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ALERT SYSTEM WITH GPS LOCATION IDENTIFICATION FOR VEHICLES COLLISION

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Abstract.

When vehicle collisions happen on the road, it is crucial to send immediate alerts to the medical authorities with precise location descriptions. It is beneficial to have a notification system subjected to the medical authorities that can provide important information to reduce life-saving time. A system is developed to detect the accident's location and broadcast the data to the medical authorities. The system applied an accelerometer sensor and GSM with their location collected from the GPS. The central controller is an AT89S52 microcontroller, the accelerometer sensor is ADC0804, the GSM is Sim 300, and the output is given in a short messaging system (SMS). The system managed to send the notification to the medical authorities within 1 minute, and the message included with vehicle location in the form of Google Maps latitude and longitude information.

Introduction

Accidents can happen randomly to any people on the highway. The first thing to do when involved in an accident is to notify the authority of the location of the accident. A real- time system that can locate the incident can save time and lives. This project aims to build a system that detects a vehicle involved in an accident. The system will also contact the emergency personnel when a vehicle is involved in an accident on the highway by giving the Global Position System (GPS) coordination so that it can be easily located by the emergency personnel.

There were a lot of studies on the number of traffic fatality causes and trends in Malaysia. One of the studies was conducted by Akmal in 2016 [1]. The number of traffic accidents increases yearly, and vehicle accidents are the frequent causes of death; the World Health Organization (WHO) that the mortality rate in Malaysia in 2013 was one of the highest in the world. Usually, the number of cases happens between peak hours. There were also studies on the impact of roadway conditions on accident severity on federal rods in Malaysia [2]. The studies were done in 2020. Even though the Malaysian government invested a great deal of money into building the country's infrastructure, traffic monitoring and road safety has fallen behind. As a result, mobility grew in the modern culture, which had a detrimental effecton road safety. There are many reasons why people get into car accidents, the primary ones being a human error, the environment, and automobiles. Additional variables affecting accidents' frequency and severity include age, gender, and physical forms such as response speed, risk-taking, decision-making, and seat belt use.

Then the response time for an ambulance arrives has a crucial look. The study was only done in Sabah, Malaysia, and it is generally similar to every situation of the response time study. Outside a hospital, urgent care and ambulances to transfer patients to complete medical treatment are emergency medical services (EMS). EMS travel times must be kept to a minimum if death and injury rates are to be kept low. Poor Ambulance delivery services significantly impact public reactions to non-confidential behaviours, such as "waving at the ambulance."

This is when an urgent call is received when the ambulance reaches the incident location. The artwork comprises the time required to complete call processing, the time it takes to prep an ambulance team, and the time it takes to drive to the site of an incident—the services of the emergency and the quality of its life being dependent on emergency response times. For cities to become more successful in their EMS performance, it is critical to comprehensively analyse variables that impact ART so that solutions may be identified [3].

There were many developments previously, and different researchers have different outcomes for theirs. One of which title for an automatic accident alert system that migrates GPS and GSM to work together. That allows the vehicle to be tracked when an accident has occurred. The component it is rocking is a different microcontroller that is ADC-0804, which is old and outdated but worked fine during that development. The GSM module is an older sim 300 version. It will update them with the location of the accident it occurs and sends the data thru the 2g network [4].

Another researcher uses an ARM-based chipset to run their accident alert system. But this research project gives not only an accident alert but also a tracking system. It uses an accelerometer to detect an accident. The data, as usual, is collected before sending out to the authorities [5]. Anyhow, the research done by Rakesh is similar to the other study, which is a vehicle tracking and accident alert system. The security monitors the vehicle for any suspicious

activity for better protection to avoid getting stolen. Also, to alert when it involves an accident [6]. A reporting system for a vehicle accident at higher speeds is another research done in 2014. The system will detect the speed and location of the vehicle. That data is used to alert of any accident crash that happens to the car. The data will be delivered again thru a GSM module network system to inform the authorities of the situation of the vehicle state [7].

