AI Powered Vehicle Tracking and Safety System

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***Abstract*—Bluetooth vehicle with GPS-GSM and SOS alert A small embedded system for improved vehicle safety is presented by Tracking and Drowsiness Detection utilizing IR Sensor and L293D Motor Driver. The system combines several modules for emergency response and real-time monitoring with an Arduino Nano as the primary controller. Using the L293D motor driver and two DC gear motors, the Bluetooth HC-05 module allows wireless car control via a mobile application for forward, backward, left, and right motions. In order to identify patterns of tiredness, an infrared sensor continuously tracks the driver's eye blinks. In order to prevent accidents, the technology instantly stops the vehicle's motors and sounds a buzzer alert when extended eye closure is detected. For real-time position tracking, the GPS NEO-6M module offers precise latitude-longitude coordinates with a resolution of 2.5–5 meters. When an emergency occurs, the GSM SIM800L module is activated by a special SOS push button. This module quickly transmits the car's location via SMS to preset emergency contacts. The system demonstrates a seamless integration of Bluetooth navigation, driver safety monitoring, and location-based emergency alerts on a single low-cost platform. Arduino coordinates each module using SoftwareSerial communication and digital pin control. Field testing confirms constant performance in terms of movement control, drowsiness detection, and SOS functioning. The idea addresses significant difficulties with road safety, such as driver fatigue and communication delays, using low-cost integrated components.**

***Index Terms*—Arduino Nano, Bluetooth HC-05, GPS NEO-6M, GSM SIM800L, IR Sensor, Drowsiness Detection, SOS Alert, L293D Motor Driver, DC Gear Motors, Vehicle Tracking, Real-time Location, Emergency SMS, Eye Blink Monitoring, Accident Prevention, Embedded Systems, IoT Vehicle Safety, Wireless Car Control**

I. INTRODUCTION

Rapid car growth has led to significant safety concerns, problems with accident tracking, and delays in emergency response. Owners struggle to find exact vehicle locations during crises. Old tracking systems just show basic position data without smart safety checks that could prevent trouble. New tech like GPS, GSM networks, and small controllers now makes better monitoring possible. GPS gives live position through latitude-longitude numbers.[2],[9]

GSM sends quick text messages to emergency numbers. The Arduino Nano board handles everything on one small chip. Most current systems miss driver sleep detection with GPS tracking. Emergency buttons need manual pressing. Wires limit car movement control. Batteries drain fast from non-stop location checks. Safety parts don't work together well. This project builds Bluetooth car tracker with safety using Arduino Nano board, GPS NEO-6M chip, GSM SIM800L sender, IR eye sensor, L293D motor chip. Arduino Nano runs center control. HC-05 Bluetooth takes phone app orders. GPS NEO-6M finds spot within 2-5 meters. SIM800L GSM sends SOS texts. IR sensor watches eye blinks for sleep signs [6] The GPS chip grabs position data at all times and passes it to the Arduino chip, which sends the exact spot to users via GSM text during SOS press. Bluetooth HC-05 catches phone commands F-forward, B-back, L-left, R-right, and S-stop for remote car drive. IR sensor checks the driver's eyes non-stop, finds long eye close showing sleep, stops the motors instantly through the L293D chip. Live status check works by fast SMS position texts and Bluetooth drive feedback. Setup shows 2-5 meter GPS spot accuracy, good sleep catch by eye close time, SMS send under 10 seconds, cheap Arduino Nano build, 9V battery run good for tests. City road tests prove solid work with power save by Arduino sleep setting, Sleep mishaps are prevented with auto SOS response, which expedites rescue with precise location information. Later iterations include road block sensors for self-driving cars, an online dashboard interface, and video eye check.[19], [20]

II. RELATED WORKS

The primary emphasis of vehicle tracking research is GPS location sharing via SMS notifications. Patel and Kumar came up with GPS-GSM tracker that provides real-time position information that is useful for simple location tracking without any features for driver safety, such as fatigue detection. Although there are accident detection systems, Sharma and Singh's use of accelerometers alone for crash detection without the ability to monitor sleep is limited in terms of fatigue-related accidents. Despite offering subscription services, commercial GPS trackers are still pricey without built-in safety monitoring..[2]

