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Driver Safety and Assistance System in Automative by Low Rate Wireless Personal Area Network



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ABSTRACT

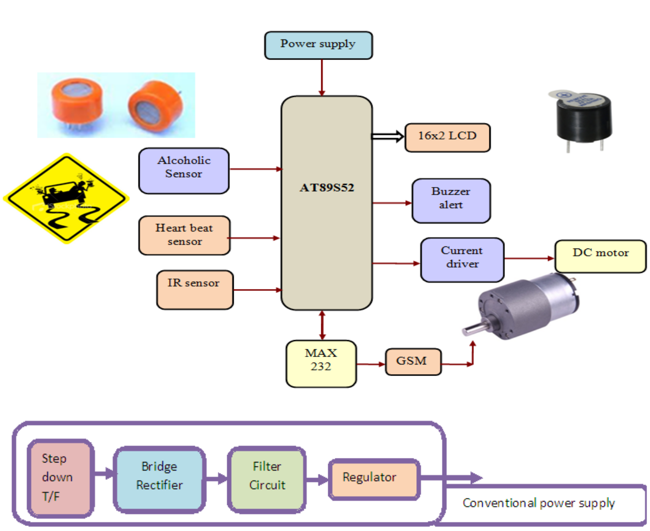
Driving while either intoxicated or drunk is dangerous and drivers with high blood alcohol content or concentration (BAC) are at greatly increased risk of car accidents, highway injuries and vehicular deaths. Every single injury and death caused by drunk driving is totally preventable. Although the proportion of crashes that are alcohol-related has dropped dramatically in recent decades, there are still far too many such preventable accidents. Unfortunately, in spite of great progress, alcohol-impaired driving remains a serious national problem that tragically affects many victims annually.

At present drunken drivers have increased enormously and so is the deaths due to drunken drivers. The main reason for driving drunk is that the police are not able to check each and every car and even if they catch any one the police can be easily bribed. So there is a need for an effective system to check drunken drivers. In our alcohol detection system the ignition of the fuel is regulated by a sensor circuit. The sensor circuit is used to detect whether alcohol was consumed by the driver recently. Our design also consists of sensor which is used to check whether alcohol is consumed while driving. The effects of drinking and driving are always risky and can often be lethal. This is an autonomous vehicle which moves by itself and avoids damage.

A heart beat sensor is also connected to monitor the heart rate. We also have a GSM modem interfaced to the controller to send the SMS to the concerned person when the alcohol is detected and abnormal heart rate at the driver. Here we are using AT89S52 as controller. In this way danger can be avoided. This project uses regulated 5V, 500mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer.

Keywords: **Actuators, Real time Control, Ultra sonic Sensors, Wireless Communication.**

BLOCK DIAGRAM:



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1.Introduction

Every year, in the United States alone, approximately six million automobile accidents take place. In total, those accidents result in about 43,000 deaths and 2.9 million injuries, not to mention the huge financial loss amounting to over 230 billion US dollars [1].
A large fraction of all automobile accidents is caused by the drivers' lack or lapse of concentration while operating their vehicles. Some drivers tend to occupy themselves with distracting activities, such as tuning the radio, eating, talking to passengers, or making cellular phone calls.
Other drivers find it difficult to maintain focus on driving, e.g., due to fatigue or health problems [2]. Elderly drivers may exhibit difficulties in personal mobility making it more difficult for them to reliably monitor the vehicle perimeter [3]. They may also develop other conditions having a negative (albeit not disqualifying) impacton their ability to focus on the road [4][5][6].

In this paper, we discuss the design concept and operation of a driving assistant, whose responsibility is to alert the driver to the presence of potentially hazardous objects within the vehicle's perimeter. By combining tactile, audio, and visual feedback, the system effectively extends the driver's range of perception as far as road conditions are concerned. In addition to directly helping the driver navigate through a busy road, it will also reduce the stress of driving, thus bringing in positive correlation into the overall experience. The net outcome of this assistance will be a reduced probability of accident.

