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Design and Development of Road Accident Prevention and Detection System using IOT

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Abstract:

Vehicle accidents have become one of the major issues, which cause the death of many people around the globe. Presently India is in the top-ranked in death due to road accidents. This is a serious matter, which needs to be solved to save the life of many injured people due to accidents. To solve this problem many automobile companies have done different systems such as safety airbags, seat belts, camera sensors, etc. but still the cause and the effect of the accident cannot be reduced. One of the major solutions is to provide proper medical treatment to the victim on time. According to statistics whenever any kind of accident happens, the witness of the accident hesitates to help the victim due to the long procedure of reporting and inquiry to the police. Mostly the victim is not in a condition to ask for any sort of help from others in that situation. In such a situation, the life of the victim is in danger due to the lack of proper treatment and medical facility in time. To solve this problem there is an urgent requirement of a system that automatically detects the accident and based on that information it communicates about the accident and its location to the hospital and relative without any delay. In this work, an IoT based Automatic Accident Detection and Location Communication System is developed that continuously tracks the location of the vehicle, when any kind of accident occurs. It automatically detects the accident and based on that information it sends that location to the hospital, relatives, and to the police quickly. The key benefit of this system is its low cost, easy to implement, easy to use, processing speed, high accuracy, and its self-reliance.

An accident prevention system is being introduced with accident identification for vehicles that will give a higher probability to reduce the accidents taking place every day on roads and at the same time if an accident occurs, the system will locate its place and will automatically inform those people who will be able to take immediate actions. Here, an Arduino based system has been developed by using Global Positioning System (GPS) and Global System for Mobile Communication (GSM) technology. An accelerometer will also be used that will measure the velocity and the amount of the vehicle's tilting when it will strike over something. Also, whenever an accident takes place, the GPS will locate the geographical coordinates for that particular place, and using the GSM it will send an SMS. The same alert will update on the database server of IoT to monitor the parameters like alcohol detected or accident occurred.

Keywords **—GPS, GSM, SMS, IOT.**

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I. INTRODUCTION

In today's world there is a severe increase in the use of vehicles. Such heavy automobile usage has increased traffic and thus resulting in a rise in road accidents. This takes a toll on the property as well as causes human life loss because of unavailability of immediate preventive and safety facilities. Complete accident prevention is unavoidable but at least repercussions can be reduced. This embedded system can prevent the accident to occur and proper preventive measures are taken in this system. The ambulance service and the police station can easily find the location as the location along with the

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google map link was sent to their smart devices with mobile network accessibility. The system consists of eye blink sensor, temperature sensor, alcohol sensor, accelerometer, GPS module, GSM module, motor, buzzer, led etc. and all these devices are interfaced with the central micro controller unit. We are going to use eye blink sensor for detecting sleep by setting the certain time limit, if the driver gets sleepy, we can warn him. Temperature sensor helps us in detecting the heat of the engine and if the engine is overheated then that of a normal condition, we can warn the driver. Alcohol sensor helps us in detecting if the driver is drunk or not. If he/she is over drunk the vehicle provides warning and the engine stops functioning. Accelerometer detects the occurrence of accident and sends signal to the micro controller for further functioning. GPS module provides us the location, speed, time and date of the certain place where the vehicle is in the real time. If accident occurs, the location of accident that we get from the GPS is send to the ambulance service and police by the help of GSM module. Everything might be all right after a simple accident so the driver can re-inform the ambulance service and police station in this case using IoT we can detect the status w.r.t date and time.

II. LITERATURE REVIEW

There are products available in the market which are not reliable when it comes to synchronizing more than one parameter. The literature survey revealed that systems available in market has a major disadvantage, it is specifically designed for one sole purpose like Accident detection, Accident prevention or accident reporting. These systems on their own have many advantages but these systems, but from cost point we have to reconsider our decision to buy these products due to their lack of multitasking ability. These systems are useful as it improves their functionalities by adding a feature to the existing system will increase the redundancies. To overcome this disadvantage, we are proposing a system which could increase the functionality and reliability such that it can prevent the vehicle accident along with accident detection system and accident reporting to the ambulance service and police station. Thus, our proposed system is much more advantageous over the existing system. Sensors are used in everyday objects such as touch-sensitive elevator buttons (tactile Sensor) and lamps which dim or brighten by touching the base, besides innumerable Applications of which most people are never aware. With advances in micromachinery and easy-to-use microcontroller platforms, the uses of sensors have Expanded beyond the traditional fields of temperature, pressure or flow measurement, For example into MARG sensors. George Atwood invented the very first accelerometer in the 1700s. The Atwood Machine, as it was called, consists of masses on springs where the velocity is calculated Based on displacements experienced.

