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Cloud, IoT and Mobile Based Conceptual Framework on Accident Avoidance System

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Abstract — Accidents are unexpected incidents that result in injuries spanning from minor to major level; some time extend to death. The accidents mostly affect human life at different levels, and the worst cases cannot be resettable. Unnecessary injuries and cruel subsequent can be protectable. Accidents can occur due to sleep while driving, mobile use, alcohol consumption and violating road rules. A technological solution is needed that addresses emerging trends and overcomes all challenges. Cloud computing technology overcomes most problems facing traditional technology. It avoids unnecessary physical server costs, storage, initial investment, and maintenance issues. IoT technology provides high-tech solutions by monitoring and observing objects in real-time via sensors. The identified applications of all three technologies are smart-campus, smart-transport and smart-city. This study aims to propose a conceptual architecture, built with an Accident Avoidant layer and is fully coping with preventing accidents by unwanted issues. The Arduino Mega microcontroller is the regulator of this system. When the driver enters the vehicle, the system examines whether or not the driver is drunk. It checks heart rate, texting while driving, speed of the vehicle and safer distance between vehicles. If the sensor detects a heart attack, it stops the vehicle. Working with IoT is a better and easy solution in the current trend with the necessary solutions. Most previous studies have failed to incorporate the range of solutions that this study suggested. When this structural model is established, the end-user can undoubtedly get substantial benefits instantly.

***Keyword** – IoT, Mobile Application, accident avoidance layer, micro controller*

I. Introduction

Accidents are unexpected incidents that produce injuries, detriment, and occasionally even death. Accidents cause severe consequences for human lives. A moment of mistake or occurrence changes everything very far which we cannot even think of. In day-to-day life, we have seen many different forms of vehicle accidents despite of the location. Vehicle accidents are also increasing uniformity with the swift growth of the human population. Government and other sectors implemented and also try to seek various mechanisms to avoid and mitigate accidents considerably. Road rules, traffic control, and human resources are prominent examples of those mechanisms. However, law-enforcement even still inefficient and faces so much difficulty to halt accidents. As a philosophical term, there is nothing more valuable than human lives. As we know, human life cannot be protected when the time up, but we can protect the same against unnecessary injuries. In real life, most of the time, we can observe various types of leg, arm, head and chest injuries, cuts, scraps, and so much more from road accidents. Most of the time, accidents affect human life in different levels, and the worst cases cannot be resettable. Even though human lives' protection not in our hands, Unnecessary injuries and cruel subsequent can be protectable. This requires a better protocol and an outstanding procedure than conventional, old law enforcement and government regulations. We need a technological solution that addresses emerging trends and overcomes all challenges in the present era.

In Contemporary cloud computing [1]–[5], IoT [6]–[8] and mobile devices are ruling the world. Around the globe, there is no place we can see without having the above-mentioned technologies. Having this technology provides a better solution with higher efficiency at a lower cost. Cloud computing technology overcomes most problems facing traditional technology. It avoids the unnecessary cost of physical servers, storage space, initial investment, and maintenance issues.

In comparison, IoT technology provides high-tech solutions by monitoring and observing objects in real-time via sensors. Sensors are tiny and cheap equipment that provide precise real-time data, requiring many sectors for several forecasting. While the services of mobile devices these days are outstanding, the output of both cloud and IoT devices eventually passes to the mobile device instantly for further operations. The identified applications of all three technologies are smart-campus [9]–[11], smart-transport [12], smart-agriculture [13]–[17], smart-healthcare [18]–[21], smart-city [22]–[24], and countless others.

There are many reasons for having a road accident. The important identified factors are sleeping while driving, mobile usage, alcohol consumption, and violate road rules. These are unstoppable problems with the traditional method. We cannot even stop at least an inch unless the drivers avoid those themselves. Nevertheless, After the advancement of web 2.0 [25], [26] and ICT in the world, everything is possible. Even we can stop all identified issues by overruling the current traditional method. The digital age makes it possible and makes it happens.

The aim of this study is to suggest solutions to avoid and respond to road accidents with the help of the cloud, IoT, and Mobile devices as a concept.

II. Literature review

A. Drowsiness

Masahiro Miyaji et al. [27] developed a system called "Simultaneous Measurement of Heart Rate Variability and Blinking Duration to Predict Sleep Onset and Drowsiness in Drivers". In this system, drowsiness is measured by using two analyses, namely, eyelid analysis and heart rate variability analysis. The eyelid system was measured by using a CCD camera with an image processing function. The first camera captures the eyelid. It identifies the head, gaze, and eyelid, then blinking duration calculated by estimating the time from the season of one eyelid closure to the following eyelid closure. Then after the prolongation of blinking, the duration will be analyzed; if it is yes, then it will consider this as drowsiness based on blinking. In the heart rate variability, the heart rate is measured by spectral analysis; then, it calculates the high frequency and low-frequency power. IF high-frequency increases, it will consider as drowsiness-based heart rate variability. Comparing eyelid and heart rate probability will be automatically calculated by the system if it is high for sleep activities. There is an alert will be given by the system for the driver.