The goal of our work reported in this paper was to establish the set of criteria for an effective
implementation of a driving assistant, to define such a system, and to build its working model from inexpensive off &t he &shelf components. The implementation was meant to yield further insights into the problem. For the sake of feasibility and easy demonstrability, the system has been installed on a ride & on toy car; however, its scalability to a "real" vehicle has not been lost from sight. One of our objectives was to make sure that the assistant could be in principle installed on any vehicle without permanent modifications to its exterior. For this reason, its sensor modules communicate over a wireless link and are powered of independent batteries. This way, they can be trivially attached to the vehicle's exterior, e.g., with magnets, without the need of wiring them to the data collection hub. The remainder of the paper is organized as follows: Section (2) discusses the current technology in driving& aid devices. Section (3) emphasizes on our proposed solution and the implementation of major functional blocks. Section (4) describes system &level integration.
Section (5) focuses on the overall test plan. Section (6) elaborates on system response time and possible sensing failure. Section (7) suggests follow & up work of our design. Finally, Section (8) summarizes the main contributions of our proposed solution.

2.Problem Statement

A. Existing Technology

Most of the academic research on driving support systems focuses on automating the actual driving rather than assisting the driver by enhancing its awareness of the car's surroundings [7] [8 to 16]. None of such automated driving systems are currently available to the public. On the other hand, several types of practical driving &aid devices have been developed and made available on the market. Blind &spot detectors, lane & change assistants, and back & up/parking sensors are a few examples. The current technology in driver support systems is diverse in terms of functionality, methodology, and implement tation. The common denominator of all those systems is obstacle detection by sensing: to this end they utilize various forms of sensors, such as laser light, ultrasonic, radar, infrared, and CCD cameras. For example, the parking support system from Backup& Sensor.com [17] places four ultrasonic sensors at the lower edge of the rear bumper. The blind & spot monitor from Valeo [18] deploys one multi &beam radar (MBR™)sensor on each side of the vehicle. Another blind & spot detector, from Xilinx [19], employs infrared sensors. The comprehensive and complex driving & aid system, put forward by the Lateral Safe project [20], integrates a long & range radar, an ensemble of short & range radars, and a set of stereovision cameras using sophisticated sensor fusion techniques. The existing driving & aid devices employ various types of indicators, such as beeping sounds and LED lights, to issue warnings to the driver. The parking system designed by Backup & Sensor.com [17] comes equipped with piezo & speakers whose beeping frequency increases as the car approaches an object. The Valeo blind &spot detector [18] emits alarm sounds and flashes LED icons on the rear view mirrors.

B. Areas for Improvement

An overview of the currently available driving & aid devices reveals a certain trend. Simple and inexpensive systems tend to focus on one specific area of the vehicle (effectively targeting a certain type of maneuver), e.g., the blind spots or the rear bumper. On the other hand, the more comprehensive systems, purporting to monitor the entire perimeter of the vehicle, are extremely complicated and thus very expensive [21]. Their decisions (based on data fusion from diverse sensors) are driven by complex rules involving AI techniques, which make them inherently uncertain and error prone [22]. In other words, there are many points where such a system may fail. Consequently, it cannot be both reliable and inexpensive at the same time.

The alert signals issued by the existing systems are limited to the audio & visual range, i.e., those signals consist of various beeps and lights triggered by the detected hazards. These days drivers tend to be more and more exposed to this kind of input, as the various personal devices (e.g., cellular phones, iPods, PDAs) compete for our attention. One can argue that the most likely type of driver being in a desperate need of reliable driving assistance is a person addicted to such devices and thus routinely overwhelmed by their noise. Such people will be inclined to subliminally push that noise into the background and, if not simply ignore it then at least fail to consider it instinctively a “true” alert.

The visual domain is not much better. Even ignoring the contribution of visual input from satellite radios and GPS navigators (which also constitute a considerable source or distracting audio input), the crowded metropolitan roads abound in numerous visual distractions. Advancements in technology will only tend to bring more of those, e.g., in the form of aggressive plasma displays, whose level of distraction is orders of magnitude above that of the old& fashioned marquee lights. Consequently, we envision two areas for improvement. First, our goal is to build a simple and inexpensive general & purpose system capable of parking assistance, as well as providing support during normal driving. Second, we would like to provide an extra level of sensory input, namely tactile feedback, whose role would be to clearly separate the system’s alerts from the background noise. Additionally, the wireless component of our system brings about the added value of flexibility, making it easy to install the driving assistant in any vehicle in a non& intrusive way (e.g., without drilling holes and/or modifying the vehicle’s wiring). As a byproduct of our exercise, we shall validate the feasibility of a low & cost, low & power radio channel for replacing wires in a sensor& based driver aid system.

