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Accident Identification and Alert System Using MSP430

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Abstract

The "accident identification and alerting system using MSP430" is an innovative project that focuses on enhancing road safety and emergency response mechanisms. This system harnesses the capabilities of the MSP430 microcontroller to continuously monitor a vehicle's movements and orientation through sensors and GPS modules. Using sophisticated algorithms, it can detect and identify accidents by analyzing data from the sensor. When an accident is detected, the system automatically triggers alerts to predefined emergency contacts and provides crucial information about the accident's location using GPS integration. This project addresses the critical need for rapid accident response, potentially saving lives and reducing the severity of injuries, making it a technologically advanced solution to improve road safety and emergency response in today's fast-paced world. Road accidents are a major source of death globally, thus, it's critical to identify and respond to them quickly to save lives. This article describes an accident identification and alerting system (AIAS) that makes use of the MSP430 microprocessor, which is renowned for its excellent efficiency and low-power consumption. To identify mishaps, pinpoint the precise location, and rapidly notify emergency personnel, the system combines sensors, GPS, and GSM modules. This technology increases victims' chances of survival and speeds up response times by automating accident reporting.

Keywords: MSP430 microcontroller, GPS modules, GSM module, RFID readers, deep learning, V2V communication, deep learning

INTRODUCTION

Accident rates have increased sharply in recent years. Employment has led to an increase in the use of cars and motorcycles, which has increased the risk of accidents resulting from speeding. People are putting themselves in danger by driving too fast, and the number of accidents cannot be reduced because no cutting-edge measures are available. This report presents a method to lower a nation's accident rate. Systems for automatically detecting and alerting people to accidents have also been introduced. By using wireless communications technology to send messages to registered mobile phones, hospitals, and police stations, the primary goal is to control accidents. When an accident occurs in a city or anywhere else, the registered mobile device receives the message faster, owing to the GSM module. Arduino serves as the central component of the system, facilitating message transmission among its various gadgets. When an accident occurs, the vibration sensor is triggered, and the GSM module sends the information to the registered number. The position of the accident can be determined by using a GPS device. Using the GSM and GPS modules, the proposed system determines whether an accident has occurred and alerts registered cell phones and the closest medical facilities to the accident site. The location can be transmitted via a tracking system to cover the

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geographic coordinates throughout the region. One of the key modules of the system, the vibration sensor, can identify an accident. Vehicle-to-vehicle (V2V) communication is a wireless technology that allows vehicles to exchange data. It can help improve road safety by enabling vehicles to share information about their location, speed, direction, etc.

LITERATURE REVIEW

Mounika, Charanjit, Tharun, and Vashista discovered a low-cost car accident alerting system [1]. An accident warning and monitoring device is designed to determine whether an accident has occurred and how seriously the driver or accident victim is injured. Jeevagan et al. proposed RFID-based vehicle identification for collision systems. The RFID readers of both cars are triggered when a collision is detected, and they use RFID tags to retrieve vehicle information. In hit-and-run situations, this method helps car owners find reckless drivers [2].

Bilal Khalid Dar, Monam Ali Shah, Saif Ul Islam, Castern Maple, Shafaq Mussadaq, and Suleman Khan introduced fog-based delay-aware accident management systems. A delay-aware accident detection system aims to decrease response and rescue times. The use of built-in smartphone sensors to identify accidents lowers the overall system cost [3]. Chang, Lai, and Dow suggested a rapid response framework for defensive driving. The goal of defensive driving is to make drivers more conscious of themselves to avoid collisions [4].

Lin and Hsu invented the Distracted-Driving Alert System. For driving perception and driver behavior recognition, a modified convolutional neural network is used, which immediately alerts the driver [5]. In 2019, Daxin Tian, Chuang Zhang, Xu ting Duan, And Yixian Wang Discovered the detection and alerting of car accidents using mobile applications. It can detect car accidents with 90% accuracy [6]. Sane and Patel discovered an automatic car accident alert system. The Global Positioning System provides the system with latitude and longitude location data, which are then sent to the rescue center via the GSM module.

The system then sends a text message to individuals specified in each emergency list. In a fully connected deep neural network, there is an input layer, and one or more hidden layers are connected sequentially. Each neuron receives input from the previous layer of neurons or the input layer. The output of one neuron becomes the input to the other neurons in the next layer of the network, and this process continues until the final layer produces the output of the network. The layers of the neural network transform the input data through a series of nonlinear transformations, thereby allowing the network to learn complex representations of the input data [7].

Priyanka Berade, Kranti Patil, Pradnya Tawate, Prof. Ghewari, M.U. introduced a system for accident alerting and fault detection [8]. G. Boopathi Raja, Keerthika A, Keerthika SG, Nandhini A, Pranitha K J. introduced a GSM-based vehicle accident alert system. [9] Malavika Prasad, Joseph, Saji, and Paul proposed road accident prediction using deep learning [10].