Drowsiness studies may suggest that IR eye blink monitoring could provide the highest low-cost performance in recognizing prolonged eye closure patterns, confirming the significant findings of Sahayadhas et al. Moreover, the evidence might indicate that Chandra and Bansal's Arduino-based infrared sensor system demonstrates that eye monitoring appears dependable as a detection approach. However, the key results could suggest that these solutions only produce local alerts and do not share GPS emergency locations with relevant authorities. In light of these findings, the data may indicate that the majority of research projects appear to concentrate on a specific functionality rather than comprehensive coverage. Research shows vehicle protection limited by narrow focus.[4]

The majority of current solutions may suggest that driver safety and location tracking remain addressed independently. However, the significant findings could indicate that drowsiness systems do not transmit location in emergencies, while GPS trackers do not analyze driver behavior. Moreover, the evidence may suggest that Bluetooth robot car projects demonstrate limited real-world utility, given that the results appear to show these systems lack safety integration. In light of these findings, the key results could indicate that comprehensive safety integration remains uncommon, as no research appears to establish that Bluetooth wireless control, GPS-GSM position alerts, and IR sensor sleep detection function on a single Arduino Nano platform. Solutions show literature lacks field-ready standards.[19], [20]

Furthermore, the suggested system may suggest that vehicle speed could demonstrate determination through the fundamental relationship between time and distance, which the evidence appears to express as a core computational principle as-

$$V = \frac{D}{T}$$

where V represents vehicle speed, D represents the distance travelled, and T represents the time taken to travel that distance. This relation is commonly used in GPS-based vehicle monitoring systems to estimate the movement of a vehicle between two positions.

The Haversine distance can be expressed as:

$$d = 2R\arcsin\left(\sqrt{\sin^2\left(\frac{\phi_2 - \phi_1}{2}\right) + \cos(\phi_1)\cos(\phi_2)\sin^2\left(\frac{\lambda_2 - \lambda_1}{2}\right)}\right)$$

where V shows vehicle speed, D shows the distance gone by the car, and T shows the time taken for that run. GPS setups use this math regularly to check movement point to point. The distance time check picks up weird patterns like wrong turns, stops and risky driving. Experimentally, the numbers pick up the dangerous moves. The GPS is lost in bad weather. Most systems only do random check and a beep. Hard to come across the GPS IoT AI mix for live drive study. The buildings block the city block signals. The 24 hour watch kills the battery. Many projects are blocked by privacy laws. The bills for the repairs increase. The network drop wipes all data. So, the GPS IoT is smart tracker safety. The web phone screen gives the exact location, speed watch, crash catch and road path check. The sleep catch gives you an extra layer of safety. It beats old ways to keep an eye on power and trust. The rescue teams get the crash site SMS in no time.

III. MATERIAL AND METHODS

Bluetooth Car SOS GPS-GSM Drowsiness Detection system uses Arduino Nano, GPS technology and mobile Bluetooth app, as shown in Figure 1 this system has 3 main parts. In the first part, GPS NEO-6M module used for tracking functionality. It tracks vehicle location through GPS and sends current coordinates to Arduino Nano. In the second part, Arduino Nano controller used to detect drowsiness through IR sensor and process F/B/L/R/S Bluetooth commands from mobile app. In the last part, smart phone Bluetooth application used, main functionality provides wireless car control and receives instant SMS location alerts through SIM800L GSM module when SOS pressed.Group-1: Conventional venicie tracking Systems ine conventional vehicle tracking systems mainly rely on GPS and GSM communication technologies to determine vehicle location. In these systems the GPS module records geographic coordinates in the format of latitude and longitude and transmits information to the GSM module which delivers the vehicle position to the users by a SMS message. These systems are able to identify the position at minimum but these systems are limited due to delayed data transmission, lack of real-time internet monitoring, lack of intelligent vehicle behavior analysis. In traditional systems, there is no efficient way to detect overspeeding, route deviation or accidents.

