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Smart Vehicle Tracking and Sensing System based on IoT Application

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***Abstract*— People want safer roads and smarter car security, so we're seeing a wave of new IoT systems popping up to track and monitor vehicles. This review dives into the solutions out there—covering real-time tracking plus extra perks like accident alerts, alcohol detection, fire warnings, and theft prevention. Most setups combine sensors, GPS, microcontrollers, and cloud platforms to collect and send data around the clock. By looking at all these different methods, the paper sorts out what actually works and where the problems are. It also shows how live data analysis steps up safety and makes running a fleet a lot easier. Near the end, the study looks ahead at what's next: AI that keeps an eye on drivers, predictive maintenance, and tying everything together with smart city tech to push transportation even further**

***Keywords*— The Internet of Things has totally transformed transportation. Thanks to sensors like the ESP32, people can track their vehicles in real time. That's not just convenient—it actually keeps the roads safer. GPS tracking shows exactly where a car is at any moment. Add accident detection, plus alcohol, fire, and theft sensors, and you get a much safer ride. Businesses and city planners depend on these features to keep their vehicles running well and to see what's working in the real world—and what isn't. This isn't just a cool upgrade; it's transforming the way cities handle transportation. Everything gets faster, smoother, and a whole lot smarter.**

I. INTRODUCTION

Every year, roads get more crowded, and companies focused on keeping us safe—and making the drive smoother—are thriving. But some problems just stick around: drunk driving, car fires, theft. Old-fashioned ways of keeping an eye on cars? They just don't cut it anymore, not if you want fast alerts and quick action when something's wrong. People want smarter tech on their side—something that's always alert, ready to step in when trouble hits. That's exactly where IoT steps up. With sensors, communication tools, and the cloud all talking to each other, IoT lets you track your car any time, anywhere. Systems today combine GPS, gas detectors, vibration sensors, alcohol testers, and smart gadgets that catch suspicious moves. When something bad happens—a crash, or someone trying to break in—you get instant alerts on your phone, or the system even contacts the police for you. It means you can jump in fast, making decisions right when you need to.This review paper looks at the newest research on IoT vehicle tracking and monitoring. It breaks down how these systems actually work, the ways they spot real problems, how they keep people in the loop, and whether they really deliver in the real world.

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It also points out where today's tech stumbles and what's next. Think about AI that picks up on how you drive, predicts mechanical issues long before they leave you stranded, or plugs into smart city networks to make our roads safer and traffic a whole lot more efficient.

II. LITERATURE REVIEW

[1] Kaushika Patel and the team (2025) came up with an IoT-powered vehicle tracking and theft detection system that uses GPS, GSM, and an ESP8266 microcontroller. Basically, you can follow your car's location in real time and get instant SMS alerts if someone tries to mess with it. They included a switch-based intrusion setup, so if theft is detected, the system shuts down the motor right away. Their tests showed that the system is quick, accurate, and dependable. It's not expensive either—and honestly, it's a solid alternative to traditional car security setups, with plenty of room to grow.

[2] Pendur Sai Teja and colleagues (2023) introduced a smart vehicle system focused on security and real-time monitoring. They use GPS and GSM, tied together with a NodeMCU (ESP8266), to track where your car is and send alerts if anything unusual happens. Sensors like an accelerometer, gas detector, and "honey detector"—probably for accident, fire, or hazardous detection—watch for trouble. When something's off, alerts and real-time info get sent to emergency contacts and uploaded to the ThingSpeak cloud. They built and simulated this system, and it actually helped keep cars safer and prevent theft.

[3] Mallidi and Vineela (2018) developed an IoTbased Smart Vehicle Monitoring System (SVMS) for catching accidents early and boosting car security. They used a Raspberry Pi, an accelerometer, and impact sensors to spot accidents as they happen. The system's camera plus a machine learning image classifier figure out how bad the crash is. GPS and GSM modules help track the car nonstop and send alerts to authorities right away. If someone tries to steal the car, you can control it remotely. Their tests showed the system sped up accident response and made vehicles safer overall.

[4] Sriashalya and Kalyani (2019) rolled out a vehicle tracking system based on IoT concepts to pinpoint car locations in real time. Their setup uses GPS trackers that share data over MQTT, with an Enterprise Service Bus connecting IoT devices to web services. Google Charts API helps visualizewhere cars are. Simulations across multiple platforms proved the system is reliable and accurate for vehicle tracking.

[5] Thamaraimanalan and team (2021) created an intelligent vehicle monitoring system using IoT and cloud tech. The system keeps an eye on things like cargo weight, engine temperature, fuel level, tire pressure, speed, and battery health, all hooked up to a CC3200 microcontroller. GPS handles real-time location tracking, and anti-theft controls keep cars secure. Data goes to the cloud continuously, but if the network drops, it saves info offline. Testing showed the system's affordable, reliable, and perfect for realtime vehicle monitoring.