RESEARCH METHODOLOGIES

Vehicle Safety Systems

Advanced Driver Assistance Systems (ADAS)

These systems are commonly found in modern vehicles and use sensors, cameras, and radars to detect potential accidents. Lane departure alerts, automatic adaptive cruise control, and automated emergency braking are examples of warnings and remedial measures they offer.

Vehicle-to-Vehicle (V2V) Communication

This technology enables automobiles to communicate with one another and share safety information, such as notifications about accidents. B. Apps for smartphones: Many smartphone apps employ accelerometers, GPS, and other sensors to identify abrupt motion changes that could indicate an accident. Authorities or emergency contacts may receive warnings from these applications.

Connected Car Platforms

Companies such as OnStar and various automakers offer connected car platforms that can automatically detect accidents and call for assistance. They also provide real-time vehicle data and GPS location information.

Wearable Devices

Wearable devices such as smartwatches can monitor the wearer's vital signs and detect unusual patterns that may indicate an accident or health emergency.

IoT and Home Automation

Internet of Things (IoT) devices in the home, such as smart sensors, can be used to detect accidents, particularly in the context of falls among the elderly. These systems can alert emergency services and caregivers.

Artificial Intelligence and Machine Learning

To identify accidents, certain systems analyze data from several sensors and cameras using AI and machine learning. For instance, autonomous cars employ AI to recognize possible crashes and take preventative measures.

Smart Helmets and Motorcycle Safety

Smart helmets equipped with accelerometers, cameras, and communication systems can be used to detect motorcycle accidents and automatically send alerts to emergency services or designated contacts.

Roadside Infrastructure

Some regions have implemented roadside infrastructure such as sensors embedded in the road to monitor traffic and detect accidents.

Emergency Response Systems

In many areas, emergency response services are equipped with technology that enables them to quickly locate and respond to accidents, often by using GPS and mobile communication.

Research and Development

Academic institutions and research organizations are continually working on improving accident identification and alerting systems through R&D projects. To conduct a comprehensive survey of existing projects, we must search for recent research papers, news articles, and company announcements in this field. We can also explore academic journals, tech blogs, and industry-specific publications to stay updated with the latest advancements in accident identification and alert systems. Additionally, we can check startups and companies specializing in this technology for specific project details.

PROPOSED METHODOLOGY

The proposed system was designed to enhance road safety by automatically detecting vehicle accidents and sending alerts to emergency services and designated contacts. It relies on onboard units (OBUs) installed in vehicles, which are equipped with essential components, such as a microcontroller, a GPS module, a GSM/GPRS module, and accelerometer/gyroscope sensors.

Key Components and Functionalities

MSP430 Microcontroller

- The MSP430 microcontroller serves as the central processing unit of the system. It coordinates the operation of other hardware components and executes an accident detection algorithm.
- It collects data from the GPS module and vibration sensor, processes the data to determine whether an accident has occurred, and triggers the alerting system accordingly.

- The MSP430's low-power features are valuable in projects such as this, as they can operate efficiently in battery-powered systems.

GSM Module

- The GSM module is responsible for communication and alerting in case of an accident.
- Once the MSP430 detects a potential accident based on the data from the vibration sensor, it can use the GSM module to send SMS messages or data to alert emergency services or designated contacts.
- The GSM module ensures that information about the accident is rapidly relayed to the appropriate parties.

GPS Module

- The GPS module provides real-time geographic location data, which is crucial for precisely identifying accident locations.
- In the event of an accident, MSP430 can collect location data from the GPS module and include it in the alert message. For emergency personnel to arrive promptly at the accident scene, this information is essential.

Vibration Sensor

- A vibration sensor is a critical component in accident detection. It monitors the motion of a vehicle and detects abrupt changes or impacts.
- When the vibration sensor detects significant vibrations or a sudden jolt, it triggers the MSP430 to analyze the data and determine whether it is indicative of an accident. If so, the alert process is initiated.

Methodology

1. The MSP 430 configuration is mounted on vehicle bumpers on either side or in the crash guard, as shown in Figure 1.
2. It notifies the MSP 430 board and presses the push button when a collision occurs.
3. This input was converted to SIM900A by MSP 430. GSM was used to share the coordinates.
4. The saved mobile number receives the notice via GSM.
5. The precise GPS location is included.
6. The location and path are known through the application's metadata.

Algorithm

- *Step 1:* Start.
- *Step 2:* Signal from MEMS sensor.
- *Step 3:* If a Collision is detected, go to Step 4; else, go to Step 2.
- *Step 4:* Location traced by GPS.
- *Step 5:* GPS sends signal/message to MSP430.
- *Step 6:* Signal sent to GSM.
- *Step 7:* SMS sent to registered mobile number.
- *Step 8:* End.