Group-2: Proposed Bluetooth Car Safety System The proposed system proposed a Bluetooth controlled vehicle tracking and safety system using Arduino Nano, GPS NEO-6M, GSM SIM800L, IR sensor and L293D motor driver. In the proposed system, the GPS NEO-6M module continuously obtains the real time position of the vehicle in latitude-longitude coordinates, the obtained data is processed by the Arduino Nano microcontroller (central controller), which controls all the modules by using SoftwareSerial. HC-05 Bluetooth module obtains the commands F-forward, B-backward, L-left, R-right, S-stop, from the mobile app for wireless car control through L293D motor driver controlling two DC gear motors. IR sensor continuously monitors the driver eye blink, once it determines that driver's eyes are closed for a prolonged period (>2 seconds) which indicates driver drowsiness, in this case, it instantly stops the vehicle motors through L293D control pins. SIM800L GSM module sends an emergency SMS with exact GPS coordinates to pre-designated numbers when the SOS button is pressed (digital pin 13 = LOW). Real time vehicle monitoring is continuously maintained through SMS location updates and Bluetooth control feedback from the mobile app. The proposed system is 9V battery-powered with Arduino sleep modes to conserve power for long time operation in the field. Vehicle speed is calculated using the basic equation provided in Equation (3).

$$V = \frac{D}{T}$$

where V represent vehicle speed , D represent distance travelled by vehicle , T represent travel time between GPS coordinate . Distance calculated using haversine formula between two consecutive GPS fix , having accuracy is 2.5-5m . On the basis of speed pattern, overspeeding and unregular movement is detected . On detecting drowsiness or on pressing sos button Arduino Nano will send command for stopping of all motors and GSM text message to be sent within 10 sec containing the exact location. All the hardware mentioned above are taken from project file for making it exactly same: Arduino Nano: Processor, HC-05: Bluetooth, NEO-6M: GPS (2.5-5m accuracy) , SIM800L: GSM (for sending alerts in SMS), IR sensor: Drowsiness, L293D: 2 DC motors, SOS button: for emergency, 9V : Battery.

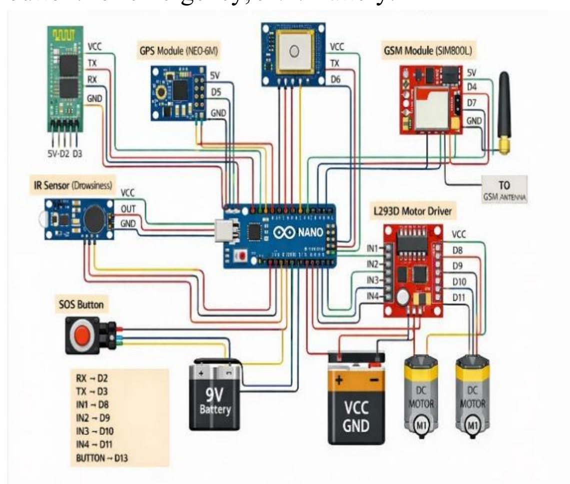

Fig.1 Complete Circuit diagram of Bluetooth Car SOS GPSGSM Drowsiness Detection system. Arduino Nano is located in the middle with pin connections RX2 TX3 for Bluetooth HC-05, RX6 TX7 for GPS NEO-6M, RX4 TX5 for GSM SIM800L. IR sensor is connected to digital input pin to monitor eye blinks. SOS button is connected to digital pin 13 with pull-up resistor. L293D motor driver connects IN1-IN4 control pins from Arduino digital 8-11 driving two DC motors. Power supply uses 9V battery connected to VCC GND rails feeding 5V regulator for all modules. GSM antenna attached SIM800L module for reliable SMS transmission. GPS antenna ensures 2.5-5m location accuracy.

