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IoT Based Automatic Vehicle Accident Detection and Rescue System

Raju Thommandru, Kopparapu Kalyani, Borugadda Swaroopa Rani, Konka Karunakar, Alapati Venkata Sai Prakash Guptha

Department of Electronics and Communication Engineering, Chalapathi Institute of Technology, Guntur, India.

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ABSTRACT

Human loss by road accidents has been a devastating issue, which possess negative implications on the socio-economic development of the societies. Most developing countries are recording higher volumes of fatalities whenever a road accident occurs due to the lack of a proper and quick system that reports accidents to the emergency services for an immediate rescue. Moreover, the chances of survival of any casualty of an accident is mostly dependent on how quick the emergency medical services arrive at the scene and quickly reaches the nearest hospital with the victims for treatment. However, these emergency vehicles are sometimes delayed by heavy traffic en route to and from the accident scene. This paper introduces a robust automatic vehicle accident detection and alert system, which uses an accelerometer to detect the tilting and the crashing of the vehicle, sends the Global Positioning System (GPS) location of the accident scene to intended security, medical and family contacts. The proposed design achieved a turnaround response, which is faster than conventional rescue system without these features. Hence, saving more lives as possible through technology.

Keywords: — Emergency Medical Services (EMS), Global Positioning System (GPS), Global System for Mobile Communication, Internet of Things (IoT)

1. INTRODUCTION

This project presents a driver assistance system which is used for lane departure of vehicles and also analysis of its working and stability with respect to changes in the behavior of driver. The driver assistance system,. Its designing wad developed from the preview of co-driver system which is a automatic system. The vehicle steering assist controller is designed using a driver model in order to take into account the driver's intentions in particular curve negotiation. This approach minimizes controller intervention while the driver is awake and steers properly. Usually, information flows through the interface from human to machine but not so often in the reverse direction. But in this model the system has an architecture in which bi-directional information transfer occurs across the control interface, allowing the human to use the interface to simultaneously exert control and extract information.

Good results are obtained using several criteria for human–machine cooperation. Poor stability situations were successfully avoided due to the robustness of the whole system, in spite of a large range of driver model uncertainty. The proposed method uses a robust lane marking detection algorithm, as well as an efficient shape registration algorithm between the detected lane markings and a GPS-based road shape prior, to improve the robustness and accuracy of the global localization of a robotic car. We show that, by formulating the positioning problem in a relative sense, we can estimate the global localization of a car in real time and bound its absolute error in the centimeter level by a cross-validation scheme. The cross-validation scheme integrates the vision-based lane marking detection with the shape registration, and it improves the accuracy and robustness of the overall localization system.

Vehicle detection can be defined as detecting the vehicles that are based on the various parameters such as colour, shape and size. It can also be defined as a system that executes the vehicle tracking. This is used to monitor traffic on roads. The traffic flow on the roads can be measured by the fixed installed sensors like induction loops, bridge sensors and stationary cameras. The traffic on smaller roads represents the main part of urban road networks that is monitored and in this the information is not collected about the on-road parked vehicles. Vehicle detection can also be defined as the detection of single vehicles by extracting the vehicle queues from the satellite imagery. The satellite imagery can be defined as a snapshot in time i.e. it covers a relatively vast area. The measurement is robust and repeatable over time even though it cannot be considered for continuous monitoring. Satellite imagery is used to estimate the vehicle fleets in countries and for these there is not an established ground based traffic monitoring systems. The vehicle detection and enumeration from satellite images requires pre-processing. The satellite sensors with very high resolution provide images with different atmospheric conditions and different viewing angles that can be affected by the illumination and pollution conditions in the urban areas. The spectral characteristics can also change by analyzing the multi temporal images.

