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Accident Detection and Alerting System

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ABSTRACT:

As nowadays, the number of vehicles is increasing rapidly, the number of accidents happening due to vehicles are also getting increased. Most of the accident happened because of increased traffic as well as high speed, drunk and driving, overstress, diverting minds and due to use of electronic gadgets. Most of the accident victims die because of not getting the medical services on time. The proposed system ensures by making emergency facilities available to the accident victim as early as possible by giving emergency message to relatives, hospitals or rescue teams by letting them know the accident location with the help of system embedded in the vehicle. This paper discusses about a system which can automatically detect an accident happened and can alert the hospitals, ambulance, rescue teams, which are nearest one. The system uses the Accelerometer to detect an accident. The micro-controller continuously monitors the output of accelerometer. The accident location of the vehicle can be tracked by using GPS module which is installed in the system. Once accident occurs, the accident location is sent through the GSM modem used in the system

1. INTRODUCTION :

Traffic is on the rise as the demand for vehicles is getting higher day by day. So, transportation needs improvement as, since demands are increasing, there will be more possibility of vehicle accidents. Vehicle accidents are one of the leading causes of the fatalities. It will be a serious consequence if people can't get help on right time. Crash analysis studies have shown traffic accidents could have been prevented with the use of this advanced life saving measure. This design focuses on providing basic information on the accident site to the hospital or police station. As a result of this sudden help, precious life may get saved. In this work, a three-axis accelerometer and GPS tracking system work for accidental monitoring. This design detects accidents in less time and sends this information to the required authorities. In this case GSM will send short message to the hospital or police station. This message will read the geographical co-ordinates of accident spot with the help of GPS. And, as now the location has been traced by the GPS, emergency medical service can be given to the accident victims as soon as possible

2. DESIGN METHODOLOGY :

The design methodology for an accident detection and alerting system using Arduino Nano involves a systematic approach to define, design, and implement the system. The methodology begins with gathering requirements and defining the objectives of the system. The system should be able to detect accidents and alert the concerned authorities or individuals. The next step is to design the system architecture and select the appropriate components. The system can be designed using an Arduino Nano board, sensors, GSM or GPS modules, and other necessary components. The sensors can be used to detect accidents, and the GSM or GPS modules can be used to send alert messages. The system design should also consider the power supply and enclosure for the system .Once the system design is complete, the next step is to select the appropriate sensors and modules based on the system requirements. For example, accelerometers or gyroscopes can be used to detect accidents, and GSM or GPS modules can be used to send alert messages. The Arduino Nano board can be used to interface the sensors and modules. After selecting the components, the next step is to design the circuit diagram for the system. The circuit diagram should show the interconnection between the sensors, modules, and Arduino Nano board. The circuit design should also consider the power supply and protection circuits. The next step is to write the code for the system using Arduino programming language. The code should be able to read the sensor data, detect accidents, and send alert messages using GSM or GPS modules. The code should also handle errors and exception Once the code is written, the next step is to test the system using simulated or real- world scenarios. The testing should cover all possible scenarios, including normal and abnormal conditions. The validation should ensure that the system meets the specified requirements and performs as expected. Finally, the system can be deployed in the target environment and maintained as needed. The maintenance may include firmware updates, sensor calibration, and module replacement. By following this methodology, you can design and implement an accident detection and alerting system using Arduino Nano.