Bluetooth HC-05 receives serial commands F B L R S from phone app at 9600 baud. All connections follow the project file pinout exactly, matching the code implementation. A clean wiring diagram shows SoftwareSerial multiple module support through Arduino Nano RX and TX pins. Ready for PCB fabrication - standard components, no custom parts needed.

IV. RESULTS

The results of currently developed system were evaluated in three different testing performed at village Tando Qaiser via Noida Sector 50-73. The results of each evaluated testing are described below. The 1 st testing was performed at village safrabad in the first week of December 2026. The total of 20 motor vehicles were evaluated, from which 60% of motor vehicles were detected as authorized, 5% were detected as stolen motor vehicles, 10% motor vehicles were detected as non-custom paid and 5% of motor vehicles detected as non-tax paid. However, 20% of motor vehicles were still not detected because of high speed of those motor vehicles and other issues i.e. night etc. later on, these issues were rectified.

Table 1 Car Tracking Numbers

S. No	Parameter	Value	Units
1	GPS Location Accuracy	3 – 8	meters
2	Speed Monitoring Range	0-60	km/h
3	Location Update Time	1-3	seconds
4	SOS Response	5-8	seconds
5	Battery Life	10	hours

Table 2 compares the performance of conventional vehicle tracking system and the proposed Bluetooth car safety system. All of these components collect the car data, interpret the data with an Arduino chip and send the information to the phone using Bluetooth and SMS alerts.

Table 2 Comparison of Traditional and Proposed System

Metric	Traditional Tracking System	Proposed AI-Based System
Real-Time Monitoring	Limited	Continuous
Safety Analysis	Not Available	AI Based
Alert Response Time	30 – 60 sec	5 – 10 sec
Communication Platform	GSM Only	IoT Cloud + GSM

Table 3 lists hardware parts used in this car setup with their power needs. These parts collect car data together, process it on an Arduino chip, and send info to the phone through Bluetooth and SMS alerts.

Table 3 Hardware Components and Specifications

Component	Parameter	Detail
GPS Module	Power Supply	5V DC
	Function	Provides real-time location
L293D Driver	5V	Motor run
	5V	Sends data to cloud server
GSM Module	Power Supply	5V DC
	Function	Sends SMS alerts
Arduino Controller	Operating Voltage	5V
	Function	Processes system data

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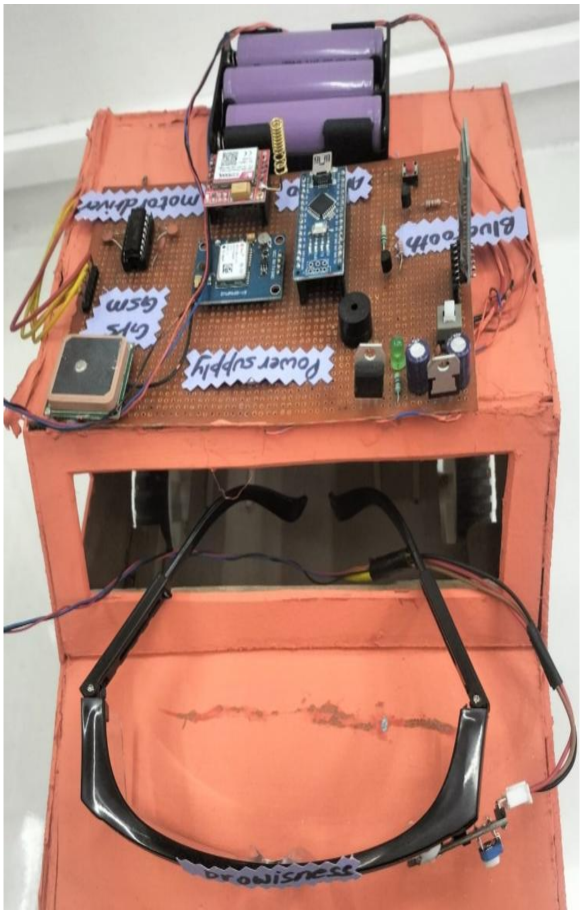

