Cloud based Framework for Vehicle Overspeed Detection

JULY 3, **2022**

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Need for the Device

According to the report ‘Saving millions of lives’, every year approximately 1.3 million persons worldwide lose their lives in traffic accidents each year, and another 20 to 50 million get injuries. Road accidents are the greatest cause of death for people between the ages of 15 and 29. There is a lot of traffic in densely populated nations like India, making it challenging to monitor the speed of every car on the road. Alcohol-impaired drivers are not always to blame for accidents caused by excessive speeding because even sober drivers can behave recklessly behind the wheel. Both the driver and the general public are at danger when someone is driving too fast.

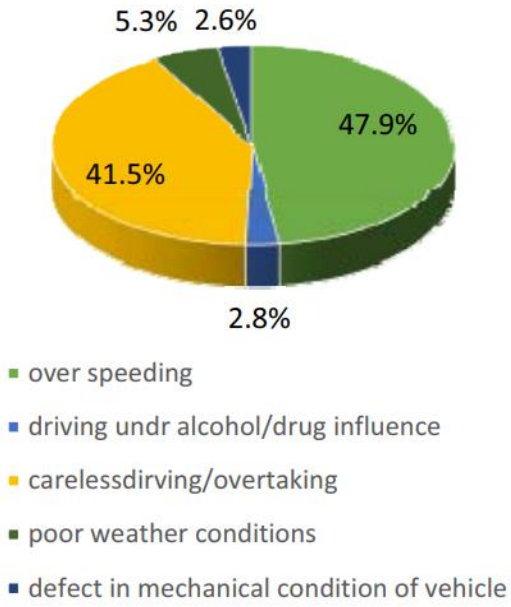


Figure: Statistics of Road Accidents in India during the last decade

As can be seen from this figure, one of the primary causes of the rise in accidents today is excessive speed. Traffic accidents have been linked in large part to excessive speeding. High speed collisions cause crashes, serious injuries, and fatalities. According to WHO statistics, speed is thought to be the primary contributing factor in about half of all traffic

accidents in some low- and middle-income nations, while it accounts for roughly 30% of traffic fatalities in high-income countries.

Speed results in traffic accidents in many different ways. Some of them are as follows:

1. The amount of time a driver has to stop and avoid a collision decreases with increasing vehicle speed. Typically, stopping an automobile travelling at 50 km/h takes 13 metres, whereas stopping a car travelling at 40 km/h takes less than 8.5 metres.
2. The probability of a crash involving injuries normally increases by 3 percent for every 1 km/h increase in average speed, and it typically increases by 4-5 percent for crashes involving deaths.
3. The severity of the impact when a collision does occur is also influenced by speed. The chance of mortality for car occupants in an accident with an impact speed of 80 km/h is 20 times higher than it would be with an impact speed of 30 km/h.

There are numerous methods used to monitor overspeeding. However, a lot of labour is needed to use these procedures. In this article, we outline the system's design and operation, giving traffic authorities a quick and easy way to keep an eye on every car right from the control centre. This technology continuously calculates the speed and GPS coordinates, which are used to determine the area in which the vehicle has been and the maximum speed permitted there. A memory card is continuously used to store the calculated vehicle coordinates and speed. A buzzer that indicates speed violation alerts the driver if any vehicle is travelling faster than the posted limit. If the driver continues to exceed the speed limit, a text message is sent to traffic authorities with the vehicle's registration number and the GPS coordinates of the location where the driver went above the limit. As a result, the same car may receive an overspeeding ticket.

Hardware Used

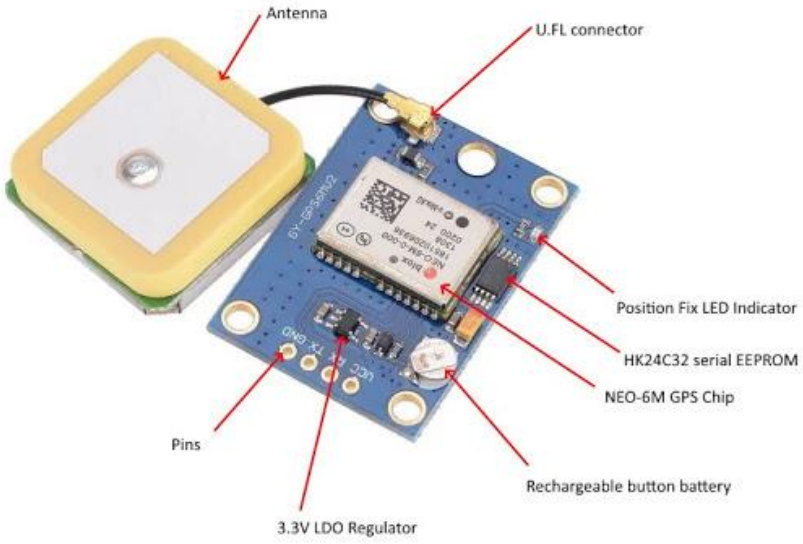


Figure: GPS Neo-6M Module

The module's brain is a GPS chip made by U-blox called the NEO-6M. The chip is less than the size of a postage stamp, but it contains a surprising number of features.It has a maximum tracking sensitivity of -161 dB and can monitor up to 22 satellites across 50 channels while using only 45 mA of current.

