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Advanced Accident Support and Tracking System

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***Abstract:** In the present day scenario of vehicular road traffic, the risk of life has become a major issue. Around 400 deaths occur every day on India's roads according to a survey by The Indian Express. Also, vehicle theft is a big problem now-a-days and this demands for an efficient tracking system. Many technologies have come up in the recent years that aim at providing a safe driving and vehicle security experience to the people. But due to high cost, many people can't afford these technologies. We propose a system that ensures safety on roads and security against theft and is cost effective too. The system that we propose acts as a post-accident support, anti-theft and tracking system. It uses GSM and GPS modules along with microcontroller and some sensors to send message alerts to the concerned authorities and people.*
***Keywords:** Accident support, anti-theft, accident alert, vehicle tracking and vehicle locking.*

I. INTRODUCTION

In the modern world, transportation is something one can't live without. Automobiles have undoubtedly revolutionized the area of transportation. Owning these luxurious vehicles makes life comfortable but at the same time, they somehow increase the chances of subjection to road accidents. In addition to this, a lost vehicle accounts to a loss of property as the automobiles fall under the category of expensive entities. The research being carried out in the field of accident support and tracking is undoubtedly engendering radical changes in the design of tracking and accident support systems. The paper provides a design which has a single system that encapsulates both the features, i.e., tracking and accident support, and is cost effective and convenient to install in any vehicle, including the lower and cheaper models. The proposed system serves multiple purposes, like: First, in case of an accident, this system helps in informing the nearby hospitals and police stations, and the family member s of the person. Second, which is also a post-accident scenario, is the creation and maintenance of an active database that stores the location of an accident as soon as it occurs. This can help the government to identify the accident prone regions. Thus the causes of the accidents can be figured out and the government can then work on improving them. Third, there can also be a speed limit set by the owner exceeding which sends a message alert to the owner. For example, parents can set the limit, and if their ward drives above that limit, they will receive an alert on their mobiles. The fourth purpose is vehicle tracking, suppose you have hired a driver and after dropping you for work he takes the vehicle somewhere else. If he takes the vehicle beyond a given area set by you, you will receive an alert informing you of the location of the vehicle. This prevents the vehicle from being taken away without the knowledge of the owner. As for the fifth purpose, suppose the vehicle is stolen, and you now know the location of the vehicle, this system gives you an option of remotely locking the vehicle preventing it from being moved any further. And to prevent any accidents from happening, the vehicle does not lock immediately after the command to lock it is given, rather it locks when the vehicle is below a certain speed limit. The paper has seven sections. Section II represents the previous related work. Section III provides a block diagram of the proposed system. Section IV is the system implementation which talks in detail about how the system works. Section V gives a flowchart representation of the process flow. Section VI talks about the advantages of the system and section VII concludes the work.

II. PREVIOUS WORK

The onset of advancement in tracking and accident support systems can be tracked down to early 1990's. However, since then, there have been tremendous improvements in design of such systems. Reference [1] proposes a smartphone application in combination with a microcontroller. The application monitors the location of the vehicle continuously. In [2], the authors have proposed a system which has a feature of vehicle tracking and also the feature of the owner having the liberty to lock the vehicle if it gets stolen. This can lead to increased chances of accident as the vehicle is abruptly brought to rest. However, the system proposed in this paper has a feature of locking the vehicle only when it is brought to rest. This reduces the chances of accident. The authors in [5] have talked about an instrument that allows access to the vehicle's status only to the authorized persons using Arduino. Reference [4] proposes a post-accident support system that notifies the nearby police stations, hospitals and the stored contacts about the accident so that help can reach timely. The drawback here is that the system will notify the authorities even if it

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is a minor accident and there's no need of pinging the authorities or concerned people. In [6] and [8], again post-accident support is introduced, where the nearby police stations and hospitals along with family members are pinged immediately after the accident occurs. And if the accident is not severe, the owner can turn the system off using a switch so that there's no unnecessary pinging. However, this may lead to confusion if the alerts have already been sent before the owner turns the system off. In this paper , the proposed system uses a threshold value of the impact and the accident is detected by the stroke sensor only if the impact exceeds this threshold value. This way, the authorities are contacted only if an emergency case is detected. Also, most of the projects have used Arduino as the microcontroller, but Arduino is not at all suitable for commercial purposes. It consumes a lot of power, is bulky and works inefficiently when subjected to multiple applications at the same time. The proposed system uses PIC16F18345 microcontroller which is compact, consumes lesser power, is cheaper and provides good speed and performance for the applications the project focuses on. In addition to this, all the previous works talk about either vehicle tracking or anti-theft vehicle locking or post-accident support but the system proposed in this paper talks about all these features embedded in a single system. Also, there is no previous work related to the creation of a database that stores the time and location of accidents so that the government can identify the accident prone areas and take measures for improvement accordingly, so that the chances of accidents are reduced.

