International Journal of Research in Advent Technology, Vol.6, No.12, December 2018
E-ISSN: 2321-9637
Available online at www.ijrat.org

Smart Control System in Automobile

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Abstract-The traffic system and the road rules sometimes go haywire leading to numerous accidents. The adoration to save lives leads to a control system for automobiles, which operates in real time. This will comprise numerous features such as the sensors which will be cheaper and functional for a low budget car helping detect a living or non-living objects well ahead of time and taking action. It will have a voice-controlled braking system and mechanism for the rear view mirrors for automatic folding in a critical situation. In critical situations, the system could avoid accidents caused by the delays in driver reaction times. This paper is structured as follows: Obstacle detection leading to slowing down of vehicles, Sensing leading to the closure of mirrors, Voice controlled braking system.

Keywords-Pattern Recognition of speech, Ultrasonic sensors, voice control, anti-lock braking system , MFCC, LPCC.

1. INTRODUCTION

Globally, the number of automobile users has been increasing day by day leading to traffic congestion. This leads to an increase in the number of accidents which occur on a daily basis. The main causes of these accidents include human driving errors and driver reaction delay times. Overcoming these deficiencies in the current scenario, there is a need for a smart control system which will control the working of the automobile to take action depending on the environment. To provide such a smart control system, in this paper, we are providing three modules which will prevent the loss incurred in accidents which consist of both human losses as well as loss of the vehicle. The system consists of various sensors and the data collected from these sensors can be transmitted with real-time constraint over wired media depending on which after processing necessary actions would be performed. For distance measurements, ultrasonic sensors are employed. This is the base of the obstacle detection system and mirror closure system.

Among the advantages of ultrasonic sensors over traditional sensors is the ability to observe and measure moving objects. Ultrasonic sensors are not affected by the colour of the object and they can detect small objects over long distances. Ultrasonic sensors can measure the distance to a wide range of objects regardless of shape, colour or surface texture. They are also able to measure an approaching or receding object. By using "non-contact" ultrasonic sensors, distances can be measured without damage to the object. They're easy to use and, in many cases, can be used in place of other traditional sensors when the environmental conditions make traditional sensors unusable.

2. EXISTING SYSTEM

In the existing system, the task of slowing the speed of the vehicle is done manually. In such a system driver has to pay his continuous care. But in such a system, it is very hard to detect some obstacles. If the user fails to pay attention or may get engaged it may lead to harmful accidents. To avoid this and to help the driver in such scenario, some automatic or intelligence based system help should be provided to the driver. Current techniques used for obstacle detection are vision based or sensor based. But the techniques for vision-based systems do not help to detect obstacles in the dark. On the other hand, such smart systems need to be more alert and appropriately at night. As sensors are not affected by the time of the day or other environmental conditions much, they have been considered as a more appropriate option. Even though sensor-based systems are available, 3d object recognition has been a challenge.

In the existing system, we can see so many cases of side view mirror destruction in congested areas or due to unnoticed objects. Also in such a kind of system, there is no automatic action provided to the vehicle. Also, the available systems are not cost efficient, which lead to less amount of implementation of such systems. Antilock braking [1] is another issue in designing an efficient braking system in automobiles. Conventionally, in automobiles equipped with ABS, it is a part of the engine control unit and prevents the locking up of wheels. Hence, applying fuzzy logic to intelligent control seems to be an appropriate way to

achieve this human behaviour, because driver's experience can be transformed easily into rules and any kind of nonlinearities can be easily tackled

3. PROPOSED SYSTEM

3.1. *Obstacle detection leading to slowing down of vehicles*

This system uses an array of ultrasonic sensors for detecting obstacles and measuring the distance between the automobile and the obstacle. This is used further to control automatic braking to slow down the speed of the vehicle. The main purpose for using an array of ultrasonic sensors is greater accuracy and greater coverage of obstacles helping 3d recognition. The array of sensors provides a greater coverage of the obstacles as the distance between the obstacle and the vehicle increases.