Mandeep and Gagandeep proposed a strategy that recognizes drowsiness utilizing the mean shift algorithm. In their system, they have utilized a webcam and the algorithm to recognize constant eye blinking with the camera's resolution 640x480. Eyes are identified from each casing, and each eye squint is estimated against a mean value. The system analyzes the eye-opening at each squint with an expected mean value. An alarm is activated if the eye-opening surpasses this value for a specific measure of straight edges. In this algorithm, the system needs to hold data about the past frames because the eye flickering estimations from an aggregate measure of frames are utilized to screen laziness[28].

Vitabile et al. developed a system called "real-time non-intrusive FPGA-based drowsiness detection system in a vehicle" to find out the drowsiness to mitigate accidents. This system consists of an 850nm infrared light source is fixed on the vehicle dashboard, causing a splendid understudy impact. This makes eye recognition simpler as the eye's retina reflects 90% of the light incident. A drowsiness state is recognized when the eyes are over 80% shut for a specific timeframe. Efficient image processing techniques are combined with established hardware technology like Field Programmable Gate Array (FPGA). This licenses constant drowsiness location and empowers the system to process a whole 720x576 casing in 16.7 microseconds[29].

Chuang-Wen et al. found an App on Android phones called "CarSafe App: Alerting Drowsy and Distracted Drivers using Dual Cameras on Smartphones". To work with this application, we need a dual camera android phone. The front camera observes the driver's eye blink ratio and the head position to find drowsiness. The rear camera is used to check the distance of the other vehicle from the driver and also check the direction of the lane if any. This application help drivers to find out the sleep-related thing as well as provide security away from collision activities by the front camera of that application. This system is something better to mitigate accident in some amounts [30].

Amna Rahman et al. presented a new system for classifying drowsiness. In this system, there is a video camera placed in the car which acquires the video frame. Face detection is made by using that frame, and it detects and crops the eye region. After that, find the two eye corners and one point on the lower eyelid. Then find the midpoint of the two upper eye corners and find its distance from the lower eyelid point. In the next step, it identifies the distance; if the distance is zero or near to zero, the eye state is classified as "closed". Eventually, if the eye state is "closed" continuously for two or more seconds, the driver is assumed to be drowsy, and an alarm is triggered. All these activities or steps are done by Viola Jones Algorithm, which generates high speed and high accuracy for real-time face detection system[31].

Mejdi Ben Dkhil et al. found a system called "A new approach for a safe car assistance system". In this system, drowsiness could be analyzed by three major categories, namely, vehicle-based measure, behavioral-based measure, and Physiological measure. In-vehicle measured, they have measured lane position and a moment of steering. In behavioral, they have measured eye blinking, head position, and head moments in Physiological, the relation between physiological signals ECG (Electrocardiogram) and EOG (Electrooculogram) is identified. Although in this system measure drowsiness in three categories, In the in-depth study, two things are essential to measuring the drowsiness of human which are eye blinking and EEG (electroencephalogram). To get the eye, blinking used a camera with Viola Jones Algorithm, which identifies the eye position and blinking step accurately and gives the output.

To get EEG output, "Emotive EPOC headsets" are used. From that headset, the signal has been gathered, and identify the drowsiness using EEG RHYTHMS. If it is "Theta", it is considered a drowsiness state. Both outputs combined and used fuzzy logic for a more accurate level. Eventually alert signal will pass to the driver.[32]

Ilya S. Dymov et al. proposed a system called "Automation Control System against Driver Falling Asleep in Traffic". In this system, there are three sensors, namely pulse, Temperature, and pressure sensors are placed in the steering wheel of the car. Also, a sound sensor is mounted with the control system at the rear of the vehicle. They have measured all three sensors reading in three category speed, namely 60 Kmph, 60-90 Kmph, and over 90 Kmph. Temperature of normal person(unsleeping) must come not less than 0,97(In 60Kmph) , not less than 0,98(In 60-90) and not less than 0,99(over 90). The pulse not less than 0, 87, not less than 0, 9 and not less than 0, 93 respectively to the speed. Also, pressure not less than 0, 5 (In 60), not less 0, 7(In 60-90) and not less than 0, 9(over 90). Once the control system gathered all sensed values, it analyzed all things together. If only one value varies from the sensor's specific value above in three categories, it warning the driver by indicating light. Suppose the driver is not sleeping. If more values vary from that particular needed range, then the system generates an emergency signal to the driver by using sound or vibration and alerts the driver for protecting from accidents[33].

Chen et al. developed a system for reducing accidents called "RFID Combining with Wireless Sensor Network (WSNs) for Real-time Doze Alarm". In this system, Zigbee used with ATmega microcontroller and Antenna corresponding to the chip. The microcontroller pretends as an intermediate device in-between RF Transceiver and sensors. There is a heartbeat sensor module connect with the driver, and the sensor starts to detect the pulse (Heartbeat) and send it to the microcontroller, and it will analyze that specific pulse. If that pulse successive abnormal, then the microcontroller passes that to the Zigbee Bluetooth module by using RF Transceiver and Antenna. There is a connection that has already been established between the phone and the Zigbee module; thus, it sends the alert warning to the driver using his/her phone[34].