It can update its location five times in a second with a 2.5m horizontal position precision, which is faster than conventional GPS units. Additionally, the Time-To-First-Fix (TTFF) of the U-blox 6 positioning engine is less than one second.

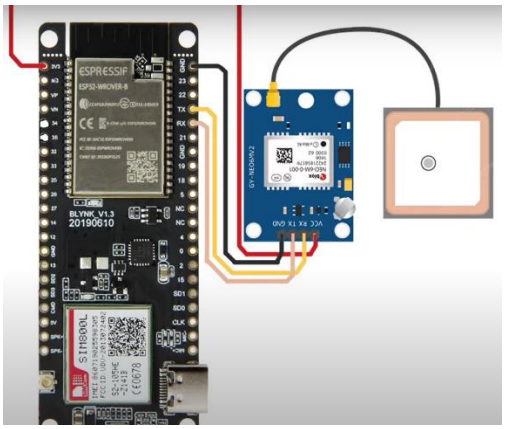
Power Save Mode is one of the chip's best features (PSM). This enables a decrease in system power usage by selectively turning on and off specific receiver components. As a result, the module uses only 11mA, making it suitable for power-sensitive applications.

Connecting GPS Module to Arduino Uno

Figure: Ttgo Sim 800L esp32 Module

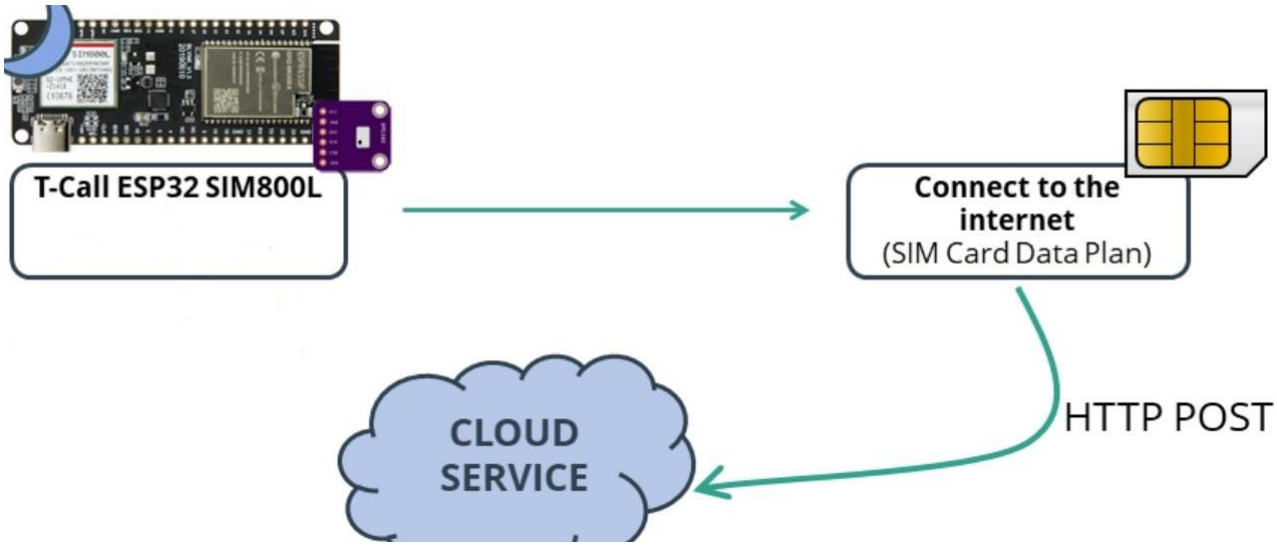
The TTGO T-Call is an ESP32 development board that combines a SIM800L GSM/GPRS module.The board includes SIMCom SIM800L GPRS module with ESP32 WiFi & Bluetooth WiSoC, and it relies on a USB-C connection for power and programming.It can also be a standalone board with a 500mA-capable built-in battery charger. Besides Wi-Fi and Bluetooth, one can communicate with this ESP32 board using SMS or phone calls and one can connect it to the internet using a SIM card data plan.

Setup



The TTGO esp32 SIM800l board will be connected to the gps module and the power source (through a type c cable). The TTGO board will be connected to the internet via a 2G sim.

Working



The SIM800L module will send the location and speed of the vehicle to the cloud. On the cloud side we will compare the speed sent by the module and speed limit of the road that the vehicle is traveling on. If the vehicle exceeds the speed limit the vehicle owner will be fined.

Moreover, depending on the location of the vehicle and the time we will also apply a congestion charge if necessary.

Limitations

The accuracy of the GPS sensor may cause issues in places such as junctions where two roads with different speed limits meet which can lead to false positives. To correct this we will be implementing a system that takes the margin of error into account. The data availability of roads and their specific speed limits is also not known which would be essential for the project. Another concern about the applicability of the project is the security issues that can arise via the drivers tampering with the hardware or software of the unit.

Future Use Cases

The on board unit can also be used for other traffic violations and vehicle safety measures such as an drunk driving detection system using OpenCV and cameras recording facial expressions and eyes. Another potential use for the device would be as a part of a system to reduce vehicle congestion on roads. This would be accomplished via real-time alerts to the driver taking into account their current position as well as the potential routes they may take and the traffic situation.

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