As we know the surface of an obstacle may not be always plain which may reflect incident pulses to undesired direction. So it is necessary to measure the roughness of obstacle and to choose a kind of ultrasonic sensor. The roughness of obstacle should be greater than the wavelength of ultrasonic waves which is calculated by solving the following formula[6]:

$$v = n*\lambda$$

In an array of ultrasonic sensors, each sensor measure it's the separate distance from an object which works simultaneously with a delay of 1 sec. Based on all measurements difference matrix is calculated to obtain an optimal or exact distance from obstructing material or any object[6].

$$Diff\ Mat(i, j) = i = 0 \text{ to } n[\ j = 0 \text{ to } n\ [\ a(i) - a(j)]]$$

Where i and j are integers from 0 to n, a() is array of distances obtained from sensors in horizontal array.

Consider a car moving at a high speed. The safety distance maintained from any obstacle is to be considered as 2 meters. If any changes are observed within this range, brakes are applied automatically and thus, the speed gets reduced. Ultrasonic sensors calculate distance based on the measurement of time of flight of the ultrasonic pulse which gets reflected back from the ground of the obstacle. Further, an optimized technique is employed to detect these reflected pulses that are detectable by a threshold comparator. The ultrasonic sensors are attached to the microcontroller which continuously keeps on tracking the distance of the obstacles in its vicinity. This information is further sent to the controller which processes the information. The control unit consists of

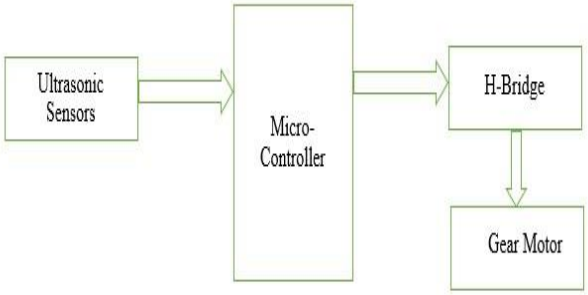

Fig.1. Motor control via Micro-controller

the gear motor, H-bridge attached to the controller. This control unit controls the automatic braking system depending upon the distance measurement. Braking system works with the help of the gear motor.

3.2. *Sensing leading to the closure of mirrors*

The side view mirrors may get destructed in heavy traffic areas due to the collision of mirrors with unnoticed objects or even in congested areas due to narrow roads. For the prevention of such loss, it is necessary to detect these circumstances in real time.

For this module, choosing a sensor is a crucial part as it reveals the performance of the system. The aspect of the sensor which comes to sense in this module is the real-time performance of the detection and communication of information. Ultrasonic (US) sensors [2] are broadly used in applications for distance measurements. Ultrasonic (US) sensors are frequently used for mid-range distance measurements.

Applications of these sensors include navigation systems (human, mobile robot and vehicles) as obstacle avoidance, distance measurement, counting devices (e.g., weight watcher, product assembly), surveillance system, object detection, edge detection, and military applications. These sensors were chosen because of their high resolution, robustness, lightweight and low cost. The use of these sensors also provides a better cost performance ratio compared to other sophisticated imaging systems, such as the ones based on stereo vision camera, GPS or laser scanning summarizes some technical specifications of the sensors used in this research. The target surface [6] ideally needs to be perpendicular to the direction of propagation of the pulses. But from the observations, it is seen that accurate distance measurement is possible

even if the angle between the target surface and direction of propagation of pulses is up to 25°.

This system can be divided into two parts, which can be considered as transmitter and receiver. The transmitter part contains sensors, conditioning circuit, microcontroller Trigonometry functions are used to determine the distance between the user and obstacle using ultrasonic sensor. After sensing the information is provided to the controller which determines the distance of the object is below a threshold value or not. If the object distance is near, a decision would be taken further to close the side mirrors thus preventing loss. This is also applicable in congested areas.