Chee-Keong Alfred Lim et al. found the system with Analysis of Single-Channel EEG on Drowsiness Detection. In this system, NeuroSky MindWave headsets were used to analyze mind wave and EEG data to check whether the eye has been opened or not. In NeuroSky, MindWave has a generic chipset known as ThinkGear that empowers the gadget to interface with user's brainwaves and procedure them. In this ThinkGear, EEG data and some other data can be accessed by using a particular library. EEG typically considered as frequency band and its analysis the different amplitude and frequency of brain wave. If it becomes a Theta type, then it is drowsiness or sleep state. In this system, all data were gathered in a MATLAB environment using a script file to facilitate communication between EEG headset and MATLAB. An application programming interface (API) and software development kit (SDK) provided by NeuroSky is utilized to support the scripting process. Data has been analyzed by using two states, namely, closed eye and open eye, which are analyzed by using EEG. According to the EEG output, if the eye is closed, there is an alert will send to the driver. They have used an algorithm to find out the eye open, and they have used the low-level theta value for getting alert. This kind of system driver always must wear a headset while driving; it may reduce the flexibility of the system, but same time brain waves with EEG will provide accurate output to get alert[35].

Zhijiang Wan et al. developed a system called ALMA (Attention level monitoring alarm) system for the Driver Fatigue in the Pervasive Environment. This system has three major parts namely, NeuroSky Mindset headset which they used to collect EEG signal form the brainwave, then an algorithm called KNN which inspect the data from the headset and identify the current status of drivers, eventually An android pad which gives a graphical interface and provides feedback alarm according to the state of the driver (According to the KNN algorithm). Here NeuroSky Mindset headset provides an application programming interface to connect with android. This system works as follows, Thinker chip of NeuroSky Mindset headset collects the signal (EEG) using brainwave, which transfers to the android pad via Bluetooth. It calculates the coefficient and accesses the KNN algorithm. According to the output of KNN, if the driver state is fatigue, then the alert will send to the driver[36].

B. Call Blockage

G.Espinosa-Garza et al. [37] developed an accident reduction system is called "Process and method for the reduction of car accidents due to call while driving". The fundamental idea of this process is to block the cellphone connection when driving. A blocking application must be enabled on the phone. This application will be triggered when the vehicle speed is more than 20 kilometers per hour. GPS detects the speed of the car. A router is installed in the car for the GPS analysis to identify the speed. If the speed continues, the block continues for up to three minutes, so the driver cannot speak to the phone for more than 20 km/h. There is an HC1 connector on each passenger's side, except for the driver; they can connect their phone to the router through the HC1 connector. If the speed increases, phone access will be blocked. Others inform the driver to drive slowly; hence the accidents are reduced in over speed.

Gila Albert and Tsippy Lotan [38] explored a study about "soft blocking" to reduce the accident with texting while driving. The core idea of this mechanism is to block notification and keep the phone quiet when driving. Similarly, generate the automatic reply when the user is driving. Thus others get a better idea of users' situation, and from that, "soft blocking" reduces most unnecessary road accidents. A user of this system must install the app on their phones to activate and a better experience. Nevertheless, a report and a result of a study conducted by Musicant et al. [39] that drivers much prefer a limited blocking app should block fewer features than "soft blocking" apps.

Another related study by Creaser et al. [40] suggested that cell blockade reduces road accidents when driving enormously. Likewise, a related study conducted by Albert and Lotan [41] revealed that 44% of drivers much prefers to block the message notification while driving, and 50% claims that they prefer auto-reply.

Firas Omar [42] suggested and built a system to minimize the accident is called the "Car Accidents Prevention System". Arduino microcontroller and android application are playing a crucial role in this system. GPS application installed in the android keeps giving the location to the microcontroller. Whenever an accident happens, the microcontroller sends the detailed accident types to the responsible person via an android application. Here the sensor connected to the microcontroller identifies the accident type.

Emily Gliklich et al. [43] accomplished a survey analysis to identify the impact of texting while driving. This study showed that 48% read text while driving, 33% write text, 43% see map activities, and 49% use nothing while driving. Moreover, this study shows that text distraction affects the accident positively. Mostly younger age group got numerous rate of an accident with texting while driving.

Many studies question and contend that texting while driving effects both the vehicle and the driver. Generally, text while driving affects a driver's response time, vehicle speed, and land position [44]–[48].

C. Collision Avoidance

Xiao Qu et al. [49] suggested a method called "Ultrasonic Ranging Car Collision Prevention Alarm System" for accident mitigation by avoiding the collision. This system is fully working with distance measures with the help of an ultrasonic sensor. The ultrasonic sensor is generally used for calculating distance by ultrasonic signal transmission and receiving process. This system consists of transmitting, receiving, convert, control, and alert units. When the car runs, the controller sends ultrasonic transmission, and it waits for the ultrasonic receiver. Once it got the received signal, it calculates the distance by using time for sending and receiving activity. Once it calculates the distance, if the distance is the minimum safe distance, then it sends an alert to make the car speed as half speed. If the distance is less than the minimum safe distance, it will send an alert to park the car. Then the driver will stop the car. In this system, something okay for accident mitigation, but it does not support drowsiness sleeping activity. If they add that feature with this system, it will be a better system for accident mitigations.

