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IMPLEMENTATION OF REAL TIME ALERT SYSTEM FOR VEHICLE RIDER USING GPS

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Abstract

Speed is one of the basic reasons for vehicle accidents. Many lives could have been saved if emergency service could get accident information and reach in time. Nowadays, GPS has become an integral part of a vehicle system. This paper proposes to utilize the capability of a GPS receiver to monitor the speed of a vehicle and send alerts basing on monitored speed and send the location to an Alert Service Center. The GPS will monitor speed of a vehicle and compare with the previous speed in every second through a Microcontroller Unit. Whenever the speed will be below the specified speed, it will assume that an accident has occurred. The system will then send the accident location acquired from the GPS along with the time and the speed by utilizing the network. This will help to reach the rescue service in time and save valuable human life.

Keywords- accident monitoring, GPS, alert detection

I. Introduction

The development of a transportation system has been the generative power for human beings to have the highest civilization above creatures in the earth. The automobile has great importance in our daily life. We utilize it to go to our workplace, keep in touch with our friends and family, and deliver our goods. But it can also bring disaster to us and even can kill us through accidents. In 2009, 33,808 people died in vehicle traffic crashes only in the USA [1]. Speed is one of the most important and basic risk factors in driving. It not only affects the severity of a crash but also increases the risk of being involved in a crash.

Despite many efforts taken by different governmental and non-governmental organizations all around the world by various programs to aware of careless driving, yet accidents are taking place every now and then. However, many lives could have been saved if the emergency service could get crash information in time. A study by Virtanen et al. shows that 4.6% of the fatalities in accidents could have been prevented only in Finland if the emergency services could be provided at the place of an accident at the proper time [2]. As such, an efficient automatic accident detection with automatic notification to the emergency service with the accident location is a prime need to save precious human life. The Global Positioning System (GPS) is a popular technology that was developed by the American Department of Defense (DoD) for military use. Later on it was available for civilian use. It is utilized for a wide range of applications such as location, direction, speed, timing, surveying, logistics, traffic management, security etc. Nowadays, it has become an integral part of a vehicle

system for tracking and navigation system. It can provide accurate time, location coordinate and speed.

This paper proposes to utilize the capability of a GPS receiver to monitor the speed of a vehicle and detect an accident basing on the monitored speed and send the location and time of the accident from the GPS data processed by a microcontroller by using the network to the Alert Service Center. The rest of the paper is organized as follows. The Related Work section discusses the researches related to the accident detection system, the Equipment and Proposed Methodology section describes the required types of equipment and algorithm to detect the accident, alert detection and reporting procedure describes the procedure to calculate the speed to detect an accident and sending procedure and finally the paper is concluded.

II. Related Work

Many researchers carried out their studies on the alert detection system. Traditional traffic accident prediction uses long-term traffic data such as annual average daily traffic and hourly volume. In contrast to traditional traffic alert prediction, real-time traffic alert prediction relates accident occurrences to real-time traffic data obtained from various detectors such as induction loops, an infrared detectors, camera etc. Real-time traffic accident prediction focuses on the change of traffic conditions before an accident occurrence, while traffic incident detection studies are concerned with the change of traffic conditions after an incident occurrence [3]. However, the performance of these detection and prediction systems is greatly restricted by the number of monitoring sensors, available funds, algorithms used to confirm an accident, weather, traffic flow etc.

Besides the automatic detection system, manual incident detection methods detect the accident from the motorist report, transportation department or public crews report aerial surveillance or closed-circuit camera surveillance. The drawback of this type of detection system is that someone has to witness the incident. Moreover, there are delays and inaccuracies due to the expression problem of the witness. Compared to this detection method, driver initiated incident detection system has more advantages which include the quick reaction, more incident information etc. However, with the severity of the accident, the driver may not be able to report at all.

III. Equipment and Proposed Methodology

A. GPS Receiver

The sensor for alert detection is the GPS receiver. Nowadays, GPS technology has become more accurate, smaller, reliable, and economical. A very sensitive and accurate GPS signal acquiring device is required for the system. HI- 204III Ultra High Sensitive GPS receiver of Haicom Electronics Corporation is proposed for this project. The receiver continuously tracks all satellites in view and provides accurate satellite positioning data. Its 20 parallel channels and 4000 search bins provide fast satellite signal acquisition and short startup time which is <8 second in hot start and <40 seconds in cold start. Tracking sensitivity of -159dBm offers good navigation performance even in urban canyons having a limited sky view. It provides output in NMEA standards in every second which allows monitoring the speed continuously.

B. Microcontroller Unit

The microcontroller unit (MCU) is the heart of the system. It receives data from the GPS, processes all data and detects the accident from the processed data. The location of the accident is also sent by the microcontroller. PIC18F4550 is proposed for the system. The large amounts of RAM for

buffering, Enhanced Flash program memory and low power consumption make it ideal for the proposed system.

IV. Alert Detection and Reporting Procedure

A. Speed Measurement

Many techniques can be used to measure vehicle speed. The most common is the car speedometer. But analog to digital converter is required to acquire speed from the speedometer. Laser speed guns [5] are limited to a single point and instantaneous measurements. But a GPS receiver provides speed information in every second. Therefore, it is more convenient to monitor the speed with a GPS receiver. GPS receiver communication is defined by the National Marine Electronics Association (NMEA) specification [4]. The idea of NMEA is to send a line of data called a sentence that is totally self-contained and independent from other sentences. Out of these sentences, GPRMC is the most common sentence transmitted by most GPS devices.

