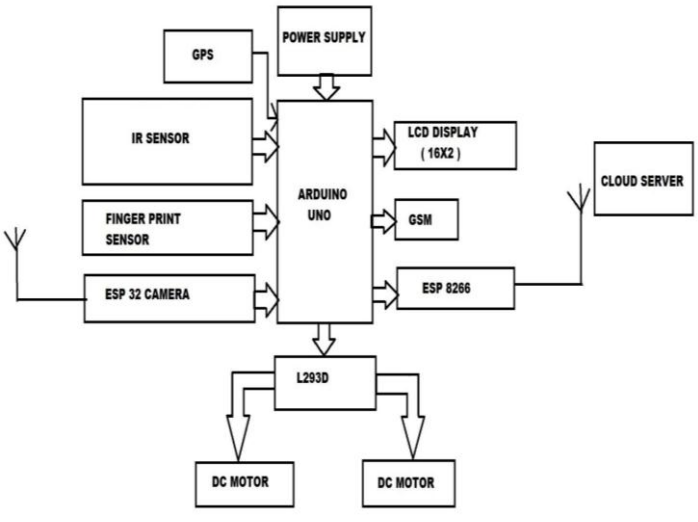

Fig-2: Detailed architecture of the proposed system

This system is designed in such a way that any person entering the vehicle has to scan their finger tip before entering the vehicle. The details of the corresponding individuals can be stored in a cloud server. By using IR sensors , the collision can be detected. Once an accident is detected, the camera will turn ON and start capturing the visuals from the location of accident. The alert message will be displayed on the LCD display. Using Global positioning system, the geographical coordinates of the location can be obtained. When an accident take place, the exact location of accident and the camera recorded evidence along with the medical details of the persons fetched from the cloud server will be sent to the nearest hospital, police station and an emergency contact. Thus immediate medical assistance can be provided to the victims.

3. SYSTEM DESIGN

The entire system is based on Arduino. It is the main controlling unit of the proposed system. The microcontroller decodes the data received from the finger print sensor, IR sensors and the GPS coordinates. Then it executes the rest of the operations.

A. Arduino Uno

Arduino is a small microcontroller board with a USB plug to connect to your computer and a number of connection sockets that can be wired up to external electronics. It is based on ATmega328P. It can either be powered through the USB connection from the computer or from a 9V battery. It can be controlled from the computer or programmed by the computer and then disconnected and allowed to work independently.

B. R307 Finger print sensor module

R307 Finger print sensor module consists of an optical fingerprint sensor, a high speed DSP processor, a high performance fingerprint alignment algorithm, high capacity FLASH chips along with other hardware and software composition. It can handle various operations such as fingerprint entry, image processing, fingerprint matching, search and template storage.

C. IR sensor

IR sensor can measure the heat of an object as well as detect the motion. The emitter is an IR LED (Light Emitting Diode) and the detector is an IR photo-diode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photo-diode., the resistances and the output voltages change in proportion to the magnitude of the IR light received. This sensor is used to detect the collision and alert the system.

D. NEO 6M GPS module

Global positioning system (GPS) works by providing information on exact location. It uses the Global Navigation Satellite System (GNSS) network for this purpose. Both the real-time and historic navigation data on any kind of journey can be obtained. There are 24 operational and 3 extra (in case one fails) satellites that move round the Earth. The control of the Positioning System consists of different tracking stations that are located across the globe. These monitoring stations help in tracking signals from the GPS satellites that are continuously orbiting the earth. Space vehicles transmit microwave carrier signals. The users of Global Positioning Systems have GPS receivers that convert these satellite signals so that one can estimate the actual position, velocity and time. The heart of this GPS module is a NEO-6M GPS chip. It can track up to 22 satellites on 50 channels and achieves the industry's highest level of sensitivity. Once the accident occurs, this module will fetch the geographical coordinates of the exact location of accident and it will be sent to the Arduino Uno. This data will be temporarily stored there until further procedures.

E. GSM SIM 800 module

Global Standards for Mobile Communication (GSM) is a set of standards for Second Generation (2G) cellular networks. The GSM SIM 800 module uses any network provider's SIM to communicate over the telecommunication network. This modem can be used to send and receive text messages and to make and receive voice calls. GSM SIM 800 is a quad-band GSM modem that functions at 850, 800, 1800 and 1800 MHz frequencies. This modem also supports features like transferring voice data, integrated support for GPRS and TCP/IP stack. Once the accident occurs, the message indicating the occurrence of the accident along with the geographical coordinates of the location will be sent to the necessary contacts.

F. ESP32 camera module

The ESP32-CAM has a very small camera module that can operate independently as a minimum system with a footprint of only 27*40.5*4.5mm and a deep sleep current of up to 6mA. It has a low power 32 bit CPU. It can be used to view and record the incident that leads to the accident. Once the collision is detected, the camera will be turn On.

G. L293D motor driver

L293D is a dual H-bridge motor driver integrated circuit (IC). It acts as a current amplifier since it take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. It contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction.