S. Sized and C. End [50] suggested a method to avoid a collision is called "Collision Avoidance System". This system contains three sub-models, namely, Treat assessment[51], path planning[52], and Path tracing. The treat assessment measures the distance matrices with the sensor; then, it passes to the path planning model. This analysis the sensor output and plans the path according to the output. With the help of Path Tracking, the vehicle follows the planned path from the path planning model. Typically collisions happen at high speed; this system provides a break and necessary actions like turning without smash with other vehicles when it identifies high speed and the possibility of collisions[53].

Umar Zakir Abdul Hamid et al. [51] developed a system with an algorithm known as "Geometrical Based Steering Control for Vehicle Collision Avoidance". The algorithm identifies a safe distance point by using the vehicle's longitude, geometric position, and the speed of the vehicle by collision detection strategy. It decides the travel path of the vehicle if there is any possibility of collisions. Eventually, it returns the vehicle from the original path in case of the possibility of accidents by avoiding collision action.

Mahesh A. Rakhonde et al. [54] developed a system using IoT to detect vehicle collisions and avoid pollution. This system has four parts: accident detection system, accident avoidance system, communication system, and pollution monitoring system. Raspberry Pie microcontroller acts as a hub and connects all four parts of the system. When the driver collides with another vehicle or faces any accident, the detection system tries to get the driver's response. If the driver gives any response, it will be okay; otherwise, the detection system will send the message to the responsible person with GPS. Simultaneously, this system measures the impacts of the vehicle.

On the other hand, the accident avoidance system tries to avoid the accident by measures the pressure of the tire and distance from other vehicles. Suppose the distance of another vehicle is less than the required amount. The avoidance system tries to reduce the speed of the vehicle by reducing the pressure of the vehicle. BMP180 sensor and ultrasonic sensors are used to measure pressure and distance, respectively. The pollution system is used to check the carbon monoxide coming from the vehicle. The communication system connects all these systems to work correctly by I.P. address via Wi-Fi networks.

Saurav Agrawal and Dr. Mrs. S.W.Varade [55] proposed a system called "Collision Detection and Avoidance System For Vehicle". This mechanism is focused on the distance between two vehicles. Based on the speed of the car, the safety distance will be changed, and the driver must observe the safety distance in order to prevent a collision. When the driver drives the vehicle without considering the safety distance, the system will generate a warning. If the driver responds to the alarm, it will be okay; otherwise, the device will slow down the vehicle until the safety distance is reached or stop the vehicle.

Mahesh Ashokrao Rakhonde et al.[56] listed a safety mechanism to prevent an accident by preventing a collision. This system comprises two parts: Active and Passive. The active component includes an automatic braking system, an anti-collision system, a lane warning, and a cruise control system. Simultaneously, the passive system provides airbags and a safe seat belt system when an accident occurs. An active system provides precautions to avoid accidents, while a passive provides safety measures when an accident happens.

Daniel Anadu et al. [57] developed a system with a simulation environment to detect and avoid a collision is called "Internet of Things: Vehicle Collision Detection and Avoidance in a VANET Environment". Arduino pretends to be the core of this platform and connects the accelerometer sensor, radio transmitter, receiver, LCD, and LED. Microcontrollers with this configuration must place each vehicle in a position to exchange a message with each other. When two or more vehicles are anticipated to crash, the radio transmitter sends all the necessary signals to another car. As a consequence, the driver can soon be warned and can be eased from disproportionate impacts.

D. Alcoholic

Nicholas A et al. [58] performed a study to assess the percentage of blood alcohol intake when driving. Twenty healthy adults were used to carry out this study, and 0.05 percent and 0.08 percent of the dosage was administered to them, and driving was tested. This experiment was performed in the field of well-traffic. As a result, it was found that more collisions were detected when the alcoholic intake was 0.08 percent higher than 0.05 percent. From the conclusion, it is evident that the acceptance of alcoholic consumption is essential to avoid unnecessary problems when driving.

Divesh Kumar et al. [59] accomplished a study to avoid a vehicle accident called "ALCOHOL DETECTION WITH ENGINE LOCKING". An Arduino microcontroller acts as a hub in this system. The Alcoholic Detection Sensor (MQ-3) is connected as a microcontroller input device. It attempts to calculate the level of alcohol intake of the driver. If the intake level is higher than the fixed threshold value, then it locks the engine with the help of the D.C. motor; if not, the driver can continue their driving.

Moreover, when it locks the engine, it sends the message to the responsible person by the SIM900A module connected as an input in the microcontroller. Similarly, an ultrasonic sensor measures the distance with another vehicle, and if the distance is low, it produces the alarm. Hence this system acts as both alcoholic avoidance and collision avoidance.

Tejaswini Nalluri and Koteswara Rao Vaddempudi [60] built a solution for a vehicle accident is called "Accident Prevention System Using Ultrasonic Sound Sensors". This system was constructed with four ultrasonic sensors and an MQ-3 alcoholic sensor connected with a microcontroller. The alcoholic sensor identifies the drivers' intake level of alcoholic and reacts based on the level of consumption. On the other hand, the ultrasonic sensor measures other vehicles' distances from the front, rear, left, and right sides. When the distance is lower than 2 meters, it starts to react by producing an alert.

