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Smart Accident Detection and Alerting System

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Abstract: Accident can take place any time any day, especially when the road is busy. Sometimes it happens due to the driver's negligence, the road conditions, or the state of the vehicle. Regardless, when an accident does occur time is at the essence. Responds time for rescue personnel to get to the accident site will be an issue. When an accident happens at a road less travels and the driver is unconscious, it will take much longer time. Even if there is a passer-by, it will take them time also to assess the situation before calling for help. By creating this system, it will reduce time taken for help to arrive. Once an accident occurs, the accelerometer will trigger the Arduino Nano, then it will receive input from the GPS module then Arduino Nano will send signal to GSM module to instantly request for aid.

Keywords: Accident, Arduino Nano, Accelerometer, Rescue Personnel

1. Introduction

In the event of an accident involving the vehicle's operator, the system will initiate an automated Short Messaging Service (SMS) to the central system. The central system will then proceed to notify the vehicle owner, ambulance services, and rescue personnel of the incident. If the accident is minor, the user of the vehicle can turn off the system with a button but if it is a major accident, and the user is unconscious and did not turn off the button the vehicle owner will receive a SMS of where the location of the accident so the owner of the vehicle can act quickly and call the ambulance and rescue service. The system employs an accelerometer to quantify the oscillation or acceleration of movement of the automobile. If an accident accelerometer sends a signal to the Arduino microcontroller, it will then send a signal to the GSM which will alert the center and rescue personnel of the accident.

1.1. Background of Study

Accidents can occur anytime regardless of the condition of the day. Even if one is driving carefully there is no assurance that other drivers are doing the same. Because of this accident can happen due to others being careless. Then if unfortunately, an accident did occur which can be two conditions where the driver is safe and conscious and the other being a terrible accident when the drivers are unconscious. Either way if the driver is conscious, they can call for help on their own, but if the driver is unconscious

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then it's up to the passer-by to do it. Another problem can occur for some passer-by with an attitude of "that is not my problem" do not even bother to help. Also, if other passers-by do help it will probably take more time to get the accurate location of the accident before calling rescue personnel. Then the rescue personnel will have to prepare for rescue.

The objective of this project is to develop a system capable of identifying a vehicle that has been involved in an accident. Contacting the emergency personnel in order to save time and lives works as described in the situation above. Since there is a chance that someone's life is jeopardized, it is essential that the emergency personnel arrive promptly. When a car is in an accident on the highway, this technology will alert the emergency personnel and give coordinate based on Global Positioning System (GPS) so that the accident scene can be quickly discovered.

1.2. Problem Statement

Emergency personnel are frequently late in arriving at the scene of accidents, which can cost both lives and precious time for the injured. because it takes time to call and tell them where the accident happened. The prospects of saving the injured persons are potentially minimal if rescue personnel arrive late and do not know the precise location of the accident. The rescue personnel are racing against time in order to rescue the accident victims. Some accidents occur in area less travel this makes it harder for the injured to call for help especially when they are unconscious, and they are no passer-by to help call ambulance. It can also be difficult for emergency personnel to reach the scene in time when passers-by fail to accurately report the location of the accident.

1.3. Objectives

The three main objectives of this project are:

I. To create a smart accident detection system as a feature for vehicle safety.
II. To alert the rescue personnel of user's vehicle that has been involved in an accident so they can react faster.
III. To create a system that can identify accident location accurately.

1.4. Comparison of Related Previous Projects Study

As shown in Table 1, after researching previous projects, it is known all the project can alert the authority when an accident happens. While doing so it is important to ensure that this project can achieve the same result.