F. ESP8266 Wi-Fi module

It is a self contained system on a chip with integrated TCP/IP protocol stack.. It can be controlled from the local Wi-Fi network or from the internet (after port forwarding). It can give the microcontroller the access to the Wi-Fi network.

4. HARDWARE IMPLEMENTATION

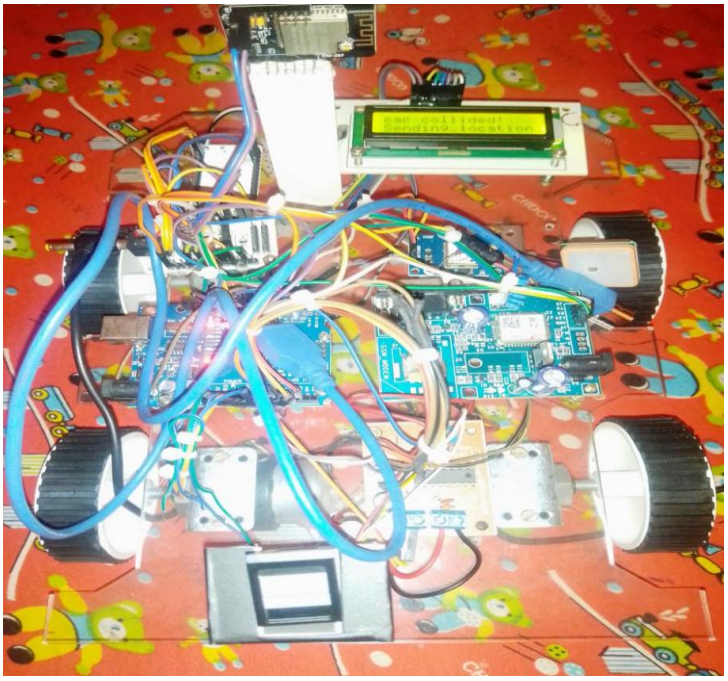

Fig-4: Implemented hardware setup

The proposed system deals with accident alerting, locating and detection. Arduino is the heart of the system which helps in transferring the message to different devices in the system. IR sensor will be activated when the accident occur and the information is transferred to the registered number through GSM module. Using GPS, the location can be sent through the tracking system to cover the geographical coordinates over the area. The accident can be detected by the collision sensor which is used as a major module in the system. Once the system is ON, you can scan your finger tip on the finger print sensor. Once the matching finger print is found from the templates, the data is sent to the Arduino Uno and the vehicle will start running. Once a collision is detected, with the help of collision sensors, the vehicle will stop and the system will send an alert message along with the geographical coordinates of the location to the nearest hospital, emergency contact and the nearest police station. The camera will be turned ON automatically once the collision is detected. The live streaming of visuals from the spot of accident is possible. The video of the cause of accident can be recorded and used as a crucial evidence for legal procedures. In many cases of road accidents, lack of proper evidence is what causes the culprits to walk free. This can be avoided with the help of this system.

5. RESULT

The outputs obtained from the system are shown below:

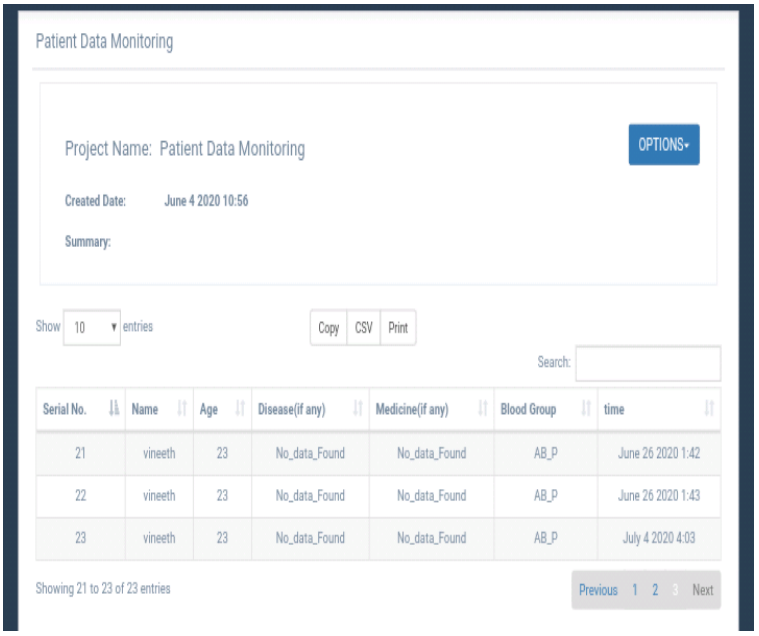

Fig-5.1: Sample data stored in the cloud server

The critical details of the persons met with the accident are available in the cloud server along with their medical history.