III. BLOCK DIAGRAM

The circuit drives its power from the vehicle's battery. A 9V battery is also used, which mainly acts as a backup in situations where the connection with the vehicle's battery is lost, for example, the post-accident scenario. But since the circuit requires a driving voltage of 4V, a voltage regulator is used. The block diagram of the system is shown in Fig. 1. The system uses PIC16F18345 Microcontroller as the control unit. The microcontroller is interfaced to GSM module, GPS module, stroke sensors, vehicle lock, and the speedometer.

IV. SYSTEM IMPLEMENTATION

A. Post-Accident Support:

For the first application which is the post-accident support, the following stages are performed:

1) *Stage 1:* The stroke sensor senses the impact of the stroke and outputs a digital value and this value is sent to the microcontroller.
2) *Stage 2:* The microcontroller receives the high pulse as an interrupt and an emergency case is detected and the controller initializes the GSM. For a low pulse sent by the stroke sensor, there's no emergency detected.
3) *Stage 3:* Once the GSM is registered, the microcontroller takes the position and time of the accident from the GPS and sends it to the nearest hospitals and police stations via GSM. Simultaneously, it also sends an alert to some contacts that the user may have stored (so that only trustworthy people are allowed to have the knowledge of the vehicle's location), and uploads the information to a cloud which has a database storing location and time of accidents which can later be referred for taking measures to avoid accidents in accident-prone areas.

B. Auto Call Attendant Applications:

For the rest of the applications namely vehicle tracking, vehicle locking, setting speed limit for the vehicle, the system uses auto attendant calling and activates DTMF (Dual Tone Multi-Frequency) in the GSM. DTMF allows the caller to access the following functions of the system:

1) *Setting the Vehicle Speed Limit:* The system provides the user with three options for choosing three different speed limits (coded in the microcontroller) by pressing different keys on the dial pad. The microcontroller sets the speed limit corresponding to the pressed key.
2) *Locking the Vehicle:* In case of theft, after the call is automatically picked up, the user presses the key defined for locking the vehicle. This key is recognized by the microcontroller which takes the speed as input from the speedometer. The controller then sends the command for locking the vehicle whenever it is brought to rest.
3) *Tracking:* When the key defined for the tracking application is pressed, the microcontroller takes the location from the GPS and using GSM, this location is sent to the contacts that the user may have stored.

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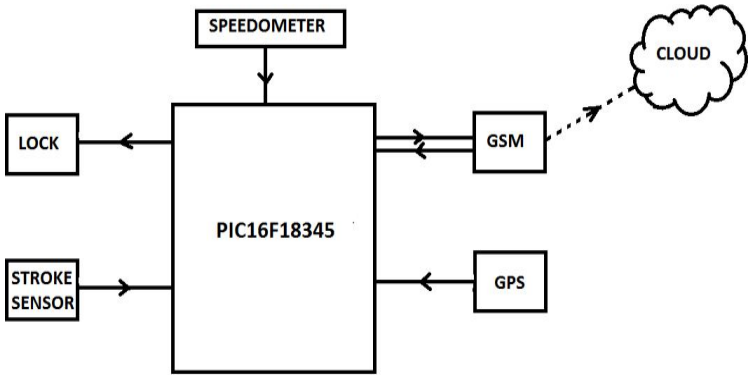


Fig. 1 Block Diagram

C. Speed Alert

The microcontroller keeps track of the speed of the vehicle continuously with the help of the speedometer. Whenever the vehicle exceeds the speed limit set by the user, the microcontroller commands the GSM to send a speed alert to the registered contacts. Every successive alert is sent only after at least 30 minutes of sending the previous alert.