Table 1: Comparison of each project

Project	Description	Components
Automatic Accident Alert and Safety System Using Embedded GSM Interface [7]	The Accelerometer Sensor MMA7361L transmits a signal to the Microcontroller ADC0804, which subsequently relays the signal to the primary Microcontroller AT89S52 for the purpose of activating the GSM and GPS module. In the event of an accident, it is recommended to utilize the SMS feature to request assistance. If a vehicle passenger remains unscathed, they	• Microcontroller AT89S52 • GSM Modem SIM300 • GPS Module • Accelerometer Sensor MMA7361L • Microcontroller ADC0804 (To detect

	may activate the panic button to signal their well-being and request assistance.	vibration from accelerometer)
Vehicle Tracking and Accident Alert System [8]	Uses AT89S52 as microcontroller. This system mainly uses on transport such as taxi and public transport such as bus. Uses a single control room to send for help. Have fire sensor as added feature.	• Microcontroller AT89S52 • GSM Module • GPS Module • Shock sensor • Fire sensor/detector
ARM 7 Based Accident Alert and Vehicle Tracking System [9]	This system uses ARM 7 LPC 2378 TDMI Microprocessor.	• ARM 7 LPC 2378 TDMI Microprocessor • MMA 7660F 3-Axis Accelerometer Sensor. • SIM 900 GSM modem • MR-87 GPS Module
Accident Detection and Messaging System Using GSM and GPS [10]	This project uses Arduino UNO as its microcontroller and vibration sensor to detect impacts. Immediately calls helps once vibration occur. No cancellation buttons.	• Arduino UNO • GSM Module • GPS Module • Vibration sensor module • 16×2 LCD

2. Materials and Methods

The process, method, and materials are described with the knowledge that are used during the studies. Decision is made by justifying pros and cons of each approach and design. Based on the previous design, this project looks to replicate the same result with similar or different method depending on the outcome.

2.1. Materials

- Arduino Nano, the perfect board for making a ton of fascinating and stunning items since it is compact, effective, complete, and breadboard friendly. This Nano board is only 45 mm long, 18 mm wide, and only 7 grammes in weight [1].
- ADXL335 Analog 3 Axis Accelerometer, A device that monitors a structure's vibration, motion, or acceleration is called an accelerometer. This module makes it simple to access the accelerometer's X, Y, and Z axis analogue outputs and includes optional header pins. It is able to detect forces of up to 3g in every axis [2].
- SIM800L GSM/GPRS module, the main chip for this module is the SIM800L GSM cellular chip which has an operating voltage of 3.4 to 4.4 volts suitable for direct current (DC) power

supply. The module is also small making it suitable for project that consume a lot of space or compact area [3].

- NEO-6MV2, a GPS (Global Positioning System) module and is used for navigation purposes it can locate its whereabouts on Earth and give out data such as its longitude and latitude. While having u-blox 6 positioning engines as its feature, making a high-performance stand-alone GPS receiver [4].
- LCD I2C, a display module plus an LCD controller makes up an I2C display. Two wires, a data line, and a clock line, are used to transmit information over the interface. character display chooses among preset characters that are stored in RAM using 8-bit commands. A character display's resolution is also determined by the low number of rows and columns of characters, which is another factor [5].
- DC-DC Step Down Adjustable Power Supply Module, the input voltage could be lowered by employing a big power resistor or power divider [6].

2.2. Project Block Diagram

Figure 2.1 shows the block diagram of the project. Arduino Nano will be the microcontroller of the system. Arduino Nano will be the one to control the action of other components such as buzzer/LED (output), GSM Module (output), GPS Module (output), Button (input) and accelerometer (input) and LCD I2C (output).

