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A REVIEW PAPER ON INTELLIGENT BRAKE & PARKING ASSIST SYSTEM

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ABSTRACT

To ensure the effectiveness of modern age technology brake & parking assist system is introduced in vehicles. This paper proposes a survey of ensuring the safety of the common man. According to the survey "Brake & Parking Assist system" is one of the latest technology which is used in the modern car for the safety of the people.

Keywords: Brake assist, IR sensor, Sonar sensor

INTRODUCTION

Brake Assist System is an added feature introduced in the vehicles in order to avoid collisions or to minimize the consequences of collisions. The brake assist system supports the driver when braking in emergency situations to achieve the shortest possible brake path while maintaining steering ability. Parking Assist System is a system which aids the driver in order to park the vehicle safely by avoiding obstacles such as other vehicle, people etc. Brake Assist detects circumstances in which emergency braking is required by measuring the speed with which the brake pedal is depressed. Some systems additionally take into account the rapidity of which the accelerator pedal is released, pre-tensioning the brakes when a "panic release" of the accelerator pedal is noted. When panic braking is detected, the Brake Assist system automatically develops maximum brake boost in order to mitigate a driver's tendency to brake without enough force. In doing so, Brake Assist has been shown to reduce stopping distance by a significant margin; up to 20% in some studies [1].

Figure 1- Demonstration of the effect of Brake Assist in Car

Background

Early in automobile development, the brakes played a rather subordinate role because the friction in the drive train was so great that a vehicle was slowed sufficiently even without the brakes being used. Increasing power and speed as well as constantly increasing traffic density led to the consideration in the 20th century of how an appropriate brake system could provide a counterbalance to greater power and driving performance. But only after advances in electronics and microelectronics could systems be developed which could react fast enough in emergency situations. The ancestor of the electronic brake systems is the ABS, which, since its introduction in 1978, has been continuously further developed and extended by additional functions. These functions intervene actively in the driving process to increase driving stability. Currently the trend in development is to driver support systems such as the brake assist system [1].

Mercedes originally invented the brake assist system in the 1990's. Their tests showed that although many drivers, especially women, reacted quickly in emergency situations, they did not apply enough pressure to the brake pedal to be completely effective. Their results also showed that drivers tend to apply the brake with less force in the initial stages of a potentially dangerous situation, and then increase the pressure as they moved further into that situation. The time spent in making the decision to apply the brakes with full force, even if it was only a delay of a split-second, meant that the car was not able to stop as soon as it would have if full pressure had been applied to the brake pedal immediately. Other studies also made engineers believe that the pulsing experienced when antilock brakes were engaged was mistakenly interpreted as a problem by inexperienced drivers, who then reduced the pressure on the brake pedal too early and inadvertently increased their risk of an accident.

Mercedes theorized that if the car could sense when a driver was applying the brakes in a panic stop situation and automatically go to full force, regardless of how hard the driver pushed the pedal, stopping distances could be greatly reduced and many accidents avoided as a result [2].

Related Works

Studies have shown that many drivers do not apply the brakes sufficiently in emergency situations due to lack of experience. That means that the greatest possible braking effect is not attained because the drivers did not press the brake pedal hard enough. Therefore, the brake assist system was developed to support the driver in critical braking situations. After advances in electronics and microelectronics could systems be developed which could react fast enough in emergency situations [1].

The research presented in this report is the culmination of automotive industry insight, objective characterization tests of BASs, and an evaluation of human braking performance with BASs. When performing a panic-braking maneuver, drivers have been shown to apply the brakes faster and more vigorously than normal in an attempt to stop the vehicle as quickly as possible. Yet, many drivers fail to engage the vehicle's maximum braking potential. The Brake Assist System (BAS) safety feature addresses this human physical limitation by supplementing drivers' braking input upon the detection of a rapid and sizeable brake pedal application [1]. Currently, the trend in development is to driver support systems such as the brake assist system. The brake assist system supports the driver when braking in emergency situations to achieve the shortest possible brake path while maintaining steering ability.

The vehicle without a brake assist system attains the ABS (Antilock Braking system) regulation range later than the vehicle with a brake assist system and consequently has a longer brake path.

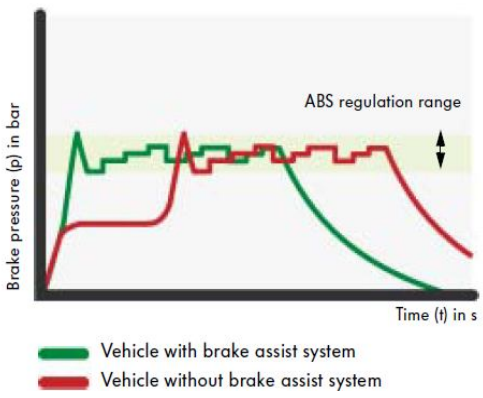

Figure 2- Graph of vehicle with & without Brake Assist System

Automotive brakes are designed to slow and stop a vehicle by transforming kinetic (motion) energy into heat energy. As the brake linings contact the drums/rotors they create friction which produces the heat energy. The intensity of the heat is proportional to the vehicle speed, the weight of the vehicle, and the quickness of the stop. Faster speeds, heavier vehicles, and quicker stops equal more heat.