2.LITERATURE REVIEW

In most parts of the developing countries, the automatic accident detection system has not been established. The accident can only be reported to the nearest police station when there is somebody who has witnessed the accident occurring in their sight or anyone passing by the scene. By so doing, most people lost their lives since this process isnot so effective in offering an immediate rescue required, as it all depends on the good attitude of the witness. In most cases, if the accident tends to occur at night or during harsh environmental conditions such as thunderstorms, snow or fog human movement is limited hence people perish in accidents without being noticed. More so, if a fatal accident occurs in the middle of a jungle, mountain range or desert usually it takes ages to notify the emergency services thus resulting in the loss of human lives. Thus, the current existing system of notifying the police about any accident, which have occurred is by the witness of a third party in most cases [5]. According to [6], an intelligent accident detection system was designed to sense a change in the original position of the vehicle using an accelerometer however a notification to the nearest hospital is only sent if the heartbeat sensor is activated. The signal from the accelerometer and the heartbeat sensor is sent to the driver's phone via Bluetooth and thereafter the driver's phone will notify the nearest health facility and the closest relatives via a text message. However, this design might be affected by phone glitches or even when the battery of the phone dies the process is terminated. Another approach of accident detection was investigated by [7], using GPS to keep track of the speed of a vehicle. A microcontroller is used in conjunction with the GPS module to compare in a period of a second, the current and the preceding velocity of the vehicle. The system presumes an accident to have occurred whenever the speed of the vehicle is under the set or threshold speed, thus it notifies with the exact spot of the scene of the accident to the responsible rescue services authorities. This system has a major drawback of ineffectiveness as vehicle accidents are not only caused by over speeding. Hence it is not a realistic and recommended method for effective accident detection. The authors in [8], designed a vehicle accident detection system based on Message Queueing Telemetry Transport (MQTT), which is used together with a vibration sensor connected to a NodeMCU microcontroller using Wi-Fi. All vibrations data collected from the sensor of the vehicle are consistently uploaded on cloud unless non-typical vibrations, which surpasses the set value are captured; then, an alert message is sent

via email to the next of kin registered on the system. The absence of GPS makes it difficult for the rescue team to locate the scene of the accident thus elongating the rescuing time, which increases a higher chance of the casualty to lose their lives. Also, the use of emails could be slow in rescuing the victim of the vehicle accident. Moreover, a smart phone can be programmed to detect the vehicle accident using Mamdani Fuzzy Logic, thus uploading all the information to the Data Centre. Upon detection an alert notification is sent to the registered relative numbers and the Communal Safety Authorities. The effectiveness of the rescue process solely relies on the proximity of the Communal Safety Authorities and the scene of the accident as presented in [9]. B. Smart Traffic Controller Systems Most emergency vehicles in developing countries use display lights and sirens to provide a sound signal for other traffic to make a way for that vehicle. However, this method is not efficient especially during peak hours (early in the mornings or late evenings) when most roads are heavily congested [10]. A smart traffic system was designed to aid emergency vehicles especially ambulances whenever it approaches a traffic junction in [11]. An android device is used from the emergency vehicle to interrupt the signal timing cycle of the traffic lights controlled by a microcontroller AT89S53 via Bluetooth so to prompt a green light signal for the emergency vehicle's lane [11]. The work in [12] designed a traffic light signal in a different dimension using the laser diode and photo diode to control the traffic density. Thus, the green signal is offered in first preference of the lane with the heaviest density whilst other lanes are on hold by a red signal. A more complicated approach of traffic management, which comprises of the use of radio frequency reader (RFID) tags and 8 barricades (2 per each lane) established before the zebra crossing lines so to block law breaking drivers who tends to override the red robot. In each lane, a RFID reader is installed on the wayside such that when an emergency vehicle passes by, the radio frequency tag on the emergency vehicle is easily detected by the RFID reader. Immediately after the RFID is initialized the barricade in that particular lane opens and the systems distorts the whole system of the traffic lights, turning to green signal so at to give first preference to the lane in which the emergency vehicle is located. At the same time the signal becomes red to the rest of the lanes and the barricades in those lane closes. This method is effective in reducing unnecessary accidents caused by reckless drivers [13].

2.EXISTING SYSTEM

Over the last few years, the automotive industry worldwide has shown considerable progress in its production. With the growing technology, rate of vehicle production is increasing and parallelly it can be concluded that the rate of accidents is also increasing. Road accidents lead to the high risk of people's life. This is because our country lacks the best emergency facilities [6]. This paper proposes an automated detection and alerting system for automobile accidents. This system helps in detecting the accidents in very less period of time, basically within a few seconds, send the basic information to the first aid center in a message including the time and location of the accident [2]. The alert message helps in locating the location so that the medical services can be provided on time and this way the precious lives can be saved. If in case there is no casuality and assistance is not required then you can terminate the message sending process using the switch provided in the device [16]. The message is transmitted via the GSM module, and the location of the accident is identified using the GPS module [3]. With the help of the Accelerometer sensor the accident can be precisely detected [11]. The angle of the car's rolls over can also be known through the accelerometer via the message. This application provides in the most feasible way the optimal solution to the poor emergency facilities provided for road accidents