3. BLOCK DIAGRAM:

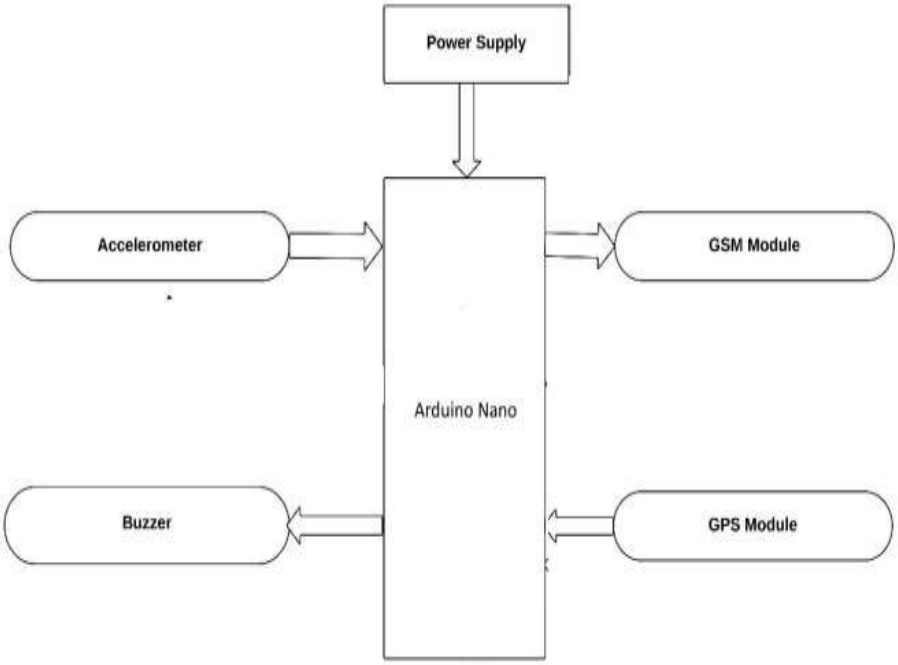

Figure 1: Block Diagram

The Accident detection and Alerting System is depicted in this block Power Supply: The power supply is the first component in the sequence, providing energy to all the other components in the device.

I. Switch: The switch is the control mechanism for turning the device on or off. When the switch is in the "on" position, power is supplied to the other components.

II. Accelerometer: The accelerometer is a motion sensor that detects changes in velocity and orientation. It provides input to the microcontroller (Arduino Nano) about the device's movement and position.

III. Arduino Nano: The Arduino Nano is a small, breadboard-friendly microcontroller board that can be programmed to perform various tasks. In this device, the Arduino Nano receives input from the accelerometer and GPS module and sends commands to the motor controller, LCD, and buzzer.

IV. GPS Module: The GPS module is a location tracking device that receives signals from GPS satellites and calculates the device's geographical position. It provides input to the microcontroller about the device's location.

V. Motor Controller: The motor controller is a device that manages the operation of one or more motors. It receives commands from the microcontroller and controls the motors accordingly.

VI. LCD: The LCD is a display screen that outputs visual information to the user. It receives commands from the microcontroller and displays the relevant information.

VII. Buzzer: The buzzer is an audio signaling device that produces sound as needed. It receives commands from the microcontroller and produces the corresponding sound.

VIII. GSM Module: The GSM module is a communication device that enables the device to connect to a cellular network. It receives commands from the microcontroller and sends or receives data over the network.

The arrow in the diagram indicates the general flow of information and control within the electronic device. The power supply provides energy to the other components, which are controlled by the switch. The accelerometer and GPS module provide input to the microcontroller, which processes the information and sends commands to the motor controller, LCD, and buzzer. The GSM module enables communication between the device and a cellular network, allowing for data transfer. Overall, the components work together to perform the device's intended functions.

4. CIRCUIT DIAGRAM:

The schematic diagram of the project is shown in the diagram above. This Accident Identification and Alerting System's circuit connections are depicted in the diagram. The GPS module's Tx pin is directly connected to ATmega328 pin 16, PB2. We have enabled serial communication on pins 10 and 11 by utilising the Software Serial Library and making them Rx and Tx, respectively, while leaving the Rx pin of the GPS Module open. Serial communication is enabled by default on Pins 2 and 3 of the microcontroller, however utilising the Software Serial library, we may enable serial communication on any of the microcontroller's digital pins. The GPS Module is powered by a 12 volt source. The Tx and Rx pins of the GSM module are connected directly to pins 4 and 5 of the microcontroller. We also used a software serial library for GSM connectivity. A 12v supply is also used to power the GSM module. The data pins of an optional LCD are linked to the LCD I2C converter board. The SDA and SCL pins on the I2C converter board are linked to pins 27 and 28 on the I2C converter board, respectively. The main benefit of employing an I2C converter board is that the number of connections is reduced. We can communicate not only with one device but also with a large number of devices utilising only two wires. For detecting an accident, an accelerometer is added to the system, and its x ,y, and z-axis ADC output pins are directly attached to the microcontroller's SDA and SCL pins, which are pin numbers 27 and 28 respectively.

