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SIT225: Data Capture Technologies

Pass Task: Use case design

Vehicle Alarm Device

With crime on the rise and so many vehicles around us in an already busy and loud environment, it isn't common for car alarms to go ignored or thieves to check parked vehicles for unlocked doors. In fact, I have encountered such events where my housemate had his laptop stolen from his car, and another resident at my student accommodation woke up to find his car having been completely searched through and left with all its doors open. In this paper, I will explore and discuss devices used to combat this issue before devising my own.

Firstly, I came to find a vast range of these pre-existing products in my research. The most prominent solution I encountered were simple GPS trackers, which are the cheapest solution with possibly complex installations which either required hard wiring to the vehicle or a wireless module which required maintenance of its battery. Although since these only provided a GPS signal, they were unable to detect activity around or inside a vehicle or create alerts. This also meant in the event of a missing vehicle, it depended on the user being previously aware of the situation in order to check the GPS status. On the other hand, the most expensive solutions were very integrated, being a small module which harnessed the diagnostic port of a vehicle to be powered. These types of devices also offered a plethora of features, such as backup batteries, detection of vehicle movement, and the ability to set boundaries on location, but this further increases the price as the device is locked into their subscription service. Reviewing what I have uncovered in this research, I hope my own device is able to provide a balance between these two types of devices, being cheap and capable of alerting a user to movement.

Another point of research I undertook, was similar DIY devices aiming to accomplish a similar task. The first related device I found was a vehicle black box system, which utilised "gas sensors, humidity sensors, vibration sensors, fingerprint sensors, temperature sensors, and IR sensors" (Josephinshermila et al., 2023). Although this is not exactly the same type of device, this complex prototype uses some relevant sensors with the cloud. As seen in Figure 1 (Josephinshermila et al., 2023), the prototype uses a vibration sensor and camera module to identify theft situations, and a Wi-Fi module to sync with cloud, SD card adaptor to

save a physical copy, and a global system for mobile (GSM) module to send a SMS message to a user's phone.

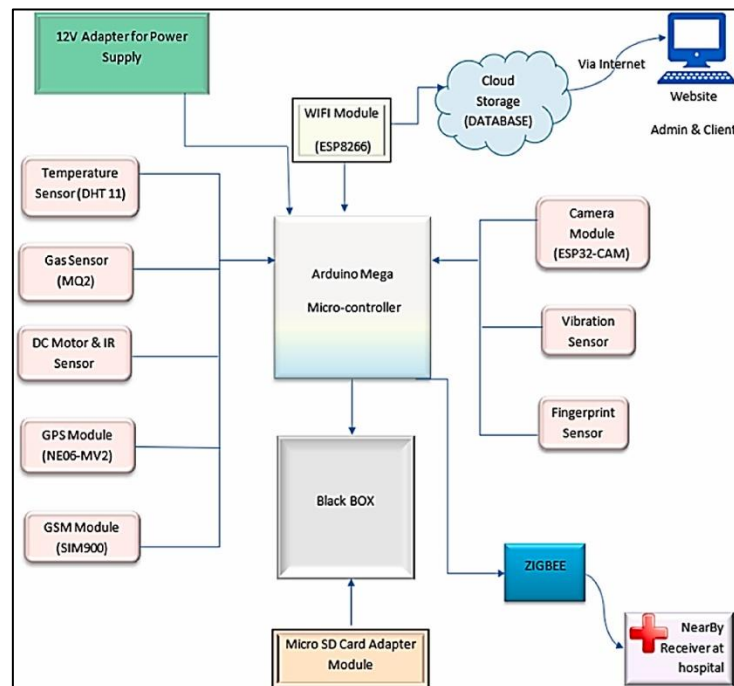


Figure 1: Josephinshermila et al.'s Block diagram of the proposed method

A more relevant example I came across was a DIY vehicle alarm which used a magnetic sensor to detect the opening of doors and an infrared beam sensor to detect the presence of people, but it also used GSM to send SMS messages similar to the previous example. Studying the layout of this prototype as seen in Figure 2 (Abraham et al., 2023), I am more in favour of the simplicity of this over the black box type. In my own device, I would like to take this further by using the bare essentials to make my prototype simple yet effective.

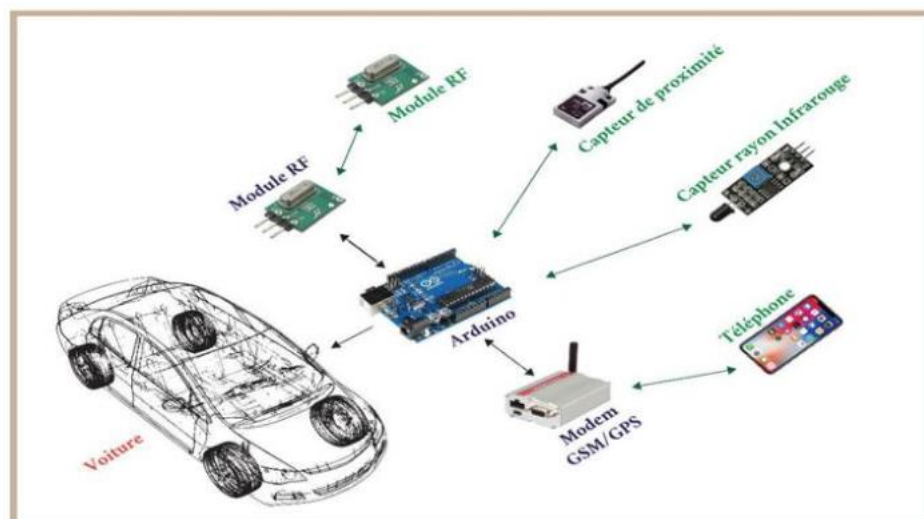


Figure 2: Abraham et al.'s System architecture diagram

Finally compiling my research, I plan for the construction of my own personal vehicle alarm system to be simple and cheap. In order to accomplish this, I will utilise an Arduino Nano 33 IoT as this will enable me to capture GPS data and sync with Arduino Cloud through WiFi without the use of any additional WiFi or GSM modules, whilst providing a user interface through a phone to control and receive alerts. As a trigger, I will use a HC-SR501 infrared motion sensor so entry into the vehicle and close proximity activity can be identified. Constructing my device, I came to find the Arduino Cloud Triggers feature to be exclusive to the Maker level of subscription plans. This could be remedied in the future by using a GSM module to handle notifications independently through SMS, which would have been required later for active WiFi anyway but was beyond my current scope and plan for this prototype. Although using a dashboard, I was able to link variables to show and reset the status of the alarm trigger remotely.

In conclusion, my vehicle alarm proves to be simple and functional. Whilst the features are quite limited with my prototype, the addition of a GSM module will allow SMS notifications and active WiFi connection through a sim card. Despite my efforts, the costs associated with my device, both parts and sim card services, would most likely place it relatively close to the price range of the competing devices I mentioned in my research, although it has the benefit of providing freedom with the choice of mobile service instead of being exclusive to a specific ecosystem.

References

- Abraham, S.G., Makengo, R.M. and Jordan, F.S. (2023) *GSM based intelligent home security system for intrusion detection.*, *International Journal of Information System and Computer Science* (Vol 7, No 1). Available at: <https://dx.doi.org/10.56327/ijiscs.v7i1.1436> (Accessed: 05 September 2024).
- Josephinshermila, P. *et al.* (2023) *Accident detection using automotive smart black-box based monitoring system*, *Measurement: Sensors* (Volume 27). Available at: <https://doi.org/10.1016/j.measen.2023.100721> (Accessed: 05 September 2024).