3. The Proposed System and its Implementation

As stated in the previous section, our main objective was to define and functionally verify a new inexpensive driving assistant addressing the need for broader area coverage and more effective stimulation for the driver. The design features a network of sensors mounted around the exterior body of the vehicle. The system also employs several types of actuators to indicate the different levels of hazard to the driver.

The proposed system contains five physically separate components: four of them are the sensor modules, called nodes in the sequel, to be attached to the car’s exterior, and the fifth one is the controller responsible for coordinating the operation of the nodes, collecting data from them, and presenting alerts to the driver. The sensor modules cover the two front corners and the blind spots on both sides of the vehicle. While the blind spot areas are the most likely ones to be neglected by drivers, the two front corners are found to produce the highest accident rates [20]. All five modules are built around the same processing unit consisting of a micro controller and a radio transceiv er.

Figure 1 shows the correlation among the system components. The sensor modules employ ultrasonic sensors, while the controller connects to three types of indicators: the LEDs panel, the buzzer, and the vibrators mounted on the steering wheel.

4. The Sensors

The function of the sensor network is to detect objects appearing in the four zones around the vehicle. Those objects can be stationary (located on the side of the road), e.g., trees or buildings, or mobile, such as other vehicles or pedestrians. The driving assistant detects objects in the monitored areas via ultrasonic proximity sensors. Infrared and radar sensors were considered as possible alternatives. However, infrared sensors lack the accuracy of their ultrasonic counterparts due to the ambient noise and infrared radiation [23]. Radar sensors, on the other hand, are expensive and complicated in use, because of the need for CPU & intensive image processing techniques. In addition to raising the project cost directly (by being expensive themselves), they would also need a more complex processing platform, which would also increase the cost of their encasing sensor modules.

5. Future Work

As the first design of the driving assistant, the prototype system has room for improvement in several areas.

A. Sensor network

The number of ultrasonic sensors in the sensor network can be increased to provide better coverage around the vehicle. In particular, the rear end and the front of the car require some form of scanning in addition to the blind spots and the two front corners covered by the current system. Furthermore, numerical analysis techniques may be applied to filter out erroneous readings and reduce the effect of noise in the sensor measurements. Also, instead of using off & the & shelf components, device & specific sensors can be designed and manufactured for use in the driving assistant.

Our experiments have indicated that the wireless network is a reliable medium for the type of system represented by our driving assistant. In particular, we have never experienced congestion problems resulting in prolonged packet loss that would affect the real & time status of an alert. This is because the alert notifications (in their present form) pose little demand for bandwidth. However, the situation may change when more sensors are added to the network, especially if the data sent by those sensors are more complicated than sequences of simple numbers. Note that any numerical processing should be done in the controller rather than the node. This is because 1) the controller is less power & constrained, 2) the processing capabilities can be centralized in one place, which will reduce the cost of the whole system. This approach, however, may increase the bandwidth required to convey the raw data to the controller and bring about congestion. Notably, the present communication protocol is open for natural improvements. First of all, considering the short distance of communication, the transmission rate can be increased (up to about 100 kbps for CC1100). Second, a TDMA scheme can be employed to guarantee bandwidth for critical nodes. The proper design clearly depends on the content and frequency of the requisite messages, but it appears feasible under all conceivable circumstances. Another advantage of the wireless sensor network is its futuristic provision for communication among different vehicles. By announcing and possibly synchronizing their mane uvers, multiple vehicles sharing the road may be able to arrive at a better social behavior, which would clearly translate into a reduced likelihood of collisions.

B. Indicators

A more elegant way of implementing the vibrators on the steering wheel would be to design a special fabric that produces tactile stimuli. The entire steering wheel can be wrapped with such a fabric, so the drivers may grip on any portion of the steering wheel, using one hand or both hands, and still feel the stimuli.

6.Conclusion

Starting from conceptualizing, designing, building to finally presenting, we have designed a driving assistant system which could be a possible solution for accident prevention. Three innovative features are characteristic of the prototype design discussed in this paper. First, an ultrasonic sensor system is implemented to detect foreign objects in areas around the blind spots and the front corners of the vehicle The underlying software is structured so that many more sensor nodes can be easily integrated into the system. Finally, the work of this project can be further expanded to evaluate the traffic pattern of multiple vehicles, which may potentially become a valuable asset for future studies in traffic control and accident prevention.

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