G. Adarsh et al. [61] constructed a prototype to avoid an accident from alcohol and other ways. Raspberry pi microcontroller act as a governor of this system and the MQ-3 alcoholic sensor is connected as an input of this prototype. This system checks three aspects; initially, it checks whether the user buckle up the seat belt or not. When it fair, it moves to the next step; if not, it waits 15 seconds, and the driver keeps delay; it sends a warning message. In the second step, it checks the image of the driver with a camera fixed in the raspberry pi camera module to ensure only one person in the vehicle. If both steps okay, then it moves to the third step. Eventually, it measures the intake level of alcohol consumption. When it more than the threshold value, then it blocks to drive the car. From this approach, we can reduce many accidents when a user tries to drive with alcohol.

Abhinava Dhanush T M et al. [62] proposed an IoT solution system to avoid an accident in two-wheelers when driving with alcohol. The key idea of this system is to identify and block the vehicle when the user intake alcoholic. An Arduino microcontroller plays a significant role and an alcoholic sensor act as an input device embedded with it. This system concerns with two properties; initially, it identifies whether the user wears a helmet or not. If so, it tries to identify the alcoholic level by the MQ-3 sensor. If the user is detected with alcohol, then the vehicle not starts. The system response only when a user uses a proper helmet, and there is no alcoholic consumption. Otherwise, it does not react. When the user gets an accident, it sends a message to the family by the Arduino board's GSM module.

A. Jesudoss et al. [63] proposed a system for mitigating accidents called "SAFE DRIVING USING IOT SENSOR". A microcontroller plays a significant role in this system. There are three sensors connected as an input of the microcontroller: "MQ-3 alcohol sensor, over-speed controller sensor, and eye blink sensor". The alcohol sensor seeks alcohol intake. If it found any, it sends an alert message to the driver and police by SMS. The over-speed controller sensor identifies the speed, and when the speed is more than 40 kmph, it reduces that speed. In comparison, the eye-blinking sensor is used to check whether the driver is asleep or not. Suppose driver sleep alert will be given to the driver.

E. Other

In general, a range of factors leads to most road accidents. A heart attack is one of the leading causes of road accidents. Muhammad E. H. Chowdhury et al. [64] Conducted a study by examining the heart attack to minimize road injuries. The wearable devices act as a significant aspect of this system. This system consists of two subsystems: the heart rate detection system and the heart attack identification system. The wearable device detects the heart rate by record EGC and sends it to the heart attack identification system. The heart attack identification system has trained with the SVM classification model, which identifies whether the driver has attacked or not. If so, it gives a warning to the driver and responsible person.
A.Anusha and Syed Musthak Ahmed [65] built a system by IoT to enhance the safety of driving. In this system, GPS and GSM play extreme roles. The microcontroller connects an alcohol sensor, buzzer, eye blink sensor, GPS, and GPRS. The GPS location of the vehicle keeps updating in a real-time web system. When the user uses the wrong route, the system will warn the user by sending a message to their phone via GPRS and sim connection. Correspondingly, if the user feels sleep or gets sleep, the eye blink sensor informs the microcontroller. A warning sound will appear from the buzzer; moreover, if the user intake alcohol car is stopped by a motor placed in the vehicle.

III. METHODOLOGY

This study aims to propose a conceptual architecture which reduces the unnecessary road accident with high practical, high efficient, low complexity, and high usability. Also, it provides an intelligent conceptual solution in the event of an accident. This framework, built with a layer called the Accident Avoidant and is fully coping with preventing accidents by unwanted issues.

A. System architecture and components

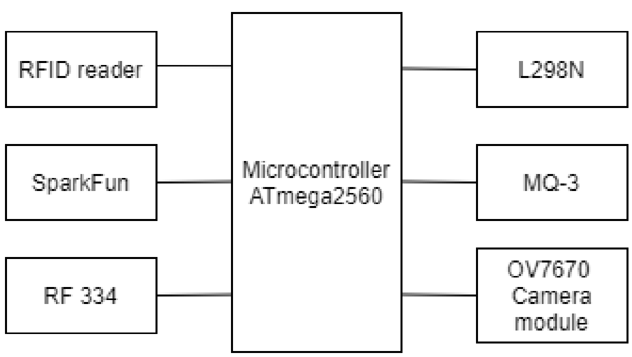


Figure 1: Microcontroller with necessary sensors

This layer is entirely concerned with preventing an accident in various ways. The Arduino Mega microcontroller is the regulator of this system. When the driver enters the vehicle, the system initially examines whether or not the driver is drunk. If the driver is drunk, then the system will identify the intake value of the alcohol. Suppose it is less than the threshold value driver can start the vehicle. If not, the engine will be blocked, and the message will be sent to the responsible person. If the person is not drunk, they can start the vehicle. In the next step, it checks the various aspects, which including heart rate, texting while driving, speed of the vehicle, and safer distance between another vehicles. If any texting activity is detected while driving with the aid of a camera module, the system suddenly stops the vehicle with an alert. If not, they can continue driving. On the occasion that the sensor detects a heart attack, the system immediately stops the vehicle. It delivers a warning to the responsible person. Besides, if the vehicle does not maintain a safer distance between the other vehicles, the driver will be alerted for up to 30 seconds. If no improvements are found, the microcontroller will change the vehicle's trajectory with the maintenance of a safer distance. Suppose the user is talking the call more than 20kmph; the microcontroller blocks the call. If a message is received by the phone when the driver drives more than 40 km/h, the system will block the particular message until it becomes less than 40 km/h, or it will auto-reply to the user. Both options are feasible; drivers may select their preferred approach. Also, if there is any sleep activity found by the system, the vehicle stops suddenly and warn the driver. Figure 1 shows the microcontroller with the necessary sensors.