This sentence contains nearly everything a GPS application needs. A GPRMC sentence contains the following:

$GPRMC, time (hhmmss), (A or V), latitude (ddmm.mmm), (N or S), longitude (dddmm.mmm), (E or W), ground speed in knots (kkk.k), direction (ddd.d), date (ddmmyy),,

*CS where Hhmmss: is time in hours, minutes, seconds in Coordinated Universal Time (UTC).

A or V: "A" (for "active") indicates that a fix is currently obtained, whereas "V" (for "inValid") indicates that a fix is not obtained. ddmm.mmm: latitude in degrees minutes and a fraction of minutes.

N or S: "N" indicates the North and "S" indicates the South hemisphere. dddmm.mmm: longitude latitude in degrees minutes and a fraction of minutes.

E or W: "E" indicates the East and "W" indicates the West.

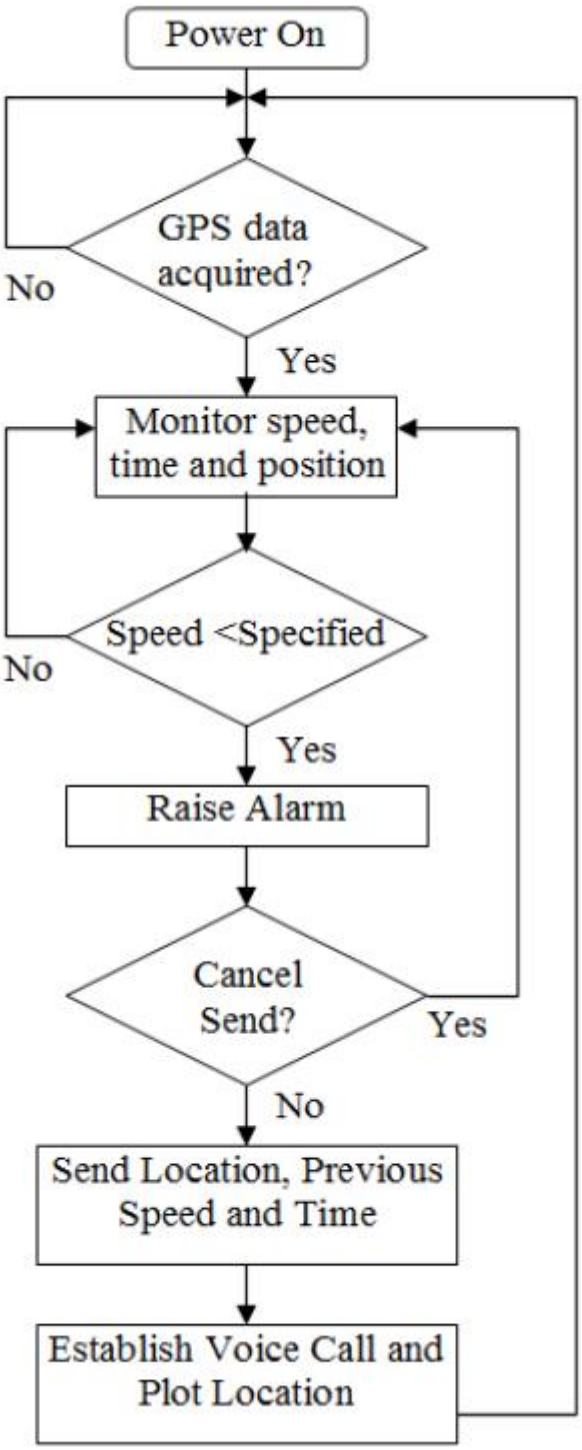
kkk.k: speed over ground in nautical miles per hour ddd.dd: indicates the current direction of travel in degree.

ddmmyy: indicates days, months, year in UTC.

B. Detection Procedure

Haicom HI-204III GPS provides data in RS-232 protocol. As such, a level converter (MAX232) is required to convert it to TTL and to connect it with the MCU's transmit and receive in. The GPS receiver acquires the GPRMC sentence in every second. From the GPRMC sentence, the speed information will be extracted by counting the number of comma (,) by the MCU. Two memory spaces will be allocated for the speed, one memory space for the time and another for the latitude and longitude. The latest time and latitude/longitude will be always saved in the memory overwriting the previous values. The last two-speed information will be always kept in memory. The latest speed information will be stored in the first memory space and will move to the second memory speed once new speed information is acquired.

The MCU will compare the latest speed with the previous speed. If the speed is less than the maximum speed found, the MCU will raise a flag to indicate an alert that an accident took place.



Flowchart of the accident detection and reporting system

V. Conclusion

Speed is one of the most significant causes of an accident. Nowadays, GPS receiver has become an integral part of a vehicle. Besides using for other purposes, GPS can also monitor the speed and detect an accident. It can use a very cheap and popular modem to send the accident location to the Alert Service Center. It can also send the last speed before the accident which will help to assess the severity of the accident and can initiate a voice call. Besides the automatic detection system, the vehicle occupant will be able to manually send the accident situation by pressing the Manual

Detection Switch. Rescue measures in time with sufficient preparation at the correct place can save much life. Thus, the proposed system can serve humanity by a great deal as human life is valuable.

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