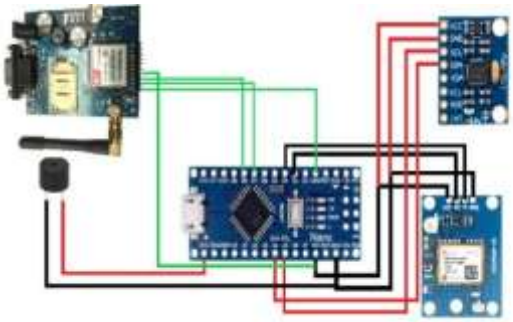

Figure 2: Circuit Diagram

5. COMPONENTS:

5.1 Arduino nano:

Figure 3: Arduino nano

The Arduino Nano board has a USB connector for programming and power supply, and a 6-pin ICSP (In-Circuit Serial Programming) header for uploading sketches using an external programmer. It also has a reset button for restarting the board and a power LED indicator.

The Arduino Nano board can be programmed using the Arduino Integrated Development Environment (IDE), which is a free, open-source software tool. The IDE supports a wide range of programming languages, including C and C++, and provides a simple and intuitive interface for writing, uploading, and testing sketches.

The Arduino Nano board is compatible with a wide range of sensors, actuators, and other electronic components, making it a popular choice for hobbyists, students, and professionals alike. It can be used for a variety of applications, such as robotics, home automation, data logging, and IoT projects.

Overall, the Arduino Nano board is a versatile and powerful microcontroller board that offers a wide range of features and capabilities for electronic projects. Its small size, low cost, and ease of use make it an ideal choice for prototyping and development of electronic systems.

5.2 NEO-6M GPS Module :

Figure 4: NEO-6M GPS Module

The NEO-6 module series is a line of stand- alone GPS receivers that use the u-blox 6 positioning engine for outstanding performance. These versatile and cost- effective receivers come in a small 16 x12.2 x 2.4 mm box with a variety of connecting choices. NEO-6 modules are suited for battery-operated mobile devices with severe cost and space constraints due to their compact architecture and power and memory options. The u-blox 6 positioning engine, which has 50 channels, has a Time- To-First-Fix (TTFF) of less than 1 second. With 2 million correlators, the dedicated acquisition engine is capable of hugevsimultaneous time/frequency space searches, allowing it to find satellites instantly. NEO-6 GPS receivers have exceptional navigation performance even in the most demanding circumstances because to innovative design and technology that suppresses jamming sources and mitigates multipath effects.

5.3 MPU 6050 Accelerometer :

Figure 5: MPU6050Accelerometer

The MPU6050 is a small, low-power, 3- axis accelerometer sensor developed by Digital Processor. Here's a brief overview of its key features: 3-Axis Sensing: The MPU6050 can measure acceleration along three perpendicular axes: X, Y, and Z. This capability allows it to detect motion and orientation changes in three-dimensional space.

Analog Output: It provides analog voltage outputs proportional to the acceleration along each axis. These outputs can be easily interfaced with microcontrollers or digital- to-analog converters (DACs) for further processing.

Wide Measurement Range: The MPU6050 has a wide measurement range, typically around ±16g (gravity), meaning it can detect accelerations up to three times the acceleration due to gravity in any direction. Low Power Consumption: It operates on a low supply voltage (typically 2.3V to 3.6V) and consumes minimal power, making it suitable for battery-powered applications and energy-efficient systems.

Compact Size: The sensor comes in a small, surface-mount package, making it easy to integrate into various electronic devices and systems with limited space. Simple Interface: The MPU6050 communicates with external devices using analog voltage outputs, I2C communication protocols. It typically requires minimal external components for operation. Applications: Common applications of the MPU6050 include tilt sensing, vibration monitoring, motion detection, gesture recognition, and orientation tracking in electronic gadgets, wearable devices, robotics, and motion- based gaming controllers. Overall, the MPU6050 accelerometer offers a cost- effective and versatile solution for measuring acceleration in three dimensions, enabling motion and orientation sensing in a wide range of applications.

5.4 GSM:

Figure 6: GSM SIM900A

The SIM900A is a popular GSM (Global System for Mobile Communications) module that enables devices to communicate over cellular networks. Here's a detailed breakdown of its key features and functionalities:

Communication Protocol: The SIM900A module supports GSM/GPRS communication protocols. GSM is a standard for digital cellular networks, while GPRS (General Packet Radio Service) enables data transmission over cellular networks. Frequency Bands: It operates in the 900/1800 MHz frequency bands, making it compatible with most GSM networks worldwide. However, it's essential to ensure compatibility with the specific frequency bands used by your cellular carrier. SIM Card Interface: The module includes a SIM card interface, allowing it to communicate with the cellular network using a Subscriber Identity Module (SIM) card. The SIM card stores subscriber information, such as network authentication keys and phone numbers. UART Interface: Communication with the SIM900A module is typically facilitated through a UART (Universal Asynchronous Receiver- Transmitter) interface. This interface allows microcontrollers or other host devices to send AT commands and receive responses from the module.