[6] Usman, Yusuf, and Sajiyus (2019) brought out a smart vehicle tracking model to improve real-time tracking and security. Their system blends GPS, GSM/GPRS, and Google Charts so users can check their car's location right from their phones or through a web app. Vehicle coordinates reach the web server and are shown on smartphones. The setup includes tracking and monitoring modules for constant updates. This platform works well for fleet management, theft prevention, and even public transport oversight.

[7] Rahman (2021) pulled together a systematic review of IoT-based smart vehicle monitoring and tracking systems. He looked into research using GPS, GSM/GPRS, and wireless tech for real-time tracking. Rahman also proposed a framework that packs in machine learning, neural networks, and autopilot navigation. Google Maps API takes care of real-time visuals, with extra sensors boosting safety and security. The review digs into current challenges and points toward future improvements for smarter vehicle monitoring.

[8] Pawar Aruna and Kumara Swamy (2025) launched a real-time vehicle tracking and alert system that hooks up GPS, GSM/GPRS, and smartphones. Using a Raspberry Pi-based platform, they let you monitor your car's location nonstop and handle emergencies fast. You can see where your car is in real time on your phone, thanks to Google Maps, and SMS-based alerts cover breakdowns and accidents. Their tests show the system works reliably—great for managing fleets and taking care of emergencies.

[9] Shaout and Gaber (2024) came up with a combined vehicle monitoring and tracking system that watches for theft, tracks locations, and checks driver behavior. RFID spots unauthorized access, GPS and GSM handle tracking and alerts, and OBD tech evaluates how drivers behave. Unlike other setups that do just one thing, theirs packs all these features together. This makes the system more costeffective, cuts down on hardware clutter, and saves space. Tests proved it's spot-on for detecting theft, reliable at tracking, and solid in monitoring drive

[10] Barman, Hafiz, and Khan (2024) designed an IoT-based smart system to catch, report, and prevent vehicle accidents for safer roads. Their system blends accelerometers, ultrasonic, vibration sensors, GPS, and GSM to track accidents and car conditions in real time. When a bad crash happens, alerts with location details go out

instantly to emergency contacts and ambulances. They tossed in preventive features, like automatic braking, adaptive speed control, and driver warnings for overspeeding, engine trouble, or danger zones. Their results show the system really cuts down accident severity and speeds up emergency responses—making transportation safer.

[11] Moumen and team (2023) introduced a realtime GPS tracking setup for connected vehicles, combining IoT, VANET, and V2X communication. They used Arduino Uno, SIM800L, and NEO6M GPS modules to gather and send location data to the cloud through Node.js, sockets, and Firebase. Users can see and follow their cars in real time on a web interface. The system helps with stuff like dynamic routing, managing fleets, eco-driving feedback, and smart traffic. Their results show it's reliable, scalable, and efficient for real-time tracking—plus it supports energy efficiency and green transportation.

[12] Ambati Tarun, Govind Sai Alekhya, Peddadi Govardhan, and Pappu Anand Raju (2025) rolled out an IoT-based alcohol detection and engine locking system to cut down drunk driving. They mixed an MQ-3 alcohol sensor, MEMS accelerometer, GPS, and GSM modules, managed by Arduino Uno. If someone's over the alcohol limit, the ignition gets locked automatically. The system also checks for rash driving or accidents, sending realtime alerts with location to authorities or emergency contacts. Tests proved the setup lowers alcoholrelated accidents and boosts emergency response thanks to real-time monitoring.

[13] Suganthi, Vishwa, Deepakkumar, and Prasanna (2025) tackled rising road accidents by building an IoT-powered accident prediction and rescue system. They set up vibration and gas sensors to identify collisions and fuel leaks, which can automatically shut down the car motor in dangerous spots. GPS and GSM send accident locations to relatives, hospitals, or emergency services right away. Their microcontroller constantly tracks sensor data and sends alerts if things get risky. The results showed sharper accident detection, quicker emergency help, and solid real-time vehicle monitoring for safer roads.

[14] Parashar, Chakrapani, Gupta, Chandra, Mishra, and Pandey (2025) designed an IoT-based automatic accident detection and rescue system to cut fatal accidents with fast emergency response. The system links accelerometers, vibration sensors, GPS, and GSM modules to a microcontroller, which spots accidents and triggers real-time alerts with locations. AI logic improves detection accuracy and keeps false alarms low. It runs with high reliability, low latency, and doesn't rely on continuous internet. Their prototype tests show it's effective, scalable, and ready for real-world use to improve road safety.