B. Flowchart for Accident avoidance layer

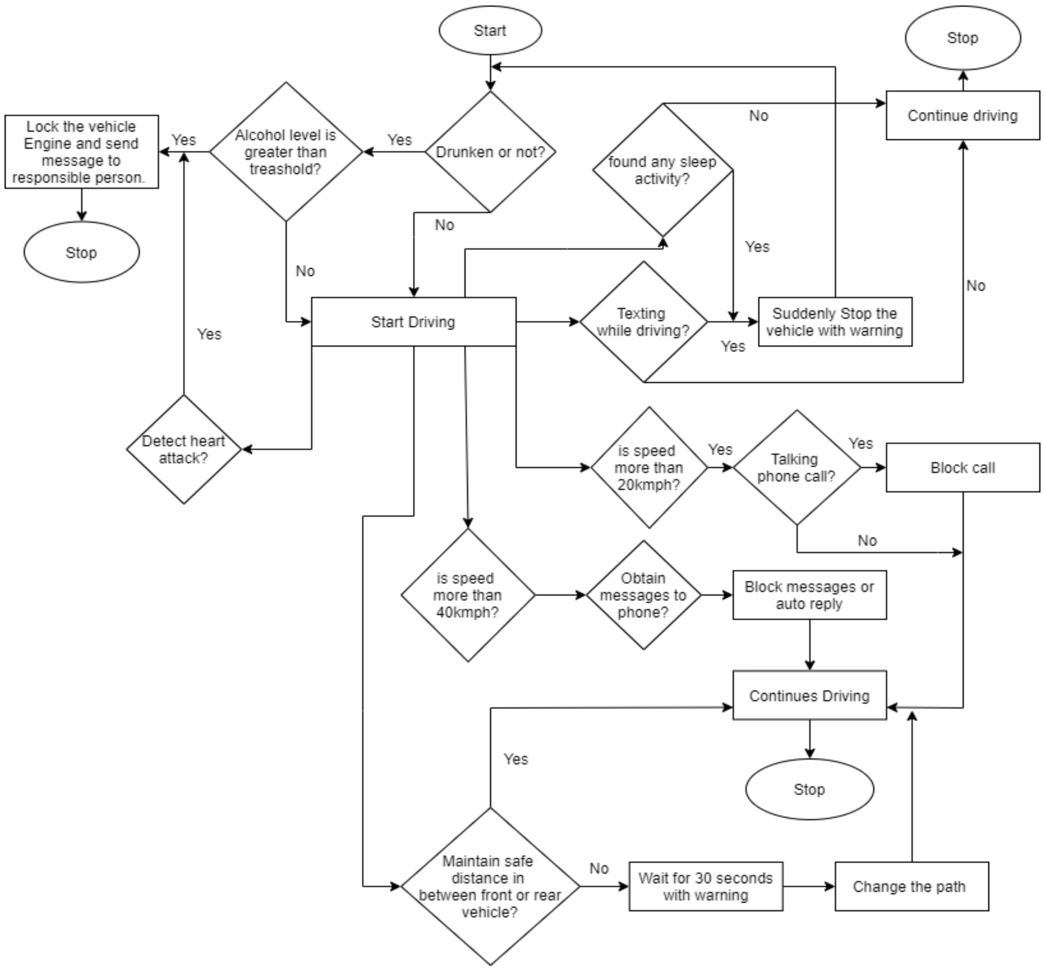


Figure 2: Flowchart of Accident avoidance layer

IV. RESULT AND DISCUSSION

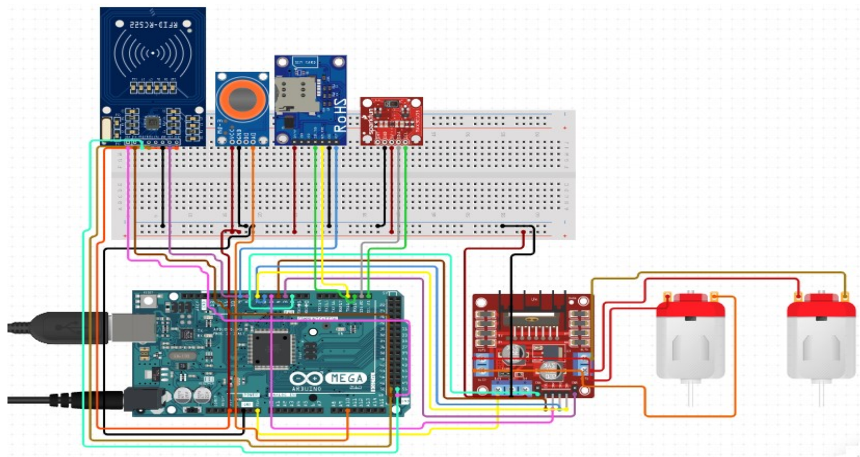
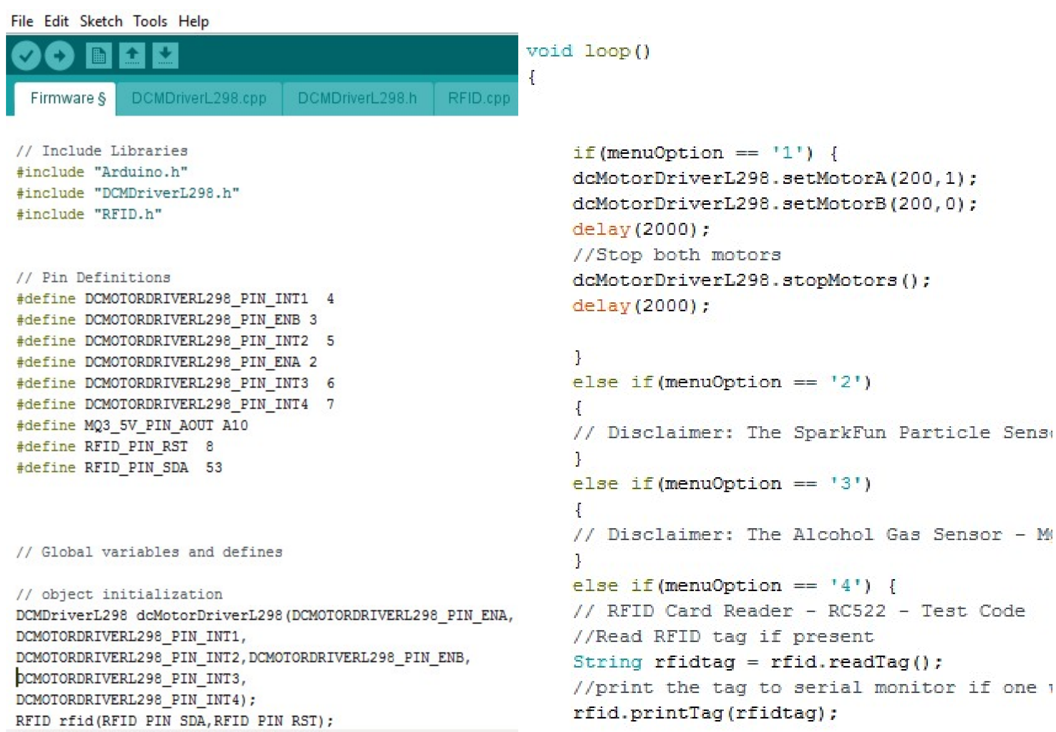


Figure 3: All sensor with microcontroller except the jammer

Figure 5 shows all the necessary sensor connected with a microcontroller in the form of simulation. From the figure, it evident that Arduino mega microcontroller acts as a hub among all sensors, as discussed earlier.



```
File  Edit  Sketch  Tools  Help
Firmware §   DCMDriverL298.cpp   DCMDriverL298.h   RFID.cpp

// Include Libraries
#include "Arduino.h"
#include "DCMDriverL298.h"
#include "RFID.h"


// Pin Definitions
#define DCMOTORDRIVERL298_PIN_INT1  4
#define DCMOTORDRIVERL298_PIN_ENB 3
#define DCMOTORDRIVERL298_PIN_INT2  5
#define DCMOTORDRIVERL298_PIN_ENA 2
#define DCMOTORDRIVERL298_PIN_INT3  6
#define DCMOTORDRIVERL298_PIN_INT4  7
#define MQ3_5V_PIN_AOUT A10
#define RFID_PIN_RST  8
#define RFID_PIN_SDA  53


// Global variables and defines