3.PROPOSED SYSTEM

In proposed framework if a vehicle has met mischances, quickly a caution message with the area Coordinates is sent to the Control focus. From the control focus, a message is sent to the close-by rescue vehicle. Likewise flag is transmitted to all the signs in the middle of rescue vehicle and vehicle area to give serial Communication between ambulance and activity segment.. The main principle of the project is the detection and rescue management. The system is on and initialization. If vehicle is normal, no messages has been sent to rescue team. And the temperature level of the driver is monitored in all the time, if it reaches the threshold level then the action has been taken automatically. Whenever accident occurred, the MEMS sensor, tilt sensor and fire sensor detect the accident

happened with vehicle. Thecontroller get the input from sensors and send the accident alert information to road side unit and then message is send to the rescue team and also GPS finds location of the vehicle and that also send to the rescue team.

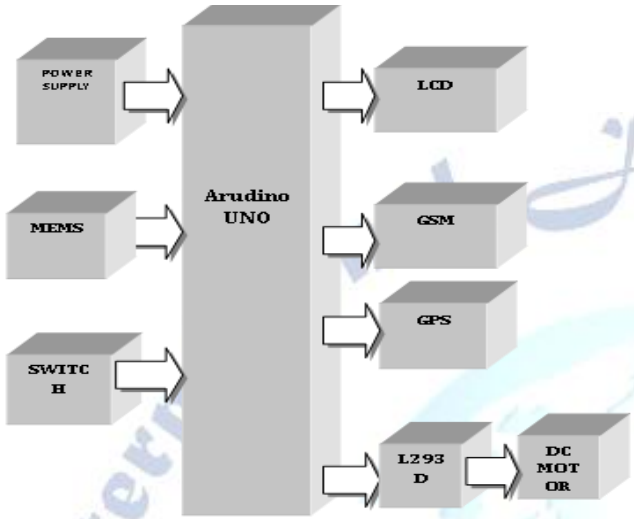

Figure1: **Block diagram of the proposed system**

4. RESULTS& DISCUSSION

When accident is occurred, the location details of vehicle/object collected by the GPS module from the satellite, this information is in the form of latitude and longitude scale. 2. Thus, collected information is then fed to arduino uno. Necessary processing is completed and therefore the information is passed to the LCD and GSM modem. 3. The GSM modem collects the information for arduino uno and then transfer it to the mobile phone through the SMS which is in text format to start ambulance.