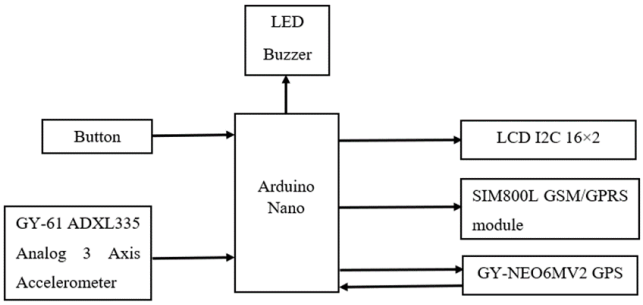

Figure 2.1: Project Block Diagram

An accelerator is used to measure vibration via magnitude and detect if is the vehicle an accident. Buzzer and LED will activate once accelerometer detects an accident. A button is used to indicate if the vehicle needs help or not if the button is not pressed 20 seconds after the accident is detected, it will send a signal to Arduino Nano indicating that the passenger of the vehicle is unconscious and needs help. The GPS module is utilized for the acquisition of accident coordinates. Upon receiving a signal from the Arduino Nano, the GSM module is utilized to transmit an SMS requesting assistance. The LCD I2C is to inform the driver of the system action by displaying “Press button if you are unharmed”, value of magnitude, and the status of rescue personnel.

2.3. Circuit Diagram

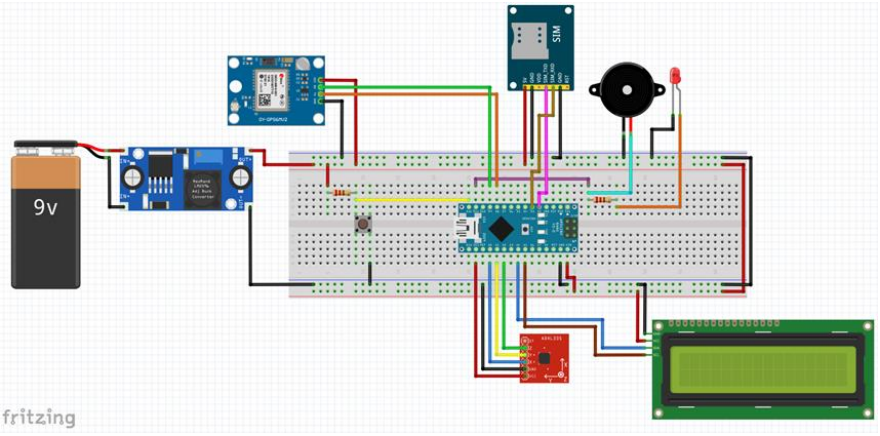

Figure 2.2: Circuit Diagram constructed via Fritzing Software

As seen in Figure 2.2, the circuit is made by using Fritzing Software, Arduino Nano is the center of the circuit. The Button, which is an input, is attached to the D12 pin of the Arduino Nano. Both the LED along with the buzzer which is an output is connected to the D11 pin of the Arduino Nano. Because the accelerometer is an analogue sensor, its X, Y, and Z pins are linked to A0, A1, and A2, respectively. The SIM 800L's RXD is connected to pin D3 and TXD pin is connected to pin D2 of the Arduino Nano. The GY-NEO6MV2 GPS' RX pin is connected to D9, and TX pin is connected to D8. The LCD I2C power supply uses 5V and the SCA pin is connected to A4 and SCL is connected to A5 of the Arduino Nano.