The two split systems used almost exclusively are:

• Diagonally split – used on most front wheel drive vehicles

• Front/rear split – used on most rear wheel drive vehicles

On a diagonally-split system, the left-front and right-rear brakes (LF/RR) are connected to one channel of the master cylinder while the right-front and left-rear brakes (RF/LR) are connected to the other channel of the master cylinder. This system is typically installed on front wheel drive vehicles because they have a front-heavy weight distribution and approximately 70% of the braking occurs at the front brakes. As such, if one part of a diagonal system failed, the overall braking would only be reduced to 50% rather than to 30% if both front brakes were lost. Diagonally-split systems also use proportioning valves either in the master cylinder circuits or in the rear brake lines to maintain the proper front to rear pressure balance. Proportioning valves will be covered in a later section. On a front/rear split system, both front wheel brakes work together on one system (channel) while both rear wheel brakes work together on a separate system.

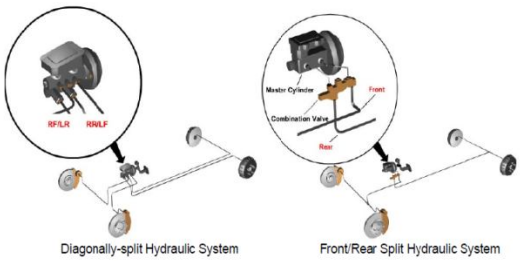

Figure 3- Hydraulic System types

To cope with the ever growing problem of traffic management and parking management an advance solution for managing and monitoring free parking space and automated guidance for user to park the car is proposed. It aims at implementing smarter and better parking guidance mechanism which reduces significantly vehicle travel time and parking time. In this system all the Infrared sensor nodes (IR sensor) sense the status of the car space and accordingly transfer the information to the AVR controller. Accordingly AVR sensor sense

the status of car parking space and displays the information on the LED screen for the user, thereby reducing the time for the driver to find vacant empty space and almost reduce the chances of entering into the unusual space which might lead into a traffic jam.

Here software implementation is used with wireless sensor network for management of car parking system without entering into the parking lot. Parking status can be known by the driver at the entrance of the parking lot only. That means a car driver can know whether the car parking space is available in the parking lot or not without entering into the parking lot by observing the parking space. This system will save most of the time of the driver for seeing the parking space and also headache of drive the car inside the parking lot and see the parking space. A wireless sensor network is a collection of nodes organized into a cooperative network. Each node consists of processing capability (one or more microcontrollers, CPUs or DSP chips), may contain multiple types of memory (program, data and flash memories), have a RF transceiver (usually with a single Omni-directional antenna), have a power source (e.g., batteries and solar cells), and accommodate various sensors and actuators. The nodes communicate wirelessly and often self-organize after being deployed in an ad hoc fashion. Systems of 1000s or even 10,000 nodes are anticipated. Such systems can revolutionize the way we live and work. Currently, wireless sensor networks are beginning to be deployed at an accelerated pace. It is not unreasonable to expect that in 10-15 years that the world will be covered with wireless sensor networks with access to them via the Internet. This can be considered as the Internet becoming a physical network. This new technology is exciting with unlimited potential for numerous application areas including environmental, medical, military, transportation, entertainment, crisis management, homeland defense, and smart spaces. Since a wireless sensor network is a distributed real-time system a natural question is how many solutions from distributed and real-time systems can be used in these new systems. Inductive loop is the most widely used detector today. New parking garages will at least install them at the entrances and exits.

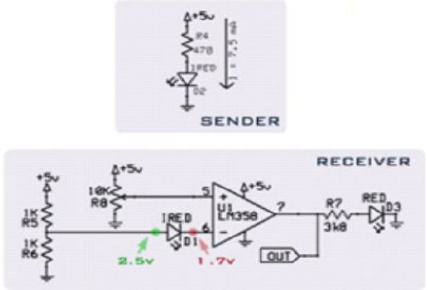

Figure 4- Transmitter & receiver of Parking Assist System

This sensor can be used for most indoor applications where no important ambient light is present. This sensor doesn't provide ambient light immunity. However, this sensor can be used to measure the speed of object moving at a very high speed, like in industry or in tachometers. In such applications, ambient light ignoring sensor, which rely on sending 40 KHz pulsed signals cannot be used because there are time gaps between the pulses where the sensor is 'blind'.