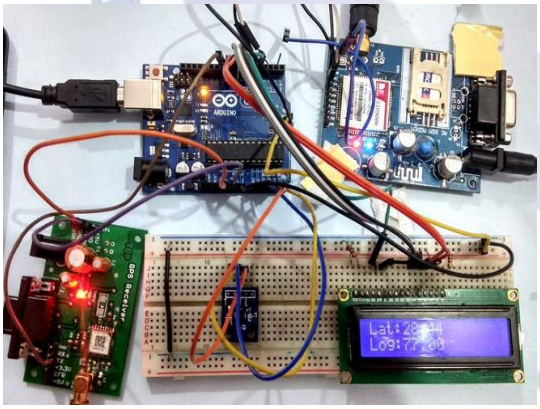

Figure 2: Implementation of the proposed system

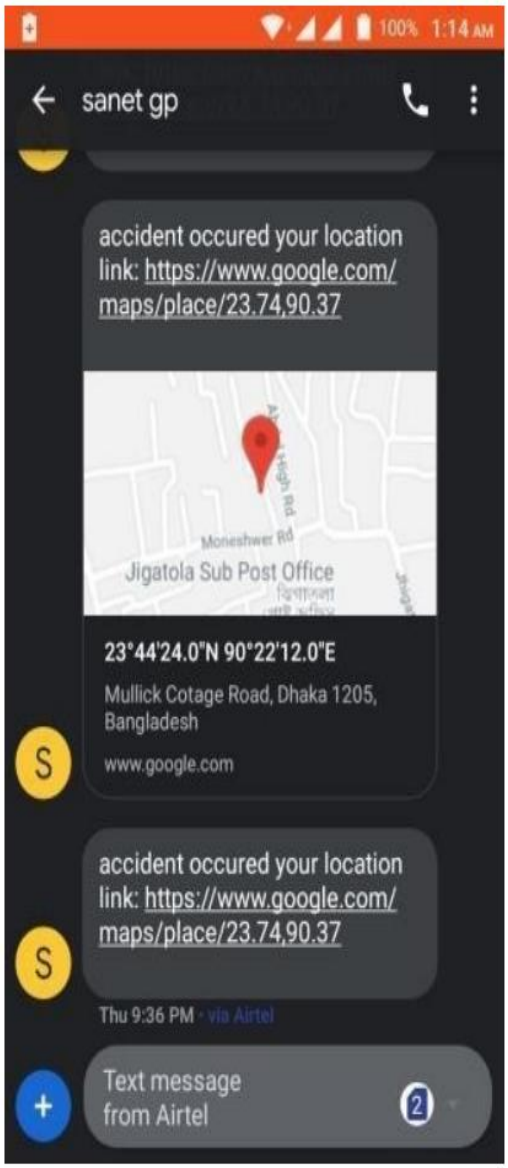

Figure 3: Sending SMS after an accident

The result and testing part is divided into two sections which represent the uniqueness of the framework and accuracy of the results.

System Test

System testing of software or hardware is conducted in a complete and integrated environment to evaluate its compliance with the specified requirements. System testing takes all integrated modules that have passed integrated testing as its input. The testing then aims to detect any inconsistencies between the units integrated. System testing can detect bugs with the interaction between different modules of a framework. System testing helps us to identify any such inconsistencies at an early stage of the development. Table 1 shows test cases, expected results and observed results of system testing.

Table 1: Test cases and results

Test Case	Expected Result	Observed Result	Test Result
Users should be able to get SMS from this system successfully	SMS should arrive	SMS received	Pass
User should see accident location	Accident location should be seen	Accident location can be seen	Pass
Ambulance should be able to get the direction to reach the accident spots	Ambulance should get proper notification	Gets the required notification	Pass
Authority should be able to update server	Can update server data	Data in the server can	Pass

5. CONCLUSIONS

The proposed system acts as a lifesaving system. This system utilizes ARM7 processor and Main Server which manages the information about traffic and ambulances data. The GPS used in the system to find the location of the accident spot (latitude and longitude).The Automatic Movement of Ambulance to the Accident Spot if implemented in countries with large population like INDIA can produce better results. It is more accurate with no loss of time. But there may be a delay caused because of GSM messages since it is a queue-based technique, which can be reduced by giving more priority to the messages interconnected through the server. The complete process of the system is carried automatically without human intervention. The system evaluated visually and found working perfectly.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] S. Iyyappan and V. Nandagopal, "Automatic accident detection and ambulance rescue with intelligent traffic light system," International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, vol. 2, no. 4, pp. 1319-1325, 2013.

[2] N. D. Ram, V. V. Krishna, D. K. Kalika and J. Kokilavani, "Smart Traffic Light Controller," Internal Journal of Latest Engineering and Management Research (IJLEMR), vol. 04, no. 03, pp. 83-89, 2019.

[3] B. Prachi, D. Kasturi and C. Priyanka, "Intelligent Accident-Detection And Ambulance- Rescue System," International Journal of Scientific & Technology Research, vol. 3, no. 6, pp. 67-70, 2014.

[4] N. Kattukkaran, A. George and T. P. Haridas, "Intelligent Accident Detection and Alert System for Emergency Medical Assistance," International Conference on Computer Communication and Informatics, 2017.

[5] A. M. Syedul, J. Jalil and M. Reaz, "Accident detection and reporting system using GPS, GPRS and GSM technology," International Conference on Informatics, Electronics and Vision, pp. 640-643, 2012.

[6] E. Nasr, E. F. Kfoury and D. J. Khoury, "An IoT approach to vehicle accident detection, reporting, and navigation," International Multidisciplinary Conference on Engineering Technology, pp. 231- 236, 2016.

[7] A. M. Abu-Mahfouz and G. P. Hancke, Extension to Simulate Localization System in Wireless Sensor Networks, Livingstone: IEEE African, 2011.

[8] B. R. Giridhar, "Traffic signals based on density with innovative clearance for ambulance," International Journal of Innovations in Engineering and Technology, vol. 7, 2016.

[9] R. Harshada, B. Tejas, V. Akshay , J. Ketan and M. Mihir , "Traffic density control," International Journal of Interdisciplinary Research, vol. 3, no. 4, 2017.

[10] W. R. Mouleeshu, D. S. Niviya, E. G. Pearlstone, K. M. Sathish and A. M. Yashar, "Make Way: An Intelligent Real-Time Traffic Light Control System," International Journal of Engineering and Advanced Technology, vol. 9, no. 2, pp. 709- 712, 2019.