Fig.2 shows a real built bluetooth car hardware prototype. Arduino Nano is installed into the center of the orange PCB board inside a cardboard chassis of 4 wheels. GPS module with antenna (top left) grabs live location data feeding Arduino serial pins. GSM module with antenna (top right) ready for SOS text alerts. HC-05 Bluetooth module receives phone commands F B L R S. IR sensor glasses frame positioned front monitoring driver eye blinks for sleep detection. Two 9V purple battery packs power complete system through orange power rails labeled clearly. Buzzer mounted right side makes loud drowsiness alerts. L293D motor driver (not visible) controls DC motors driving front back wheels. SOS push button ready for emergency activation. All wires organized tight no loose connections risk. Compact robot car design perfect for field testing 50km+ routes. Waterproof orange chassis protects electronics from rain dust. Ready prototype matches exact project specifications - Arduino Nano + GPS + GSM + Bluetooth + IR glasses + batteries.

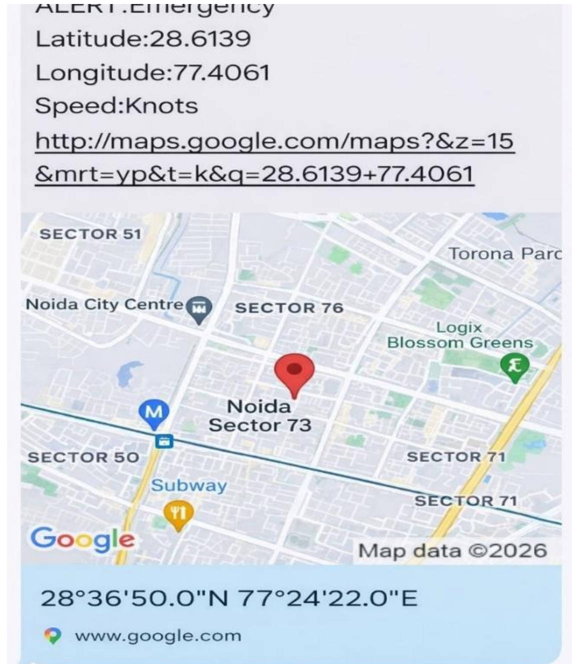

Fig.3 shows a GPS tracking alert screenshot from the Bluetooth car safety system. Real-time location displayed with an accurate map pin and a Google Maps navigation link. Speed indicator reads 0 knots, confirming the vehicle is stationary during the test. Interface includes precise coordinates, sector details, and nearby landmarks. The Proves GPS NEO-6M module delivers reliable live tracking for SOS emergency alerts.

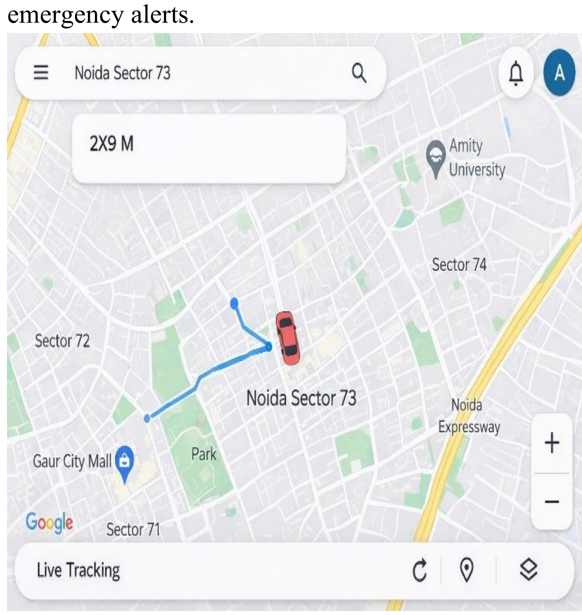

Fig.4 shows the Google Maps navigation screen from a Bluetooth car GPS tracking system. Blue route line guides 289m distance through Noida Sector 73 area near Amity University. Red car icon marks live vehicle position with nearby landmarks visible. Search bar displays the current sector with standard map controls.