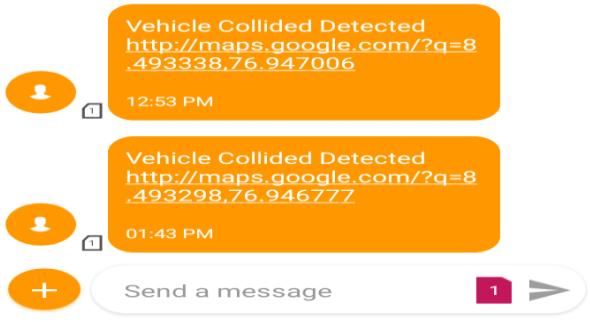

Fig-5.2: The SMS received from the GSM module with a collision alert along with the exact location of accident. The link will directly lead to Google Maps

Once the collision is detected, the microcontroller will activate the GPS module which in turn will fetch the geographical coordinates of the exact location of accident. The alert message along with the exact location will be sent to the immediate contacts via the GSM module.

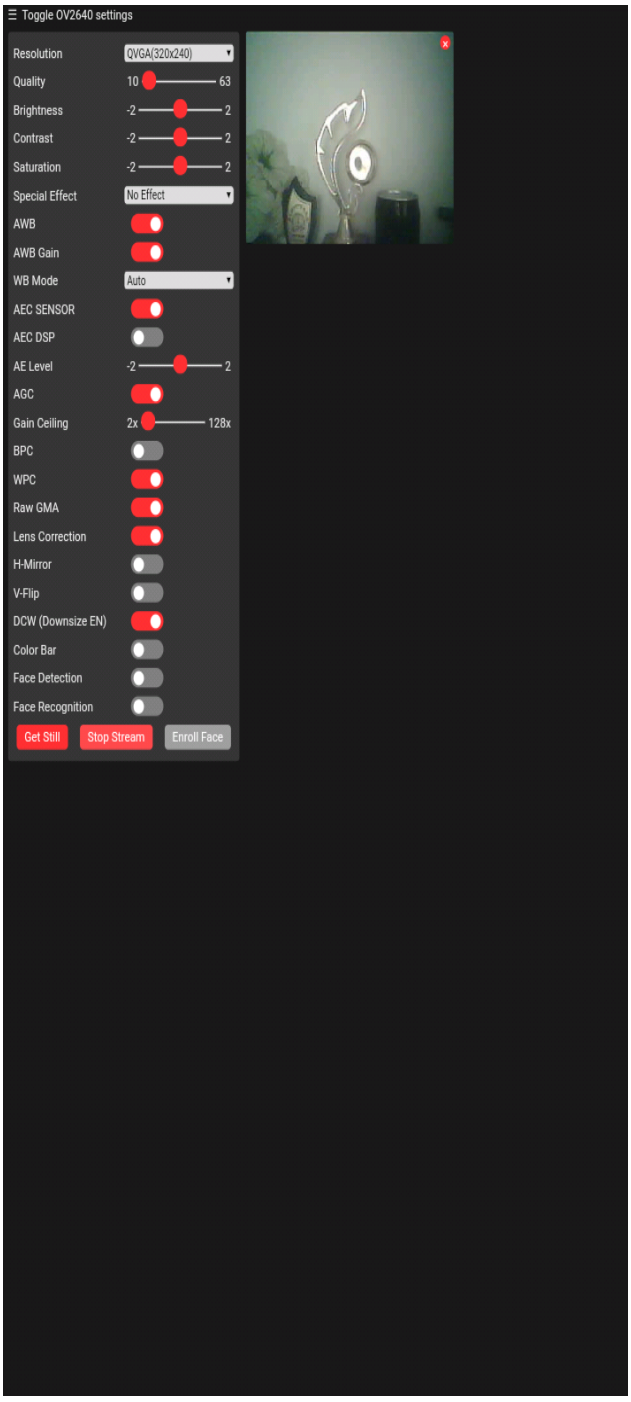

Fig-5.3: Live streaming via ESP32 camera module

Once the collision is detected, the camera module will turn On. The live visuals from the location of accident can be captured by tracking down the IP address.

6. FUTURE SCOPE

With the help of a common identity card like the Aadhar card, a large cloud database including the critical medical details of all people across the country can be created. A separate server can be created just for medical purposes only. The control and access to this data base can be strictly limited to higher authorities in the medical sector or Government. The biometric features of every citizen can be obtained from the Aadhar card. Hence, by using the finger print scanner and the large data base containing the medical details of the individuals, the critical details of any random citizen entering the vehicle can be obtained. This details can be easily sent via the GSM module, in case an accident occur. This system can only be implemented with the permission of the Government of India.

7. CONCLUSIONS

This paper offers a system that will help in reducing the number of deaths in remote places due to the lack of immediate medical assistance to the victims of road crashes. This system can alert the nearest police station and the hospital. It can also send an alert message to an emergency contact. The finger print sensor verifies the identity of each individual before entering the vehicle. The cloud server can store the critical details of the individuals along with their medical history. Once an accident take place, an alert message along with the geographical coordinates for the exact location of accident will be sent to the people who can take immediate actions. This helps in decreasing the minimum time required for the treatment to begin thus increasing the chances of survival of the victims. In addition, the system has a camera module that gets activated once there is a collision. The live visuals from the location of accident can be captured and recorded. It can be sent to the nearest police station to be used as a crucial evidence. Since there is valid evidence, the culprits has to face the law for causing the accident.

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