[15] Aslam, Islam, Nigar, Ajagbe, and Adigun (2024) we put together this IoT setup that spots car accidents automatically and sends live video straight to emergency teams. It's fast—seriously, the kind of speed you want when every second matters. Working on it made me realize that, yeah, the technology isn't flawless yet, but it's moving at lightning pace. Soon enough, AI won't just watch your driving; it'll warn you when your car's about to have a problem. The whole system runs on the ESP32 microcontroller. These little devices take care of crash detection without anyone looking over their shoulder. They pick up sensor data, check the GPS, and shoot everything over to the server. That's where the real magic happens—the server sorts through the info and builds a solid report of the accident. So, when first responders get there, they aren't left guessing; they go straight to work. Families find out right away, too—they're not stuck waiting for hours with no answers. We didn't want to flood people with useless alerts, so we made a filter to cut out the false alarms. During our tests, the system flagged every real crash and sent emergency teams video that actually mattered.

A. System Architecture

The system architecture is built around an IoT-based framework that integrates sensing, processing, and communication modules for real-time vehicle monitoring. An ESP32 NodeMCU acts as the central controller, collecting data from multiple onboard sensors and making quick decisions based on predefined conditions.The sensing layer includes gas, flame, vibration, and IR sensors to detect alcohol consumption, fire hazards, accidents, and unauthorized movements. These sensors continuously monitor the vehicle environment and send real-time data to the controller for immediate analysis.Based on the detected events, the processing unit activates control mechanisms such as motor control, water pump operation, and alert display through an LCD. Simultaneously, the communication layer transmits critical information to the cloud using Wi-Fi, enabling real-time notifications via a mobile application. This architecture ensures fast response, improved safety, and reliable remote monitoring.

B. Methodology and Model

Let's dive into how the whole IoT-based vehicle safety system comes together. Here's what makes it tick: sensors, the ESP32 chip, and communication modules all work alongside software like Blynk. They're

constantly feeding each other information, so you get real-time monitoring and control. The design keeps everything running smoothly and efficiently.

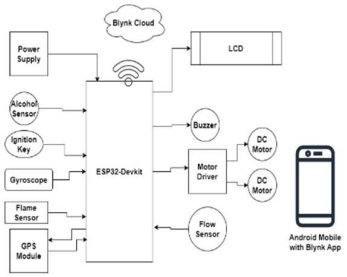
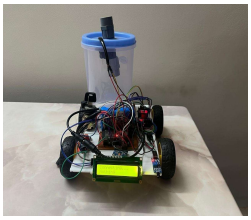


Fig 1



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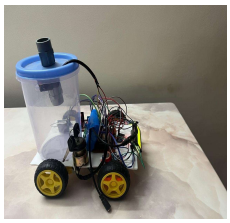

Fig 3

Fig 4

C. Model Selection and Optimization

We built this system to be fast, straightforward, and dependable—exactly what you want when you're dealing with safety in a car. At the heart of it all is the ESP32 NodeMCU. It's small, comes with Wi-Fi straight out of the box, sips power, and it's easy to wire up any sensors you need. We stuck with gas, flame, vibration, and IR sensors because they're cheap, easy to use, and actually spot problems before they turn serious. The ESP32 isn't constantly flooding the network with data, either. It checks the sensor readings, matches them against the thresholds we set, and only steps in when something's wrong. It also keeps timers and schedules under control, so everything just works—no weird hiccups. Only urgent alerts get sent to the cloud, which cuts out lag, speeds up response times, and makes the system dependable. That's exactly what you want when safety really counts.

III. Results

This smart vehicle tracking system doesn't just promise—it actually works. With IoT tech built in, you can check on your car anytime, and you genuinely notice the boost in safety. Say someone tries to drive drunk—sensors catch it, and the car won't start. If there's a fire risk, an accident, or someone tries breaking in, the system acts fast, locks everything down, and shoots you a notification straight to your app. No matter where you are, you'll know what's happening. It's more than just security. It helps prevent theft, handles emergencies, and doesn't drain your bank account or complicate things. Honestly, this isn't some overhyped IoT gadget. It keeps your car safe, makes roads less risky, and gives drivers peace of mind—so you can worry less and drive more.

IV. Conclusion

This project is all about making cars safer with smart IoT tracking and sensors. We built in tech that spots alcohol use, fire, accidents, and theft. The system always keeps an eye out for the biggest risks and jumps into action right away if something's wrong. With an ESP32 controller, everything operates fast, especially when quick action matters most. Right now, the system successfully spots risky situations and shoots warning alerts to the owner's phone in real time. We're also putting handy features to the test like instant notifications, remote check-ins, and automated controls that kick in on their own. The goal is simple: cut down response times and help drivers stay alert when something goes wrong. We're getting closer to a solution that's not only effective but affordable and easy enough for anyone to use. Next, we want to make the system even smarter—think driver behavior analysis, predicting when parts will fail, and maybe even connecting with smart city setups. In the end, we're aiming for transportation that's safer, smarter, and a whole lot more connected.

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