Power Supply: The SIM900A module operates on a relatively low voltage, typically around 3.4V to 4.4V. It usually requires a stable power supply to function correctly. Additionally, it includes a low- power sleep mode to conserve energy when not in use .Overall, the SIM900A GSM module provides a convenient and cost- effective solution for adding cellular connectivity to a wide range of electronic devices, enabling communication over GSM networks for both data and voice applications.

5.5 Buzzer:

Figure 7. Buzzer

A buzzer is an electronic device that produces sound by vibrating a diaphragm or a metal plate with an alternating current. It is commonly used in electronic devices, such as alarm systems, timers, and appliances, for producing audible alerts or notifications A piezoelectric buzzer is an electronic device that produces sound by vibrating a piezoelectric material, such as quartz or ceramic, with an alternating current. The piezoelectric buzzer consists of a thin disk or sheet of piezoelectric material, which is bonded to a metal diaphragm or plate. When an alternating current is applied to the electrodes on the piezoelectric material, it changes shape and generates a mechanical vibration, which in turn produces sound waves.

The piezoelectric buzzer has the following features and specifications:

Operating voltage: 5V to 24V Frequency range: 1kHz to 5kHz Sound pressure level: up to 100dB Power consumption: less than 100mW

Operating temperature: -20°C to +70°C Dimensions: varies depending on the model

The buzzer is a versatile and reliable sound generator that can be used in a wide range of electronic applications. Its simple design, low power consumption, and wide frequency range make it an ideal choice for producing audible alerts or notifications in electronic devices.

6. RESULTS:

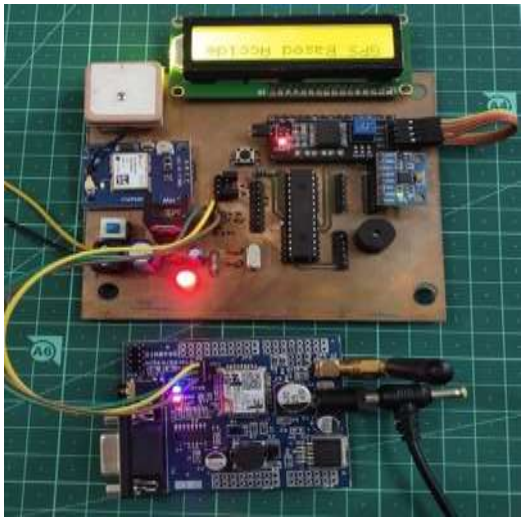

Figure 10: Project PCB

The primary PCB of the project is illustrated in Figure 8.1, and it incorporates the MPU6050 Accelerometer, GPS module, GSM 800C module, microprocessor, LCD, and 5V Voltage Regulator section.

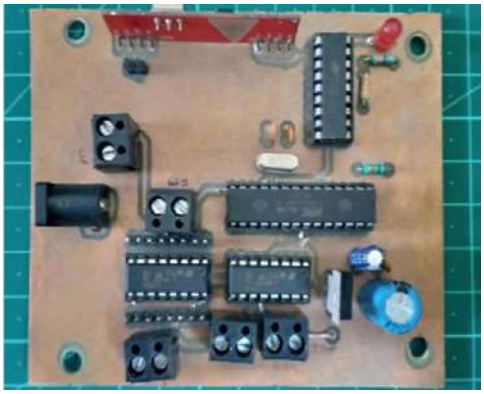

Figure 11: Motor Driver

The PCB for the motor driver circuit is Figure 8.2. The vehicle's four motors will be driven by the motor driver circuit, which is a prototype of the vehicle. The motor driver is made up of two L293D ICs, each of which can drive two motors. As a result, two L293D driver ICs were employed to operate four motors. The ATmega328P microprocessor controls the motor and is coupled to the motor drivers ICs. When an accident is detected, the buzzer will begin to beep, and an emergency message with the location of the accident will be sent to the registered number within 2 minutes. If there is a minor accident or a mistaken detection of an accident, there is a switch that must be pressed within two minutes to stop the emergency message from being sent.

