INTELLIGENT BRAKING SYSTEM FOR AUTOMOBILES

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Abstract - - In most urban areas of the world especially in India accidents related to transportation and automobiles cause a huge number of fatalities. This can be contributed to the poor infrastructure, lack of road etiquettes and almost nonexistence of measures to enforce laws of the road. On average, 1214 accidents take place every day in the country. The Intelligent braking system could play an important role in reduction in the number of accidents by a simple solution of governing the speed of the vehicles. It uses GPS coordinates to locate the present zones that are the most accident prone like schools and hospital areas. The vehicle entering to these zones will acquire the assigned speed limit by the activation of brakes.

***Key Words*: Intelligent braking system, GPS supported braking, automobile braking.**

1 .INTRODUCTION

In most urban areas of the world especially in India accidents related to transportation and automobiles cause a huge number of fatalities. This can be contributed to the poor infrastructure, lack of road etiquettes and almost nonexistence of measures to enforce laws of the road. On average, 1214 accidents take place every day in the country. The Intelligent braking system could play an important role in reduction in the number of accidents by a simple solution of governing the speed of the vehicles.

1.1 Principle

Intelligent Braking System uses GPS coordinates to locate the present zones that are the most accident prone like schools and hospital areas. The vehicle entering to these zones will acquire the assigned speed limit by the activation of brakes. The traditional medium used for brake system (compressed air) can be now controlled with the speed and precision offered by modern electronic abilities. Intelligent Braking System (IBS) introduced in commercial vehicles providing rapid brake response and release for every single wheel therefore ensuring safety. The extremely rapid response time provided by the electronic control can be used for crucially shortening the braking distance by introducing advanced control of braking system operation. Such a complex task imposed to the control of braking system cannot be based on the driver abilities and need to be done independently of the driver. The advanced strategy for the braking force management, proposed here, is based on intelligent controlling of the braking forces distribution between the front and rear axle of power-driven vehicle and/or between towing/trailer combination and/or between tractor/semi-trailer. Intelligent braking system has a lot of potential applications especially in developed countries where research on smart vehicle and intelligent highway are receiving ample attention. The system when integrated with other subsystems like automatic traction control system, intelligent throttle system, and auto cruise system, etc. will result in smart vehicle maneuver. The driver at the end of the day will become the passenger, safety accorded the highest priority and the journey will be optimized in term of time duration, cost, efficiency and comfortability. The impact of such design and development will cater for the need of contemporary society that aspires quality drive as well as to accommodate the advancement of technology especially in the area of smart sensor and actuator. The emergence of digital signal processor enhances the capacity and features of universal microcontroller.

1.2 Working

The overall system is designed so that the position of the vehicle is determined using GPS coordinates and corresponding values are fed into the DSP for processing, resulting in the DSP issuing commands to actuator to function appropriately. The most popular systems like Antilock Braking Systems (ABS), Traction Control and Stability Control employ different types of sensors to constantly monitor the conditions of the vehicle, and respond in an emergency situation. An intelligent braking system includes a GPS module integrated either in a smart phone or a navigation system which continuously acquire vehicle's position and sends to the microcontroller through Bluetooth. The microcontroller processes the data and controls the brake pressure by using solenoid valves and thus actuating the brakes.

2. COMPONENTS

(A). Electronic Brake Control Module

The controlling element of the intelligent braking system is a microprocessor-based Electronic Brake Control Module (EBCM). If the vehicle is equipped with traction control, the microprocessor is called the Electronic Brake Traction Control Module (EBTCM). Inputs to the system include four wheel speed sensors, Bluetooth module, the brake switch, ignition switch and unswitched battery voltage. Outputs include three bi-directional motor controls, four indicator controls, two solenoid controls, and the system enable relay. A serial data line, located in terminal 9 of the Data Link Connector (DLC), is provided for scan tools.

The EBCM/EBTCM monitors the speed of each wheel. If any wheel begins to approach lock-up and the brake switch is on, the EBCM/EBTCM controls the motors and solenoids to reduce brake pressure to the wheel approaching lock-up. Once the wheel regains traction, brake pressure is increased until the wheel again begins to approach lock-up. This cycle repeats until either the vehicle comes to a stop, the brake is released, or no wheels approach lock-up. Additionally, the EBCM/EBTCM monitors itself, each input (except the serial data line) and each output for proper operation. If any system malfunction is detected, the EBCM/EBTCM will store a DTC in non-volatile memory (DTCs will not disappear if the battery is disconnected).

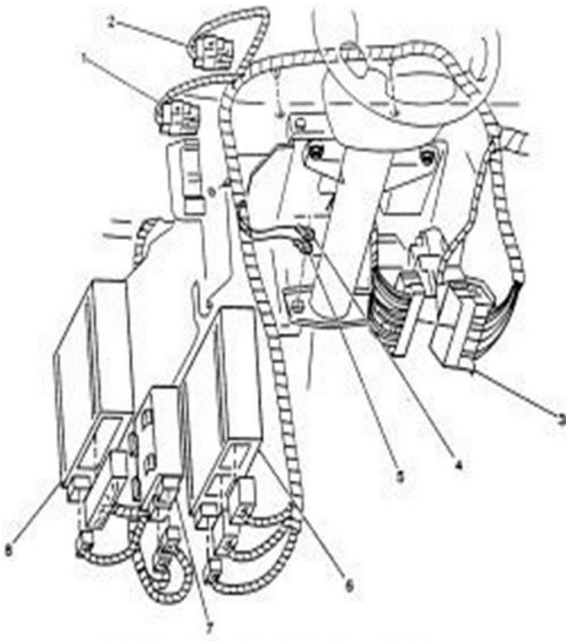

FIG 1. Electronic brake control module

Components of EBCM are- (1). Hazard Lamp and Turn Signal Lamp Flasher (2). Electronic Brake Control Relay (3). Electrical Connector C201 (4).Instrument Panel Ground Connection (5). ABS Ground Connection (6). Body Control Module (BCM) (7). Daytime Running Lamps (DRL) Control Module (8). Electronic Brake Control Module (EBCM)