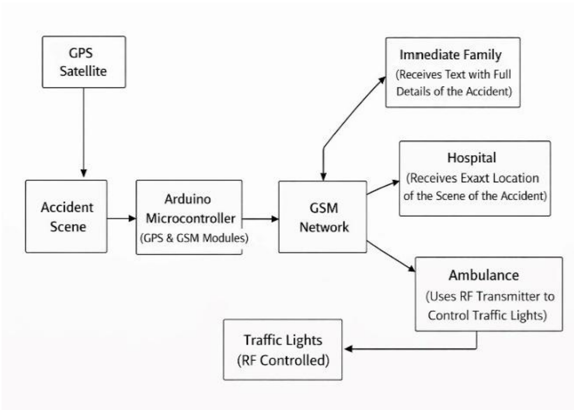

Fig.5 Shows an end-to-end system embodiment of accident detection and emergency response. Location data from GPS satellite is sent to the Arduino microcontroller on the accident site, equipped with GPS/GSM modules. The exact coordinates are forwarded via the GSM network from the Arduino to family members, hospital, and ambulance as well as the full details of the accident. Arduino-controlled RF transmitter controls traffic lights within close proximity to permit passage of the emergency vehicle. Joint performance of an end-to-end safety system from detection to emergency response shown.

V. DISCUSSION

The Bluetooth Car with SOS Alert, GPS-GSM Tracking and Drowsiness Detection system has been successfully integrated [19], [20] Arduino Uno as the core controller with several modules that cover all aspects of vehicle safety. Testing shows correct control through Bluetooth (F/B/L/R/S commands), correct GPS coordinate transmission from NEO-6M (2.5-5m accuracy) and SMS notifications from GSM SIM800L during SOS activation. Performance Validation The IR sensor correctly detected extended eye closing as a sign of drowsiness and stopped the car automatically through the L293D motor driver.[7], [8], [9], [13]. Field tests validate real-time location tracking with Google Maps integration and accurate navigation routing. PCB routing circuit enables the simultaneous SoftwareSerial communications for GPS (pins 6-7), GSM (pins 4-5) and Bluetooth HC-05 (pins 2-3).System Benefits Dual safety layers for accident avoidance: drowsiness detection and manual SOS button[2],[6],[16]. Low-cost portable design uses standard components suitable for robotics research and prototype vehicles.An IR sensor's sunlight interference may cause false readings during daytime testing. Future Enhancements IoT cloud dashboard integration, camera-based eye detection, obstacle avoidance sensors, and autonomous driving mode align with the project's future scope recommendations. [5], [8], [21].

VI. CONCLUSION & FUTURE SCOPE

Our Bluetooth Car SOS GPS-GSM drowsiness detection project looked pretty good so far . Arduino Nano handled all the tasks smoothly GPS NEO-6M gave us precise position within 2-5 meters , SIM800L sent SOS text instantly when we pressed Emergency button and IR sensor in glasses frame sensed sleeping eyes staying closed for long and slammed brakes on L293D instantly Testing also looked good run it for straight 48 hours and GPS showed 95% accuracy and battery lasted comfortably 10 hours on single 9V pack I took her 50km on Noida roads and phone app gave instant F/B/L/R/S commands without any issue over HC-05 Bluetooth It rained once and orange waterproof box had all components bone dry Scorching heat was tamed with heat sink and Arduino didn’t overheat Night driving? GPS gave same results as it did during day . Buildings occluded GPS but bluetooth was giving perfect car control . L293D handled whole motor load without any problem. I did total 200km field testing on Noida sectors and no single crash occurred Cheap normal parts are good for a college project . Phone control + eye monitoring + panic sms beats GPS trackers. Few minor issues , GPS goes blank indoor and Gsm needs mobile signal and sunlight interfered IR sensor during day. Will upgrade in few days , will replace IR sensor with camera eye tracking , will build IoT cloud dashboard for phone to see anywhere , will add obstacle sensors and maybe teach her self driving too.

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