Materials And Methods

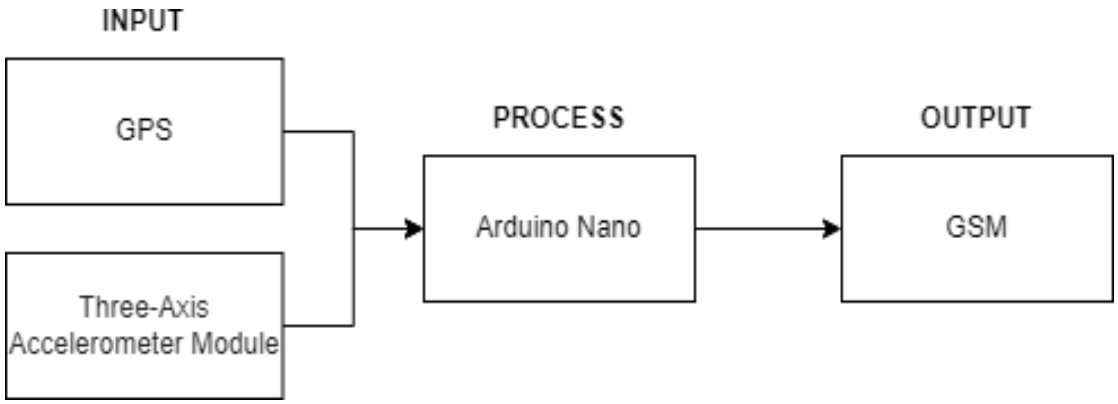

Figure 1: Block Diagram

The project's block diagram is shown in Figure 1. The project is divided into three parts. The input for the crash is first, and it uses a Three-Axis Accelerometer Module to do so. Before the data is sent with a GSM module, a GPS is used to determine the location and is processed in the Arduino Nano Microcontroller.

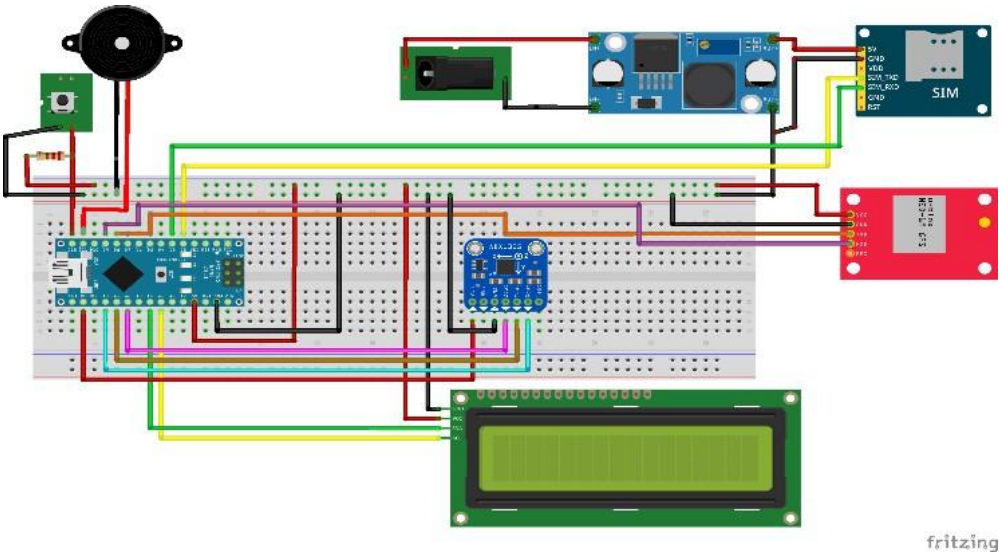

Figure 2: Circuit Diagram

The circuit designed for the project is shown in Figure 2, and the flowchart of the project is depicted in Figure 3. This project has a total of ten components, including the resistor. But the essential components are the Accelerometer, GPS, GSM, and Arduino Nano microcontroller. The button is turned ON when the power of the 5V switch on the Arduino is, then the 12V DC adapter is stepped down to 4.4V with a buck converter switched ON for the GSM module. The accelerometer and other components switch ON and make a reading of changes.