// object initialization
DCMDriverL298 dcMotorDriverL298(DCMOTORDRIVERL298_PIN_ENA,
DCMOTORDRIVERL298_PIN_INT1,
DCMOTORDRIVERL298_PIN_INT2,DCMOTORDRIVERL298_PIN_ENB,
DCMOTORDRIVERL298_PIN_INT3,
DCMOTORDRIVERL298_PIN_INT4);
RFID rfid(RFID_PIN_SDA,RFID_PIN_RST);
```

```
void loop()
{

    if(menuOption == '1') {
    dcMotorDriverL298.setMotorA(200,1);
    dcMotorDriverL298.setMotorB(200,0);
    delay(2000);
    //Stop both motors
    dcMotorDriverL298.stopMotors();
    delay(2000);

    }
    else if(menuOption == '2')
    {
    // Disclaimer: The SparkFun Particle Sens
    }
    else if(menuOption == '3')
    {
    // Disclaimer: The Alcohol Gas Sensor - M
    }
    else if(menuOption == '4') {
    // RFID Card Reader - RC522 - Test Code
    //Read RFID tag if present
    String rfidtag = rfid.readTag();
    //print the tag to serial monitor if one
    rfid.printTag(rfidtag);
```

Figure 6: Sample coding for the connection of figure 5

Figure 6 shows the sample coding written in Arduino IDE for the connection of sensors in figure 5.