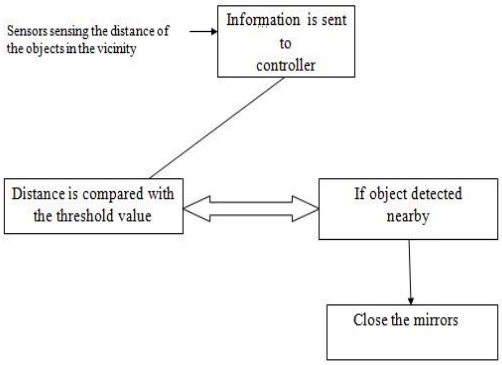

Fig.2. Working of side view mirror closing

3.3.*Voice controlled braking system*

Voice controlled system consist of two parts speech recognition system and control system. Speech recognition system analyses human instructions and passes correct commands to the control system. In speech recognition, system catches all voice commands from a user and then it checks in the database to ensure its correctness. For short applications, Speech recognition system works on pattern matching which is faster than other techniques. In pattern matching analyzed commands are matched with stored commands in the database. After this, commands are converted into an appropriate form which is understandable by actuators. But for complex applications voice recognition system works as shown in figure:

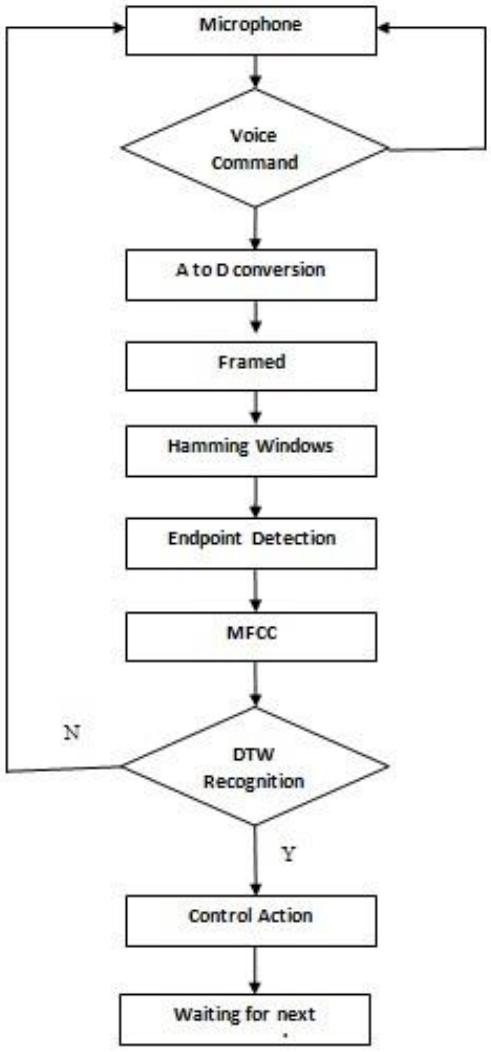

Fig.3. Flowchart for voice controlled braking system

In the above figure, Speech recognition involves feature extraction from the acoustic signal. Feature extraction [4] involves two techniques which involve Mel Frequency Campestral Coefficients (MFCC) and the linear prediction coefficients (LPCC). In these two techniques, the MFCC parameter is faster and accurate than LPCC. Both techniques involve Dynamic Mme Warping (DTW) which is based on pattern comparison, Hidden Markov Modelling (HMM) which is based on statistics model, Neural Networks (NN) which is based on neural network. An important aspect in this system is the recognition accuracy.

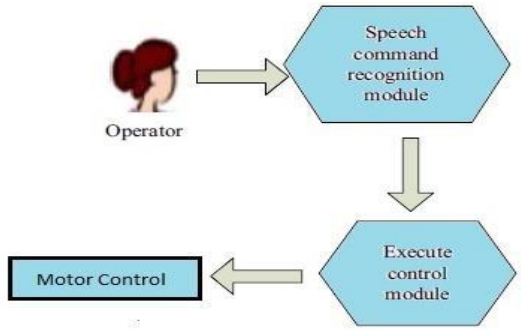

Fig.4. Working of a voice-controlled braking system

Simple isolated words recognition is more accurate. For this less time is required as well as it requires less powerful hardware. For example, just the word 'brake'. Considering all these parameters, DTW is appropriate as it is more accurate for isolated words and real-time application.

4. CONCLUSION

In this paper, we have tried to implement some cost-efficient techniques which are simple as well as operate in real time. The main focus of the paper is based on the analysis of the information sensed by sensors. This smart control will help in automatic action performance in case of lag in driver reaction times and will save lives which are lost in accidents

□
(A.1)

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