(B). Bluetooth Module (BC-05)

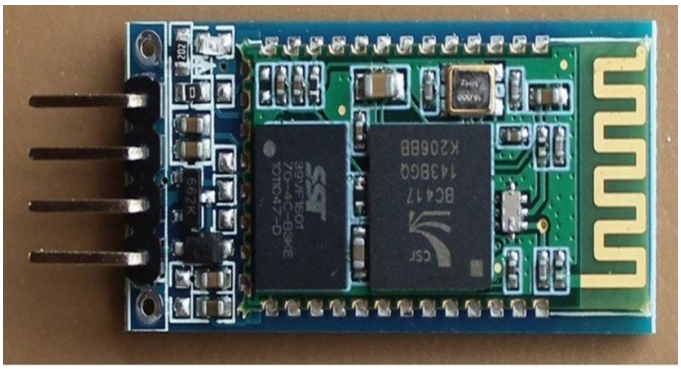

FIG 2. Bluetooth Module

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature).

(C). Arduino UNO

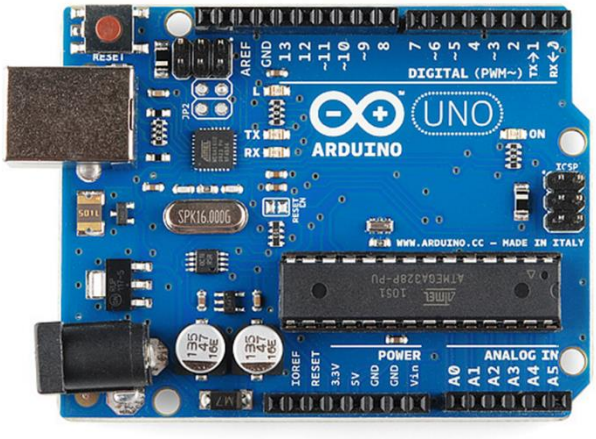

FIG 3. Arduino UNO

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. The Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

Features:

Microcontroller: ATmega328

Operating: Voltage 5V

Input Voltage (recommended): 7-12V

Input Voltage (limits): 6-20V

Digital I/O: Pins 14 (of which 6 provide PWM output)

(D). GPS module /Smart phone

The GPS module used in our Project is integrated in the smartphone which is used to pair the phone with the Bluetooth module in the micro controller. GPS module can

also be used with a navigation system. It continuously locates the vehicle's position and sends the feedback to the microcontroller through Bluetooth.

The schematic representation of Intelligent Braking System using GPS is illustrated in the below figure. It consists of EBCM, Arduino (microcontroller), Bluetooth module, and a GPS module.

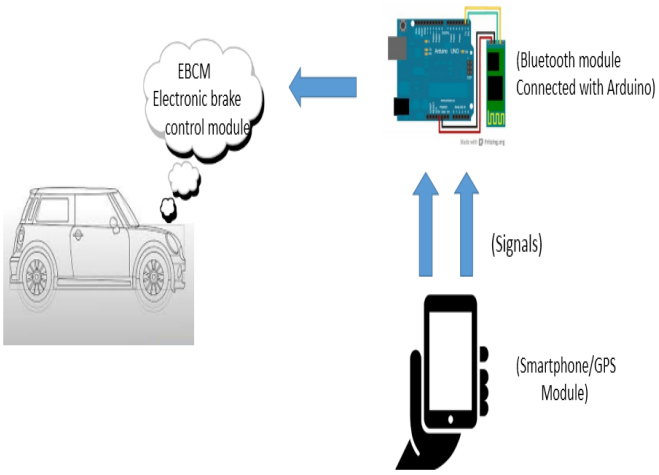

FIG. 4 SCHEMATIC DIAGRAM

3. CONCLUSIONS

In this report the innovative idea of implementing intelligent braking system is discussed and thereby analysed its various parameters for regular realistic application. Intelligent braking is one of the smart options which can be implemented in various applications for stopping a moving body without jerky motion. Intelligent Braking System (IBS) is an efficient and modern method to reduce the number of accidents by governing speed in cities, highways and other urban areas hence making our roads safer for everybody, as it uses GPS coordinates to locate the present zones that are the most accident prone like schools and hospital areas. By the implementation of this 'Intelligent Braking System' in automobiles, we are looking at a reduction in almost 15% of road accidents and related fatalities in the designated areas. We can also control rash driving to a certain extend and help in the enforcement of speed limits.

We have used the previous work on advance braking system and used that to define the basic braking control problem and have developed intelligent control method for this system. Clearly the approaches and conclusions that we present are somewhat preliminary and are in need of further significant investigations. Our present work realized us that implementation of this smart system can feasible and of real time use. Approaches and conclusions that we present are somewhat preliminary and are in need of further significant investigations. While making some changes we can use this on any available vehicle. Also improved and precise programming is necessary for real time operation. Application of intelligent braking system for critical dynamic condition need to be analysed.

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