EXPERIMENTATION AND RESULT

Creating a Proteus simulation of an accident identification and alerting system with MSP430, GSM, and GPS modules is a demanding undertaking that involves several critical steps, as shown in Figure 2. First, Proteus software must be opened, and a new project must be initiated. The custom components for the MSP430 microcontroller, GSM module, GPS module, and accelerometer or impact sensor must be found within Proteus libraries or created from scratch.

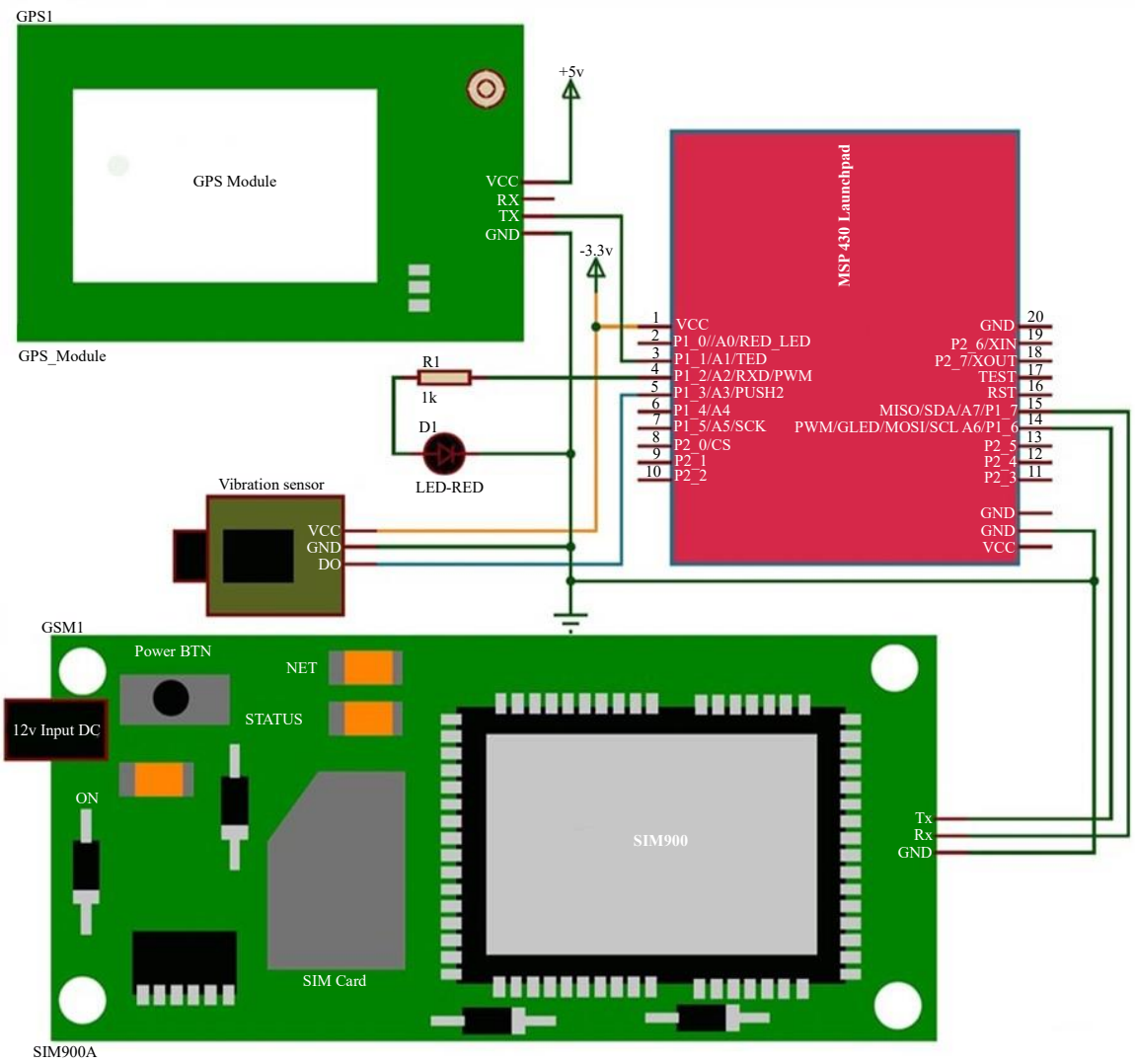

Figure 1. Circuit board for the accident identification system.

These custom components must be designed to mimic the behavior of their real-world counterparts, including the pin configurations and functionality. After placing and connecting these components within the workspace, attention is paid to programming the MSP430 with firmware that emulates data acquisition, accident detection, and alert generation, which must be incorporated into the MSP430 component in Proteus. Simulating sensor data and GPS output is essential, similar to modeling GSM communication to send and receive messages.