The Global Positioning System (GPS), originally Navistar GPS, is a satellite-based Radionavigation system owned by the United States government and operated by The United States Space Force. The GPS project was started by the U.S. Department of Defense in 1973, with the first prototype spacecraft launched in 1978 and the full Constellation of 24 satellites operational in 1993.The Global System for Mobile Communications (GSM) is a standard developed by The European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile devices such as Mobile phones and tablets. It was first deployed in Finland in December 1991. By the Mid-2010s, it became a global standard for mobile communications achieving over 90% Market share, and operating in over 193 countries and territories. 2G networks Developed as a replacement for first generation (1G) analog cellular networks. Subsequently, the 3GPP developed third-generation (3G) UMTS standards, followed by the fourth-generation (4G) LTE Advanced and the fifth-generation 5G standards,

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Which do not form part of the ETSI GSM standard.

Many researchers have focused their work on an accident monitoring system to control road accidents and save lives. Some of the work has been discussed in this section. In one of the works [3], the author proposed the concept of GPS receiver to get information about vehicle speed to detect an accident. The GPS system monitors and compares with previous values with Microcontroller. Decrease of speed to a certain limit then this is declared to be an accident. In [4], the author proposed the concept of the incident detection system to detect the accident by using the car airbag sensor with GPS and GSM.

In another paper [5], the author proposed the accident detection system by using the Smartphone. In [6], the author uses the sensor to prevent the accident, and the wireless module is used for reporting purposes. The main drawback of this technique is it is very much expensive and difficult to install. In [7], the author discusses the accident is detected by using the accelerometer and flex sensor after that the location is provided to the nearest hospital, police station by using the GPS system and GSM module. In one work [8], the author proposes that the accident is detected by using the GPS speed and map-matching algorithm. Finally, that data is sent to the Server. In this system, the GPS will automatically track the position and the vehicle speed in every 0.1-second time interval to observe the vehicle. In another work [9], the author discusses the Real-Time Embedded System for Accident Prevention. Here the author designs an Atmega328P microcontroller system to track the location and alert corresponded people. Here the total process is done automatically which is very much helpful as after the accident the person may not able to send the location information to others [10]. Here the total process is divided into two parts one is the Receiver side and another one is the Transmitter side. Here in the transmitter side, the speed of the vehicle controlled by using the RF transmitter, which is placed at a fixed distance from the zone. Here for the security system, different types of sensors are used such as smoke sensors, alcohol sensors, and eye sensors. Here the piezoelectric sensor is used which will automatically detect the signal when the collision occurs and then it sends the information to the Atmega320P microcontroller [11]. Finally, the location of the place is estimated by using GPS and sends information to previously stored numbers (house, hospital, etc.) [12]. In [13], the author proposed the concept of the automatic smart accident detection system. In this work, the sensor continuously observed the change in speed, movement which is analyzed in the Smartphone application. In another work [14], the author proposed the Smoothed Particles Hydrodynamics (SPH) based accident detection system. Here at first, the motion flow is captured from the videos. After that, the coherent motion field is extracted from thermal diffusion and the moving particle is approximated. Then the potential particle is obtained to detect the accident from the video. The authors [15] propose an automatic accident detection system by using street surface estimation of traffic. The technique is not effective because there was a chance of false alarming and then it will be not sure to prevent or report an accident. In [16], the author proposes which uses module such as GPS, accelerometer, gyroscope, GSM, and auto-dialer. In this system, the MPU6050MEMS sensor is used to detect the accident by using the 3-axis accelerometer and gyroscope. And the GPS module tracks the location of the accident which is sent to emergency providers. After that, the auto-dialer feature automatically informs the victim's family about the accident. In one of the works [17], an application was developed to detect the accident and provides the notification to the medical

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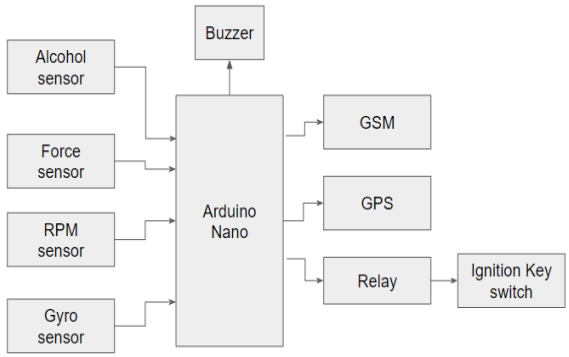
associates timely. In [18] the author proposed the concept of fog-based accident management system using the smartphone inbuilt sensor is used to detect the accident. In another paper [19] the author proposed the concept of smart accident detection system by using the vehicle sensor which continuously observes the speed, pressure, rotation movement of the vehicle. After that, the Smartphone analyzes the sensor data. Here the app is designed to analyze the data of the sensor to detect the accident.

III. PROPOSED SYSTEM

In this proposed project we are going to control the speed of the vehicle according to the respected zones. Our project explains that a various color strips are marked on the road where we need to control the speed within the limit and vehicle will have a color sensor attached in it which will recognize the color marked on the road and accordingly maintain the vehicles speed in that particular limit.