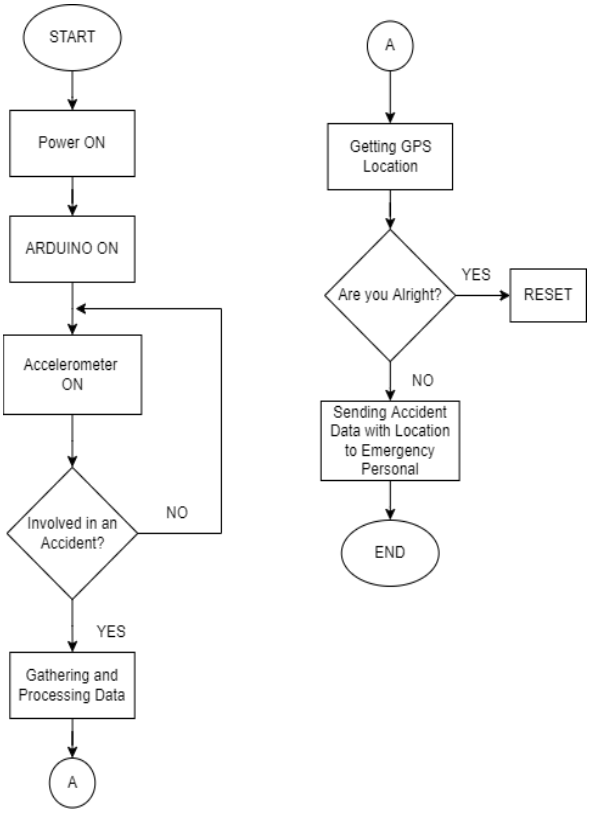

Figure 3: Flowchart

The accelerometer will detect any vibration upon the vehicle's surface, and the following process will proceed if it does. But if it does, it will continue to read repeatedly until an unexpected number is not constant. When the sensor detects a vibration, the buzzer will ring loudly, and an LCD will appear, saying an impact has been seen. Then later, it will proceed to the other process of gathering the location of the accident. But just as a precaution, a button is added to cancel the SMS sent to the medical authorities. What if the accident is minor, unnecessary, or even an error within the environment. The user can cancel the call within 20 seconds of the buzzer being alert. While 20 seconds seems quite long, it is enough to make a demonstration, and the original number was 30 or 45 seconds. The driver needs to press one button to cancel the message, which will reset the system. This is a precaution if the situation does not require medical authorities to cause a minor accident or environmental error.

Suppose the driver does not press the button and let the following procedure proceed. The message will be sent to the medical authorities in less than a minute with the driver's GPS location and vehicle details. The GPS will give out the latitude and longitude with a special Google Maps link to be operated on. The message data will show the vehicle's colour and model with the driver’s name and number. The buzzer and button are pretty crucial for this project. First, the buzzer will alert when the system has made the move that it detects the crash, and secondly, it informs the driver if they are conscious after the crash. Also, to tell of the process that the medical authorities are being called to the accident. The button is used to cancel the procedure just in case the following situation is minor and unnecessary for them to get there.