7. CONCLUSION:

IoT systems consist of intelligent devices that use embedded systems with the help of processors, sensors, and other communication devices to collect and process data received from the environment. IoT devices send collected sensor data using an IoT gateway. IoT gateways send data to the cloud for analysis or analyse it locally. These devices may also communicate with other related devices, exchanging data with each other and taking immediate action. Humans can interact with devices, but devices do most of the work without human intervention like access to Settings, Instructions, or Data. Most motorcycle accident fatalities are the result of delayed response, not deaths at the scene. If a driver is involved in an accident, they are more likely to be shocked. Even with an impact, they may or may not be able to call for help on their own, as either their hands, head, or chest can be damaged during the fall. Being exposed to the elements makes this type of injury very likely. Assuming the clash occurred in a crowded, or at least deserted, area, there is still no guarantee that an outsider would take the responsibility into their own hands and seek help or call emergency services. This kind of thinking makes things difficult. No one calls for help, delaying necessary emergency response. Others are too busy to help strangers when they have more important things to do. For this reason, it is necessary to notify important persons for the driver in such situations. The paper aims to detect motorcycle accidents, verify that it is not a false alarm, and alert emergency contacts providing details of the location and time of the accident. This ensures that the recipient has enough information to contact the necessary authorities at the crash site immediately and provide the necessary assistance. It also makes it easier for the recipient to go to the scene and grasp the situation, even if an accident occurs nearby. This paper can further be extended by implementing some

additional features. The amount of contacts can also be extended to have a list of emergency contacts who will receive the details of the crash.E3S Web of Conferences 391, 01145 (2023) https://doi.org/10.1051/e3sconf/202339101 145 ICMED-ICMPC 2023 It can also be implemented in a way to add a location address to each contact and then send only to the three nearest contacts to the crash site. This will increase the likelihood of getting proper help in times of a motorcycle crash.

8. REFERENCES :

[1] C. Thompson, J. White, B. Dougherty, A. Albright, and D. C. Schmidt, "Using Smart phones to Detect Car Accidents and Provide Situational Awareness to Emergency Responders," in 3rd International ICST Conference on MOBILE Wireless MiddleWARE, OperatingSystems,and Applications (Mobilware 2010), 2010.

[2] R. K. Megalingam, R. N. Nair and S.

M. Prakhya, \Wireless Vehicular Accident Detection and Reporting System," in International Conference on Mechanical and Electrical Technology (ICMET 2010), 2010, pp. 636640.

[3] Wineyard Technologies, \Automatic Vehicle Accident Detection and Messaging System using GPS and GPRS", www.morth.nic.in/writereaddata/ma inlinkFile/File761.pdf

[4] R. Elvik, P. Christensen, A. Amundsen, \Speed and road accidents: an evaluation of the Power Model," TOI Report, [Online]. Accessed on 12 October 2011. Available: http://www.trg.dk/elvik/740- 2004.pdf

[5] B. Huang and J.Preston, “A Literature Review on Motorcycle Collision”, Transport Studies Unit Oxford University April 2004.

[6] Vikas Desai, “Design and Implementation of GSM and GPS Based Vehicle Accident Detection System”, IJIT, vol. 01, Issue-3,2013.

[7] Nicky K., Arun G. Mithun T.P., “Intelligent Accident Detection and Alert System for Emergency Medical Assistance”, IEEE, Jan-5, 2017.

[8] T. Kalyani, S. Monika “Accident Detection & Alert System”, IJITEE, vol. 8, Mar-2019, pp.227-229.

[9]. Bonnells, J. De Gouveia, J. Reimers, B. Scherschel, Senior Design Group 22, University of Central Florida, Fall 2016 - Spring 2017, (2017)

[10] M. Kumari, S. Kumar, A. Kumar, N. Kumari, Int. J. of Sci. and Res. 9, 11, (2020)

[11] Automatic Motorbike Side Stand Slider, Available: Online: https://nevonprojects.com/ automatic-motorbike-stand-slider

[12] S. Parameswaran, P. Anusuya, M. Dhivya, A. Harshiya Banu, D. Naveen Kumar, Inter. J. of Engg. Res. & Tech. 4, 11, (2016)