V. FLOWCHART

MPLAB IDE software has been used to program the PIC microcontroller. The microcontroller is coded based on an algorithm that has been shown in Fig. 2 in the form of a flowchart. Specific key numbers have been allotted to each application in the flowchart for the auto call attendant system. The flowchart depicts how the same circuit responds to different situations in different ways and how the process flow continues.

VI. ADVANTAGES OF THE PROPOSED SYSTEM

When compared to other existing models, the proposed model has the following advantages:

1) *Cost effective:* Accident support systems have never been a common sight in vehicles. And the vehicles that have an accident support system are quite expensive and are affordable only by the elite class of the society. One doesn't expect lower end models or cheaper vehicles to come with this feature. The proposed model is cheaper than the existing models and can be installed even in lower model vehicles conveniently.
2) *Long life:* This system has a life of about 2.5 years and even after that the life can be extended by replacing the battery. As the system uses the vehicles battery and only uses its own battery in case of emergencies, the battery drainage is minimum.
3) *Flexible:* This system can be installed in any vehicle from bikes to cars, in any model which makes in flexible in its use.
4) *Accident Prevention Measures:* These systems send data to a database whenever an accident occurs. If many vehicles use this system, then whenever and wherever there is an accident, it will be recorded in the database which will be helpful in recognizing the accident prone areas and concerned authorities can then take suitable actions towards finding the cause helping reduce the accidents.

VII. CONCLUSIONS

The proposed project provides a portable, low cost and compact design which has a life of around 2.5 years. It appeals to a larger section of the vehicle owning society as it can be conveniently installed in any vehicle regardless of its model. This automated system can reduce the time for searching the location and consequently, the person can be treated as soon as possible which can save many lives. In addition to this, the database that stores the location, time and number of accidents provides sufficient data to the government to recognize the accident prone areas and to work up counter measures for the same. The locking function in addition to the tracking system increases the possibility of retrieving the stolen vehicle. The feature of getting an alert if the set speed limit is exceeded can help to reduce the chances of accident.

The proposed system caters to the general problems of any vehicle owner affordably.

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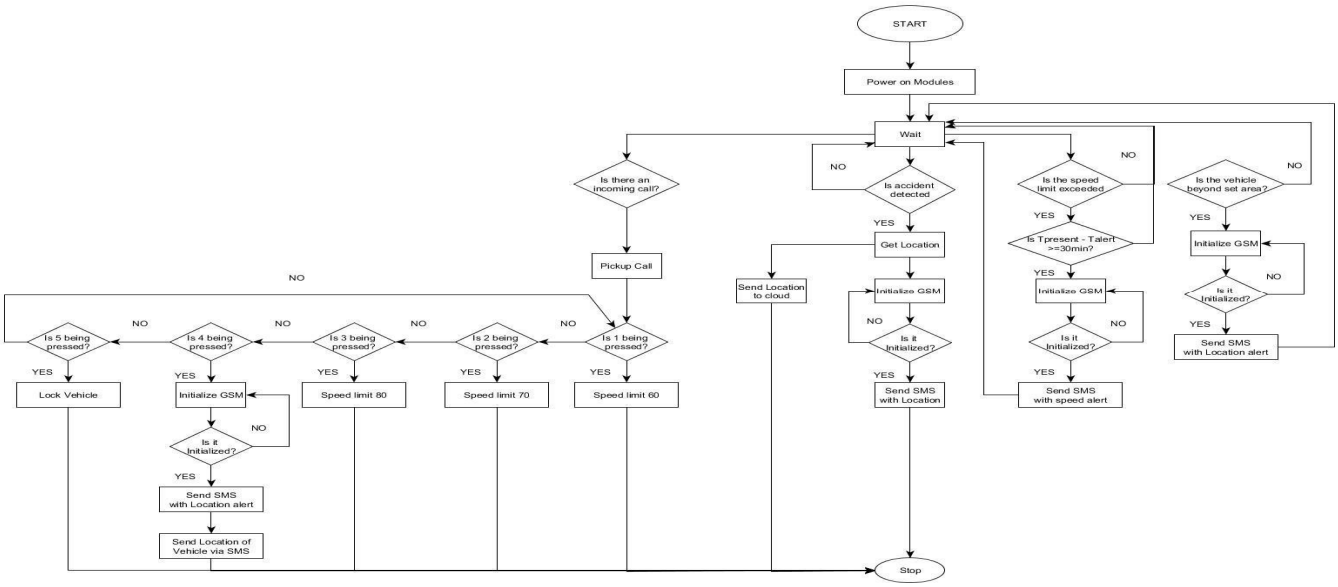