[11] Ravikiran, D. N., & Dethe, C. G. (2018). Improvements in Routing Algorithms to Enhance Lifetime of Wireless Sensor Networks. International Journal of Computer Networks & Communications (IJCNC), 10(2), 23-32.

[12] Ravikiran, D. N., & Dethe, C. G. Fuzzy Rule Selection using LEACH Algorithm to Enhance Life Time in Wireless Sensor Networks. Advances in Wireless and Mobile Communications. ISSN, 0973-6972.

[13] Rajesh, G., Thommandru, R., & Subhani, S. M. DESIGN AND IMPLEMENTATION OF 16-BIT HIGH SPEED CARRY SELECT PARALLEL PREFIX ADDER.

[14] Polanki, K., Purimetla, N. R., Roja, D., Thommandru, R., & Javvadi, S. Predictions of Tesla Stock Price based on Machine Learning Model.

[15] Thommandru, R. A PROSPECTIVE FORECAST OF BRAIN STROKE USING MACHINE LEARNING TECHNIQUES.

[16] Rajesh, G., Raja, A., & Thommandru, R. OPTIMIZATION OF MINIATURIZED MICROSTRIP PATCH ANTENNAS WITH GA.

[17] Vellela, S. S., & Balamanigandan, R. (2022, December). Design of Hybrid Authentication Protocol for High Secure Applications in Cloud Environments. In 2022 International Conference on Automation, Computing and Renewable Systems (ICACRS) (pp. 408-414). IEEE.

[18] Vellela, S. S., & Balamanigandan, R. (2024). Optimized clustering routing framework to maintain the optimal energy status in the wsn mobile cloud environment. Multimedia Tools and Applications, 83(3), 7919-7938.

[19] Praveen, S. P., Sarala, P., Kumar, T. K. M., Manuri, S. G., Srinivas, V. S., & Swapna, D. (2022, November). An Adaptive Load Balancing Technique for Multi SDN Controllers. In 2022 International Conference on Augmented Intelligence and Sustainable Systems (ICAISS) (pp. 1403-1409). IEEE.

[20] Priya, S. S., Vellela, S. S., Reddy, V., Javvadi, S., Sk, K. B., & Roja, D. (2023, June). Design And Implementation of An Integrated IOT Blockchain Framework for Drone Communication. In 2023 3rd International Conference on Intelligent Technologies (CONIT) (pp. 1-5). IEEE.

[21] Vellela, S. S., & Balamanigandan, R. An intelligent sleep-awake energy management system for wireless sensor network. Peer-to-Peer Netw. Appl.(2023).

[22] Addepalli, T., Babu, K. J., Beno, A., Potti, B. M. K., Sundari, D. T., & Devana, V. K. R. (2022). Characteristic mode analysis of two port semi-circular arc-shaped multiple-input-multiple-output antenna with high isolation for 5G sub-6 GHz and wireless local area network applications. International Journal of Communication Systems, 35(14), e5257.

[23] Srija, V., & Krishna, P. B. M. (2015). Implementation of agricultural automation system using web & gsm technologies. International Journal of Research in Engineering and Technology, 04 (09), 385-389.

[24] Potti, D. B., MV, D. S., & Kodati, D. S. P. (2015). Hybrid genetic optimization to mitigate starvation in wireless mesh networks. Hybrid Genetic Optimization to Mitigate Starvation in Wireless Mesh Networks, Indian Journal of Science and Technology, 8(23).

[25] Potti, B., Subramanyam, M. V., & Prasad, K. S. (2013). A packet priority approach to mitigate starvation in wireless mesh network with multimedia traffic. International Journal of Computer Applications, 62(14).

[26] Potti, B., Subramanyam, M. V., & Satya Prasad, K. (2016). Adopting Multi-radio Channel Approach in TCP Congestion Control Mechanisms to Mitigate Starvation in Wireless Mesh Networks. In Information Science and Applications (ICISA) 2016 (pp. 85-95). Springer Singapore.

[27] S Phani Praveen, Sai Srinivas Vellela, Dr. R. Balamanigandan, "SmartIris ML: Harnessing Machine Learning for Enhanced Multi-Biometric Authentication", Journal of Next Generation Technology (ISSN: 2583-021X), 4(1), pp.25-36 . Jan 2024.