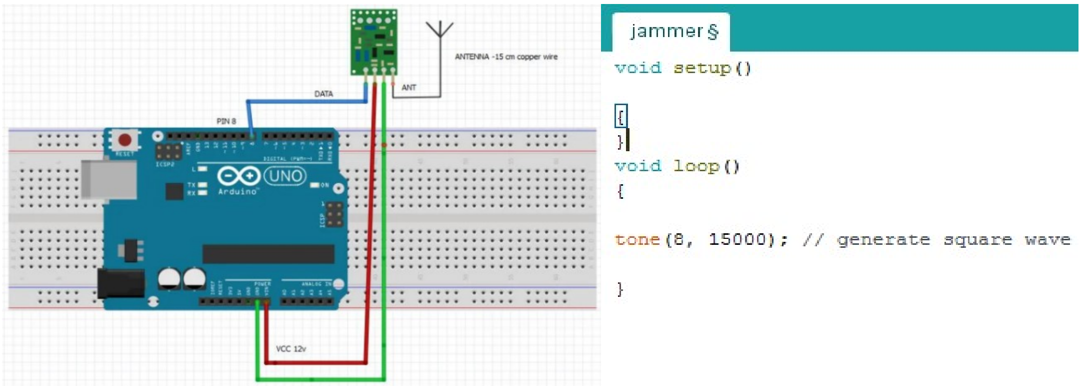


Figure 7: Jammer with microcontroller setup and necessary coding

Figure 7 shows the cellphone blockade jammer with the necessary coding to block the signal of the phone. Here we can set the noise frequency to the cellphone signal to block or cut the call. When the speed of more than 20km/h, we can fix the jammer to cut the call and continues driving without having any issues. tone() method used to provides or generate a square wave at a necessary frequency. Tone(8, 1500) in coding, 8 specifies the PIN of jammer connected in the Arduino port, and 15000 indicates the frequency. We can adjust the frequency as our wish, based on the speed.

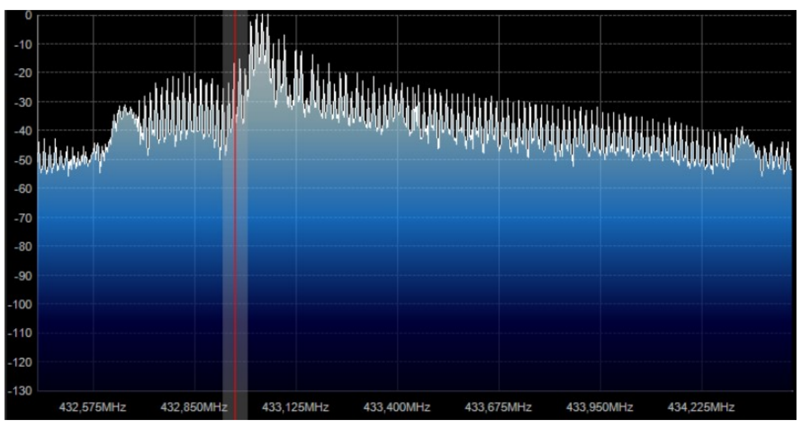


Figure 8: Spectrum of the jummer at given frequency

Figure 8 shows the spectrum of the jammer. When we set the noise at a specific point, it will block the call as display in the red vertical line in the figure. Based on the equation v=fλ (where v-velocity, f-frequency and, λ-wavelength), we can fix the frequency to cut or block the call.

System components and usage

Table 01.

Sensors and its applications

Sensor / Tools	**Usage**	**Image**
RFID reader	- Read the pulse coming from the RIFD tag placed in the wearable device [66], [67].	
RFID tag	- It measures the human pulse and passes to the RFID reader [68], [69].	
SparkFun (MAX30105)	- It is used to measure the heart rate, the distance between other vehicles, and eye blinking simultaneously. - In this study, it is used to avoid an unnecessary accident from the cardiac problem, collisions, and sleep [70]–[72].	
L298N Motor Driver with Dual Hobby DC motors	- It controls the speed and direction of motors embedded into it [73]–[77]. - When the safe distance of another vehicle less than the safe distance, we can change the path using this sensor with a dual motor, which is connected to the engine. - The speed parameter can control with this sensor; hence text while driving and call while driving even influence by this sensor's help.	
MQ-3	- Detect the alcohol intake level from the breath of the human [59], [78]. - Using this sensor, when the alcohol level more than the threshold value, it can lock the engine by the stop the motors (L298N) connected to the engine.	

Camera module sensor OV7670	- It is used to capture images [79], [80]. - In this study, we use this to identify whether the driver is texting while driving or not.	
Jammer 433 module	- It used to block the signal [81], [82] - In this study, this helps to block the call when the speed is more than 20km/h.	
QuadBand GPRS-GSM SIM800L	- It used to voice call, text message sending, and internet [83], [84] - In this study, it used to send auto-reply in case of getting a message more than 40km/h and also sending the emergency messages to a responsible person.	

CONCLUSION

A reliable, and robust accident prevention framework with all technical terms is proposed throughout this study. In fact, working with IoT is a better and easy solution in the current trend with the necessary solutions. Most previous studies have failed to incorporate the range of solutions that we suggested in this study. When we establish this structural model, the end-user can undoubtedly get substantial benefits instantly. Throughout this study, the most recent technologies, and trends we proposed. It sometimes deals with the higher initial cost. However, nothing is more important than human life. In contemporary, accidents are severe, and it needs a potent mitigation system. Most of the experts and authorities in various domains are looking for better ways to address this issue. In that respect, this system offers a revolutionary and instantaneous remedy.

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