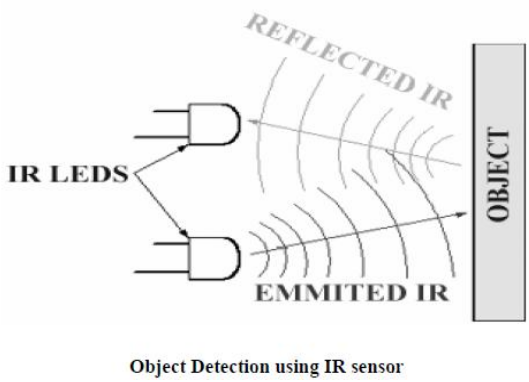

Figure 5- Object Detection using Infrared Sensors

As the name implies, the sensor is always ON, meaning that the IR led is constantly emitting light. This design of the circuit is suitable for counting objects, or counting revolutions of a rotating object, that may be of the order of 15,000 rpm or much more. However this design is more power consuming and is not optimized for high ranges. in this design, range can be from 1 to 10 cm, depending on the ambient light conditions. The sender is composed of an IR LED (D2) in series with a 470 Ohm resistor, yielding a forward current of 7.5 MA The receiver part is more complicated, the 2 resistors R5 and R6 form a voltage divider which provides 2.5V at the anode of the IR LED (here, this led will be used as a sensor). When IR light falls on the LED (D1), the voltage drop increases, the cathode's voltage of D1 may go as low as 1.4V or more, depending on the light intensity. This voltage drop can be detected using an Operational Amplifier [5][6][7].

Basic theory

- Driver does not step forcefully enough on the brake in an emergency. As a result, only a small amount of brake force is generated.
- The pedal effort of this type of driver might weaken as time passes, causing a reduction of braking force.
- Based on how quickly the brake pedal is depressed, brake assist assesses the intention of the driver to apply emergency braking and increases the brake force.

- After the brake assist operation, if the driver intentionally releases the brake pedal, the assist operation reduces the amount of force simultaneously.

Basically, a brake assist system monitors the driver's use of the brake pedal, automatically sensing an attempt to stop the car, as a result of panic. It then generates very high braking power, even when the driver is only pressing lightly on the brake pedal. When this is used together with anti-lock braking systems, it results in faster and safer braking. Depending on the driver, statistics for emergency stops in cars using this technology range from a 20% - 45% reduction in stopping distances, a potentially significant difference in critical situations. Some road tests show that a driver needs up to 240 feet (73 meters) to stop a car going approximately 60 mph (100 km/h). In the same scenario, cars with brake assist were able to come to a complete stop in as little as 130 feet (40 meters). Since it only takes one-fifth of a second to travel a car length at highway speeds, the superior speed with which the brake assist is able to react also accounts for its improved safety results over traditional braking systems.

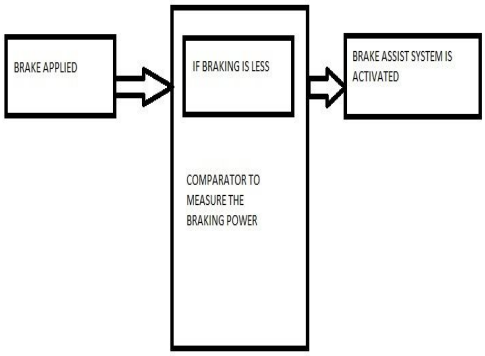

Figure 6- Block diagram of activation of Brake Assist System

Power Assist System

Most modern vehicles are equipped with a power assist (boost) system to aid the driver when applying the brakes. The two most common types of assist systems are vacuum assist and hydraulic assist Vacuum Booster The two types of vacuum boosters used on modern vehicles are the single-diaphragm and the tandem-diaphragm (or dual-diaphragm) booster. Both booster types operate similarly but the tandem-diaphragm booster is smaller in diameter and is used on vehicles where space is critical.

Vacuum boosters are mounted between the brake pedal pushrod and the master cylinder and receive engine vacuum through a hose and check valve (one way valve). The check valve

holds vacuum pressure and assures power assist capability during times of low engine vacuum (i.e. the engine quits). With the check valve in place, a booster will have enough reserve vacuum for 2-3 brake applications after engine vacuum is lost.[9]

Disc Brake

Disc Brakes are used in the front of the vehicles. While some vehicle have both the front as well as rear disc brakes. The advantage of disc brake over drum brake are as follows :

- Better fade resistance
- Reduced pulling & grabbing
- Self- adjustment capability [3].

DISCUSSIONS

In an unknown environment, it is important to know about the nature of surface properties in order to interpret Infrared sensor output as a distance measurement. Here Ultrasonic sensor can play an important role in determining the surface properties. Since stereo camera vision systems do not perform well under some environmental conditions such as plain wall, glass surfaces, or poor lighting conditions, the IR and US sensors can be used additionally to improve the overall vision systems of mobile robots. The co-operation between the Ultrasonic and Infrared sensors are utilized to create a complementary system that is able to give reliable distance measurement. They can be used together where the advantages of one compensate for the disadvantages of the other. The integration of the information supplied by the multiple Ultrasonic and Infrared sensors can be a means to cope with the spatial uncertainty of unknown, unstructured environments in several applications of advanced robotics, such as flexible industrial automation, service robotics, and autonomous mobility [10][11][12][13].

CONCLUSION

The implementation of brake and parking assist system is a boon for the mankind. At times when the braking is required at a flash in order to avoid the collisions or to minimize the effects of collisions, brake assist system proves to be beneficial. Moreover the users should bore the fact in minds that nothing can replace the respons or action of the driver. So driver should remain alert while driving.

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