Results

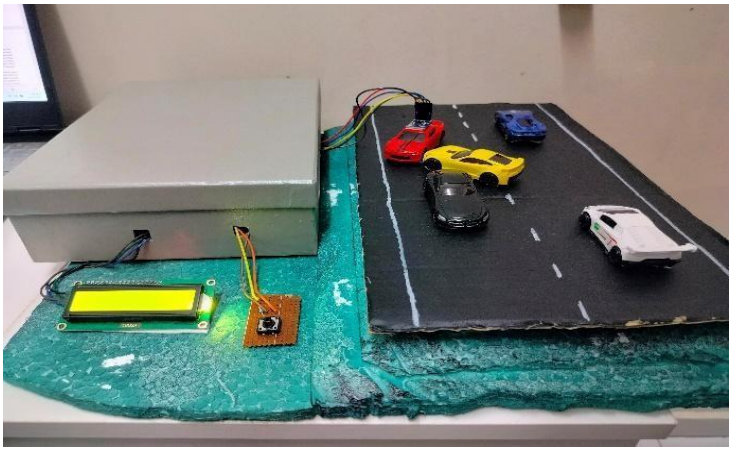

Figure 4: Final Project

Figure 4 shows the complete design of the project, with the road and cars being the main scenario of it. The components are kept well-managed in the box; as mentioned before, many wires are used here and there. The research has also put on problems to the sensors when too many wires are in the box. The outside shows three components: the LCD, a Button, and an Accelerometer module attached to one of the cars. A huge tap will trigger the sensor and alert the buzzer inside the box.

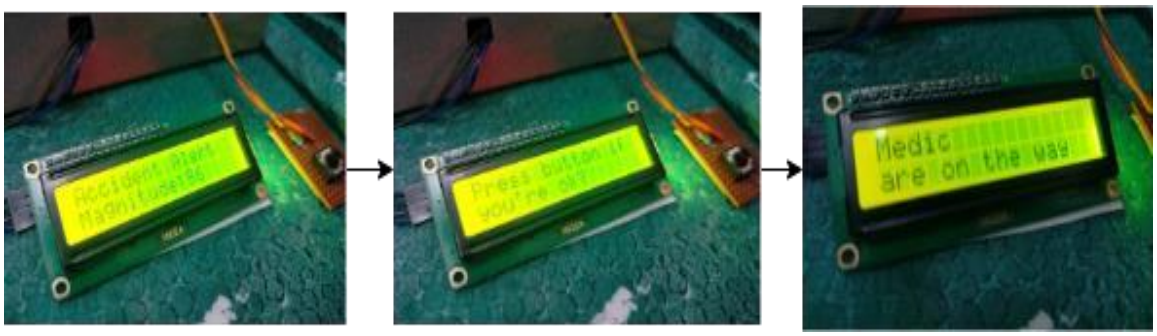

Figure 5: Message success in calling the Medical Team

Figure 5 shows the progress of the display alerting the user of an accident that just has occurred. It first informs the amount of impact detected, then a second message tells the driver if it is alright and asks to abort the call if the accident is only minor. If no answer is responded to within 60 seconds, a message will be sent to medical authorities about the accident.

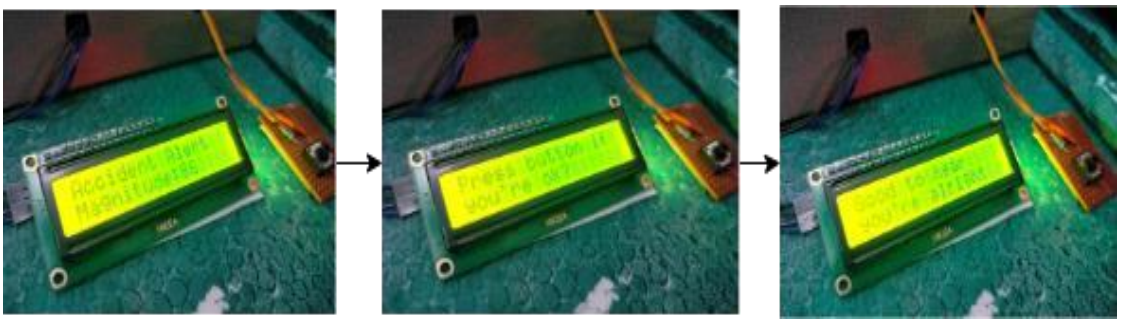

Figure 6 Message Success on Cancelling the call to the Medical Team

Figure 6 shows a different side of the story when the button is pressed. Within 60 seconds of the message appearing, the machine will ask if the driver is alright if the accident situation is minor and if it is necessary to call emergency personnel to fetch their help. If no, then pressing that button will cancel the call for the medical authorities to get to the site of the accident if it is minor.