The simulation can also include an optional user interface if it has been designed. Testing and debugging the simulation to ensure accurate system behavior is crucial before proceeding to real-world hardware deployment, which involves additional considerations, such as power management, safety, and regulatory compliance.

CONCLUSION

This project can be used to detect accidents rapidly to rescue lives that have been through an accident. It is user-friendly and simple to comprehend. The system consists of hardware and software segments. The equipment unit had accident detection sensors installed in the car and was controlled by an MSP430 board. Advantages of this system include affordability, security, and ease of use. The approach presented in this study reduces the number of accident-related deaths.

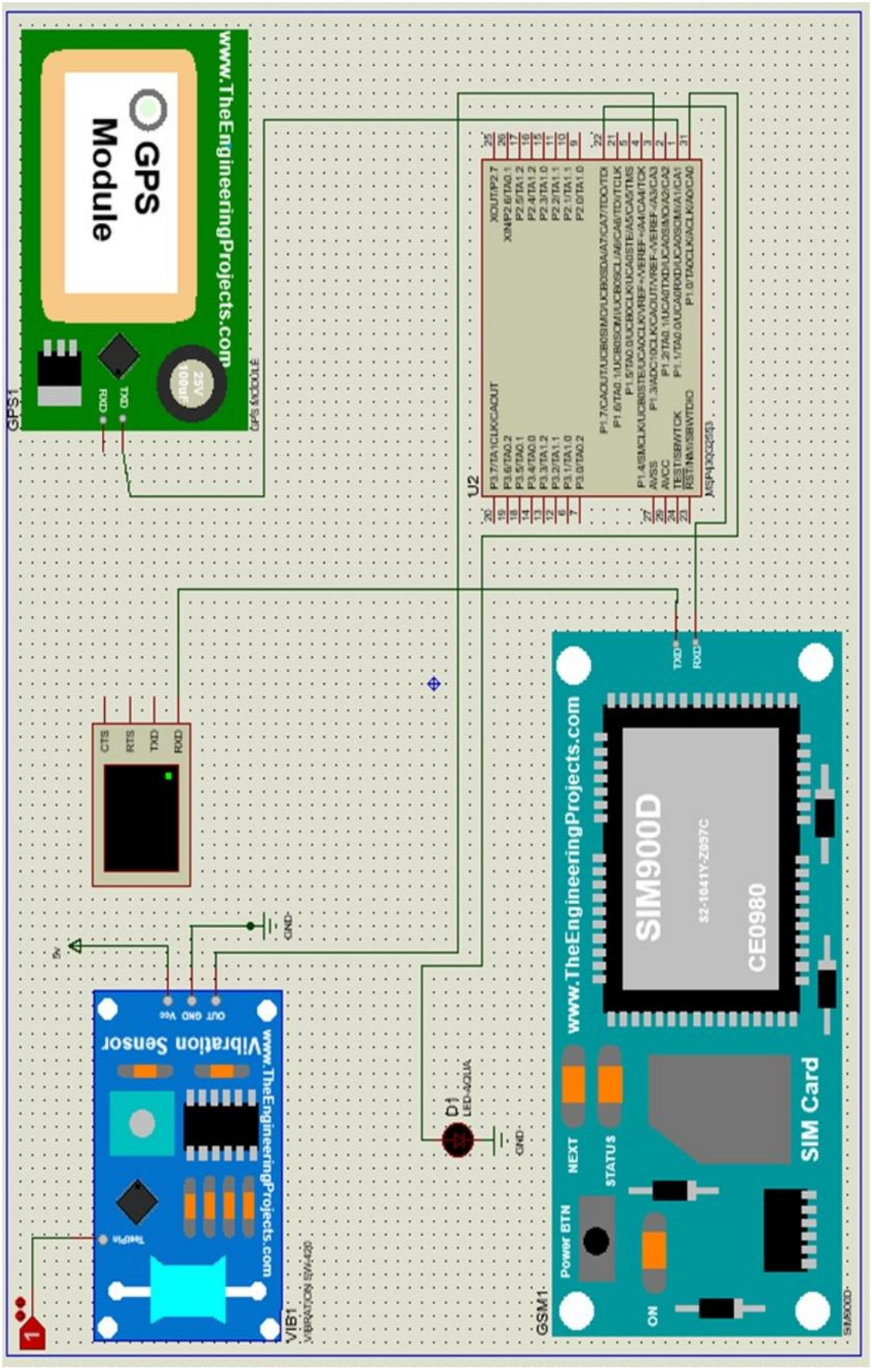

Figure 2. Connected circuit for accident prevention system.

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