2.4. Project Flowchart

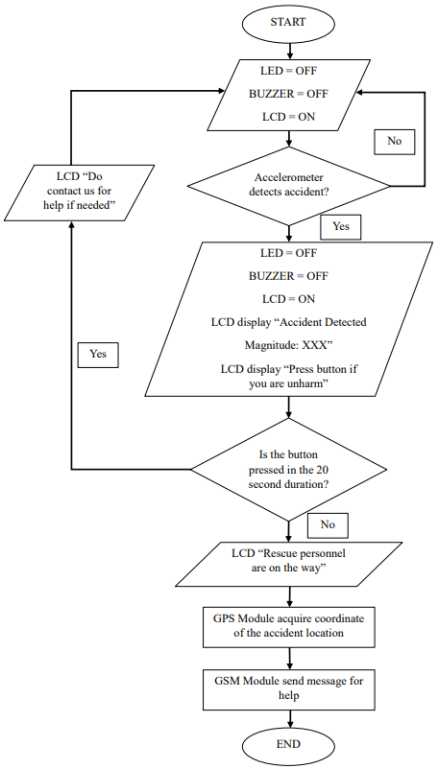

Figure 2.3: Project Flowchart

As seen in Figure 2.3 once the accelerometer senses accident, it will then send a signal to Arduino Nano, once signal receive Nano will then send a respond to LCD display that mention it detects an accident. Arduino Nano will then wait for a signal from the Button. If the Button is pressed LED and Buzzer will turn OFF. If the Button is not pressed after 20 seconds the sensor detects an accident, Arduino Nano will then send a signal to the GPS module acquiring its location and then send the location to rescue personnel via the GSM module.

3. Results and Discussion

The physical circuit was implemented in order to obtain results, as the accelerometer cannot be accurately simulated. This outcome can be classified ultimate findings for the entire circuit.

3.1. Results

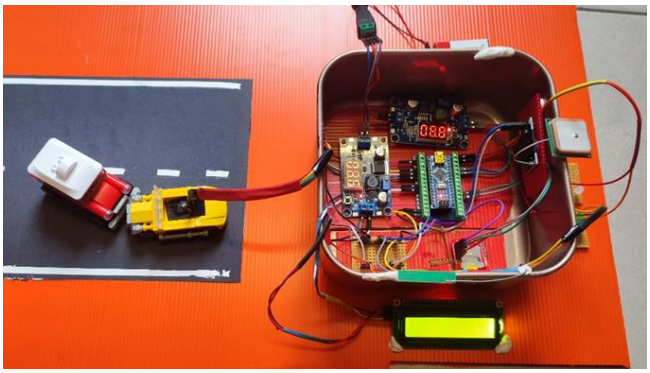

Figure 3.1: Accident Simulation

Figure 3.2: LCD display 1

Figure 3.3: LCD display 2

Figure 3.4: LCD display 3

Figure 3.5: LCD display 4

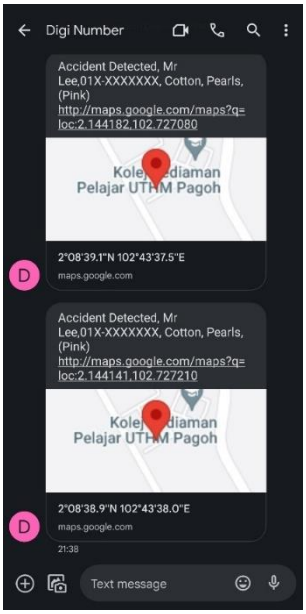

Figure 3.6: Messages Contains

3.2. Discussions

As seen in Figure 3.1, if an accident occurs, the system is triggered and the LCD will display "Accident Detect, Magnitude: [Magnitude Value]" as shown in Figure 3.2, then it will change display to "Press button if you are unharm" as depicted in Figure 3.3. As shown in Figure 3.4, if the driver is conscious or it was a minor accident, the driver can press the button within 20 seconds then the LCD will display "Do call us for help if needed". At the same time as this is happening, the Buzzer and LED will turn ON. Figure 3.5 shows that if the driver is unconscious due to the accident and is unable to press the button, the LCD will display "Rescue personnel are on the way" and the system will then proceed to send an SMS to the center and the center will contact rescue personnel that is nearby location

of the accident. These SMS will contain Vehicle Owner, Contact Number, Car Brand, Car Model and Car Color as seen in Figure 3.6.

4. Conclusion

In conclusion this project creates a new type of safety feature for vehicles for the sole reason of the objectives which are to reduce the time taken for rescue personnel to aid the injured once an accident occurs. By gathering research on accident trends in Malaysia it is known that this type of system is very useful. Past projects made by other individuals also aid in this research because it has given much information regarding their projects and how it functions. After implementing all the components into the system, and a series of troubleshooting the project works and functions the way it should be.

Acknowledgement

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