Unfortunately, if any accident happens the family members or emergency services are not informed in time. This results in late emergency service response, which can lead to an individual's death or cause severe injury. In this project we are using an android smartphone to detect accidents and report it to the nearest available emergency responding stations with the exact location of victims where an accident took place through an IoT application. Hence, vehicles today require security which can be achieved with the help of this application. Through the mobile application we can constantly monitor the speed of the vehicle, whether the vehicle is met with an accident or someone is trying to steal the vehicle. We propose a vehicle system for accident prevention and accident alert to make the world a much better and safe place to live.

This proposed system does not depend on external inputs to detect accidents, it is a self-accident detection technique. In this system, there is a setup that contains an accident-detection sensor, GPS receiver, ESP 32 that work collectively to detect accidents instantly and will send alerts via SMS to family members and police stations. At the same time the status is updated on the cloud server. If alcohol detected before the start of car the car will not start and alert gives alcohol detected, If the alcohol detected while running the car then car speed automatically decrease and driver have to stop the car. If the speed increases above the limit, then the buzzer continually rings. Force sensor is used to detect the impact and send the SMS with GPS location and update the cloud server for the same. We can access the cloud server website from mobile or laptop too.



We use Arduino nano main controllers, sensors are Alcohol sensor, Force, RPM for speed, Gyro for axis. GSM for SMS, GPS for coordinates and Relay for ignition switch and Buzzer.

Initially Arduino is programmed to get the gyro,force and alcohol data. If alcohol is detected the relay will trigger and the ignition switch will not work so the car will not start. If RPM is above the limit (100km/h) then the buzzer ring continues. If an accident occurs the force sensor & gyro sensor send the signal to Arduino and send signal to GSM

to send SMS with GPS coordinate. Same will be updated on the cloud server database.

IV. SOFTWARE

The compilation processes-

The Arduino code is actually just plain old c without all the header part (the includes and all). when you press the 'compile' button, the IDE saves the current file as Arduino c in the 'lib/build' directory then it calls a makefile contained in the 'lib' directory. This makefile copies arduino.c as prog.c into 'lib/tmp' adding 'wiringlite.inc' as the beginning of it. this operation makes the arduino/wiring code into a proper c file (called prog.c). After this, it copies all the files in the 'core' directory into 'lib/tmp'. these files are the implementation of the various arduino/wiring commands adding to these files adds commands to the language The core files are supported by pascalstang's Procyon avr-lib that is contained in the 'lib/avrlib' directory at this point the code contained in lib/tmp is ready to be compiled with the c compiler contained in 'tools'. If the make operation is successful then you'll have prog.hex ready to be downloaded into the processor.

NOTE: the next release will see each architecture (avr/pic/8051) to treated as a 'plug-in' to the IDE so that the user can just select from a menu the microcontroller board to use and the IDE will pick the right compilation sequence. A program for Arduino hardware may be written in any programming language with compilers that produce binary machine code for the target processor. Atmel provides a development environment for their 8-bit AVR and 32-bit ARM Cortex-M based microcontrollers: AVR Studio (older) and Atmel Studio (newer).[53][54][55]

IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Sketch A sketch is a program written with the Arduino IDE. Sketches are saved on the development computer as text files with the file extension. ino. Arduino Software (IDE) pre-1.0 saved sketches with the extension .pde. A minimal Arduino C/C++ program consist of only two functions:

setup(): This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch.

loop (): After setup () function exits (ends), the loop () function is executed repeatedly in the main

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program. It controls the board until the board is powered off or is reset.

V. CLOUD SERVER

Cloud storage is a model of computer data storage in which the digital data is stored in logical pools. The physical storage spans multiple servers (sometimes in multiple locations), and the physical environment is typically owned and managed by a hosting company. These cloud storage providers are responsible for keeping the data available and accessible, and the physical environment protected and running. People and organizations buy or lease storage capacity from the providers to store user, organization, or application data.

Cloud storage services may be accessed through a collocated cloud computing service, a web service application programming interface (API) or by applications that utilize the API, such as cloud desktop storage, a cloud storage gateway or Web-based content management systems.

Cloud storage is based on highly virtualized infrastructure and is like broader cloud computing in terms of accessible interfaces, near-instant elasticity and scalability, multi-tenancy, and metered resources. Cloud storage services can be utilized from an off-premises service (Amazon S3) or deployed on-premises (ViON Capacity Services).[5]

Cloud storage typically refers to a hosted object storage service, but the term has broadened to include other types of data storage that are now available as a service, like block storage.

Object storage services like Amazon S3, Oracle Cloud Storage and Microsoft Azure Storage, object storage software like Openstack Swift, object storage systems like EMC Atmos, EMC ECS and Hitachi Content Platform, and distributed storage research projects like OceanStore and VISION Cloud are all examples of storage that can be hosted and deployed with cloud storage characteristics

For our project we use 000webhost.com as free web cloud server.

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