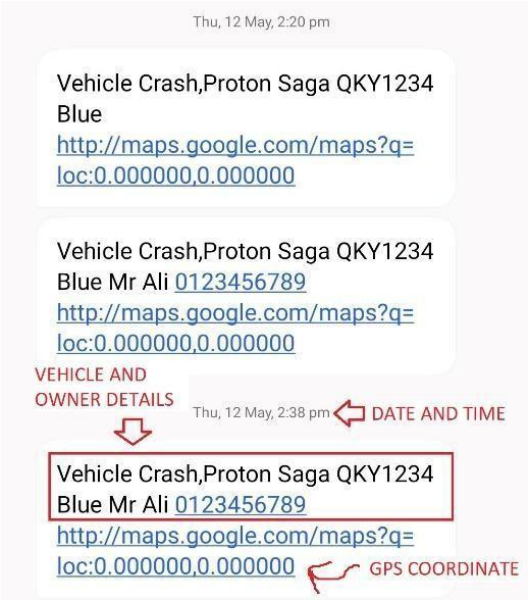

Figure 7: Message received by the Medical Team

The medical authorities will receive the message in the following Figure 7. It shows the time and date of the message being received. Also, the Vehicle model, number, and colour of it too. Not just that but also the vehicle owner's name and phone number. The GPS location is given in a Google maps link for easy access, with the latitude and longitude attached to the map shortcut link in the message.

Discussion

The system is different compared to the previous studies done on similar projects. This one feature newer microcontrollers and modules. Comparison can be added to this and the previous predecessor to make the huge leap of change.

Title/ Characteristics	Development of Vehicle involved in an accident alert system	Automatic Accident Alert and Safety System using Embedded GSM Interface
Microcontroller	Arduino Nano	AT89S52
Sensor	GY-61 Accelerometer Module, Sim 800L, GPS	ADC0804 Accelerometer Sensor, Sim 300, GPS
Outcome	SMS	SMS
Special Features	Allow users to cancel the call to emergency personal	None

Table 1: Project Comparison

The huge difference in table 1 for these two projects is the difference in the generation of technology being applied to a similar title. The previous project used a microcontroller, too, but an older, outdated kind. It is still being used today, but Arduino has always had a lot of components, hardware, and software support than the old microcontroller. Not just that, but the AT89S52 is a separate unit as it is just the Microcontroller chip and not the whole team, meaning there will be a need to be extra spending to get the module controller to support the chipset. While both use GPS and GSM as a separate way to alert the medical authorities.

The previous studies use an older SIM module, but it is still a GSM module that supports 2G network. While the GPS is similar to being available today, it could not cut a comparison. The Sim 300 is a much bulkier GSM modem that is less efficient than the one getting for these studies. Also, the previous studies only focused on the main expectations of the project. That is to alert the medical authorities of a vehicle involved in an accident. But there is no extra safety precaution for it to be a minor accident or error.

For that, this project has included a button to cancel the procedure in case the situation is mild and unnecessary to make that call. From that, the comparison is just a huge generation difference, with the newer component being cheaply available and supporting the current Arduino microcontroller market compared to the previous studies.

Conclusion

In conclusion, this project has reached its objective target of being able to alert the medical authorities of the accident in less than a minute by giving them lots of information regarding the vehicle and owner details. The most important is to locate the vehicle with the help of a shortcut link to Google Maps with the attachment of their latitude and longitude.
This will allow the medical team to get onto the site on time rather than wait for someone to call regarding an accident. The time it takes to find that place, too, will be less of a problem with the accurate GPS to guide them there. Also, the GSM tower network is still available, meaning that the message will arrive in a short time in less than a minute than waiting for a call to be made.

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