Fig. 2 Flowchart

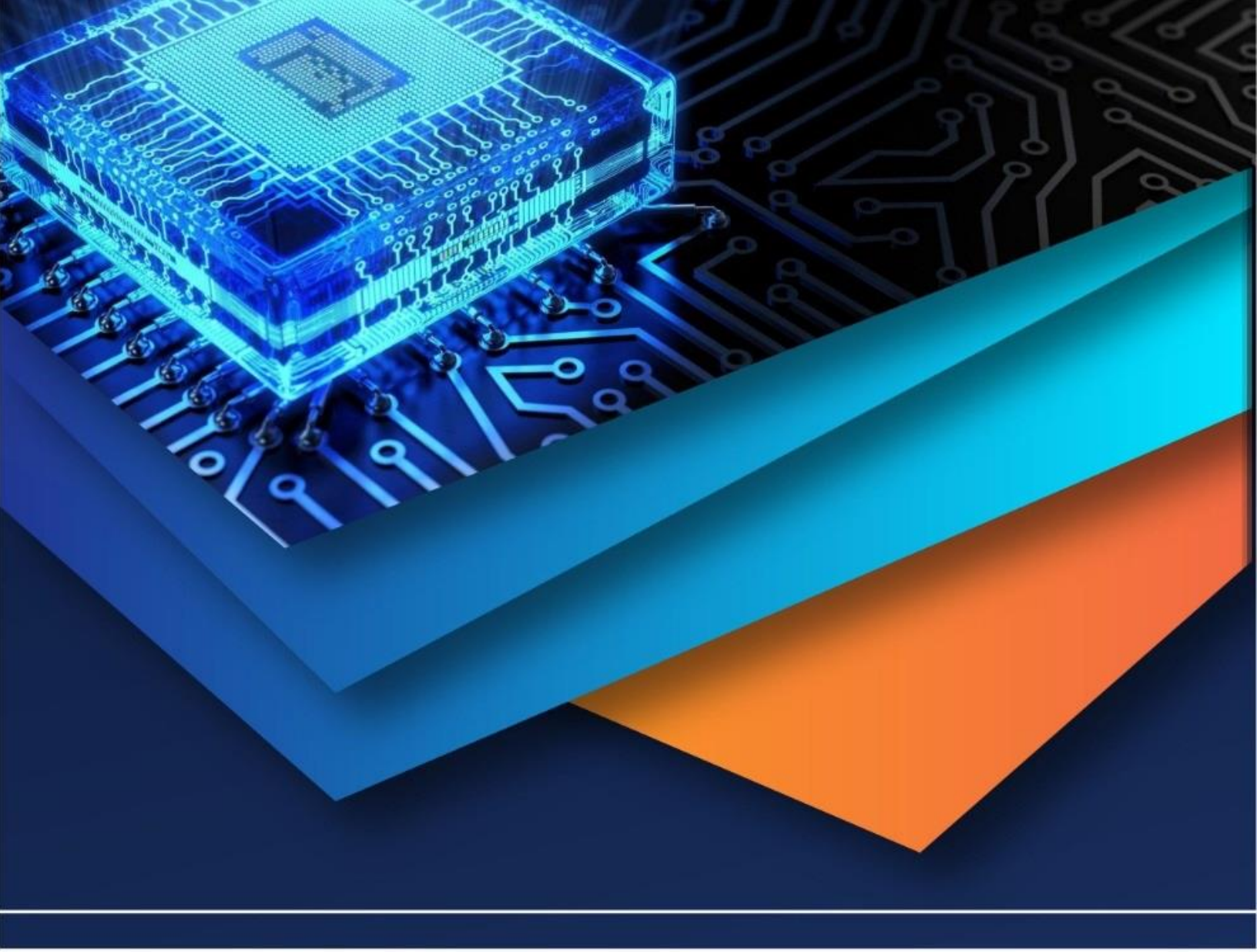
VIII. ACKNOWLEDGMENT

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