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Efficient Technique for Speed and Temperature Controlling In Smart Car

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Abstract: This paper uses a "Smart Car" as the platform for intelligent control research. The name Smart Car because its ability to reduce the requirement of driver's attention by carrying out most of the activities like parking, collision avoidance, driving, communicating with neighbouring vehicles etc. In this paper, the three aspects which are projected are Speed controlling, Temperature controlling and self-driving to a destination using GPS system. The controlling of the smart car includes: The extraction of path information, self-driving with direction and speed control. And a small addition to this Smart Car is Temperature Controlling. Nowadays, temperature variations are more due to which switching of fan (or AC) is done frequently. Henceforth, automation makes this task more convenient and easier.

I. Introduction

Ability to reduce the requirement of driver's attention by carrying out most of the activities like parking, collision avoidance, driving, communicating with neighboring vehicles etc. Need for reduction in traffic collisions, resulting deaths and injuries, caused by human-driver errors, due to delayed reaction time, and distracted or aggressive driving.

Speed controlling is helpful in avoiding accidents and also would reduce the workload of driver. Generally driver has to constantly monitor the traffic and react accordingly, a minute negligence way also lead to accidents. Thus automation ensures fast response to traffic and eases the driver by self-controlling the speed of cars. Comfortability of the passengers is also one of the major concern. The temperature controlling is one which adds on to the comfortability. Assigning destination to the car which can be done using GPS positions. Destination being fixed, the car uses its speed controlling mechanism to travel to the destination without the help of driver.

Here for the Speed Controlling part ultrasonic sensors are used which helps to avoid collision of two vehicles by detecting the neighbouring vehicles and it can also be used to maintain the speed of the car by taking the speed of the neighbouring cars in front as the reference. **GPS**, is a device that is capable of receiving information from **GPS** satellites and then to accurately calculate its geographical location.

Thus by using this, the car is designed to reach a particular destination on its own. The Smart Car on its path to destination has no neighbouring vehicles to maintain its speed then, it travels in a constant predefined speed.

Here the temperature inside car is sensed using temperature sensor based on which corresponding variations to bring down to normal temperature are done automatically.

II. Procedure

Block Diagram

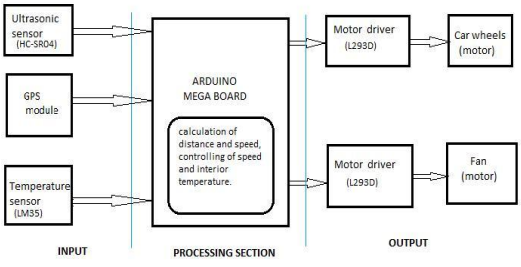


Fig. 1 General Block Diagram

Fig.1 illustrates the simple flow of signal in three sections. The sections are Input, Processing and Output sections. The input section consists of sensing part which includes Ultrasonic Sensor, Temperature Sensor and GPS module. The processing section contains microcontroller (Arduino Atmega2560). The output section comprises of motor and its control unit.

1) Ultrasonic Sensor (HC-SR04):- Once it encounters the trigger pulse the Module automatically sends eight 40 kHz signal and detect whether there is a pulse signal back. The return signal is detected and the time taken for this signal to return back is used for computing distance of the object by which the signal is reflected.
2) Temperature Sensor (LM35):- **LM35** is a precision IC temperature sensor with its output proportional to the temperature (in ^{o}C).With **LM35**, temperature can be measured more accurately than with a thermistor. It also possesses low self-heating and does not cause more than 0.1^{o}C temperature rise in still air.
   The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every ^{o}C rise/fall in ambient temperature, *i.e.*, its scale factor is 0.01V/ ^{o}C.
3) GPS Module (Ublox NEO-6M):- GPS receivers take information which is transmitted from the satellites and uses triangulation to calculate a user's exact location.

   GPS is used in a variety of ways:
   - To determine the position of locations.
   - To navigate from one location to another.
   - To create digitized maps.
   - To determine the distance between two points.
4) Microcontroller (Arduino Atmega2560):-

5) Motor Driver (L293D):- The L293D is a quadruple half H-bridge bidirectional motor driver IC that can drive current of up to 600mA with voltage range of 4.5 to 36 volts. It is suitable to drive small DC-Geared motors, bipolar stepper motor etc.

Methodology

1) Distance Measurement:-

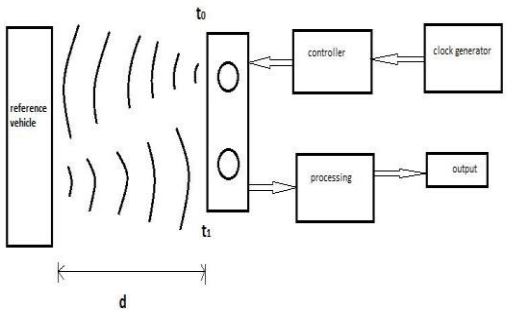


Fig. 2 Distance Measurement Using Ultrasonic Sensor

The ultrasonic sensor mounted on the car to detect objects is also used to measure distance between them. It sends sound waves from one opening and detects the echo signal from the other opening.

Sound propagates 330m/s using this we calculate distance from the reference car as follows

Speed= distance/time.(m/s)

At t0 signal is sent and at t1 signal is received back,

T=t1-t0

D=2d,

Where d is distance between objects

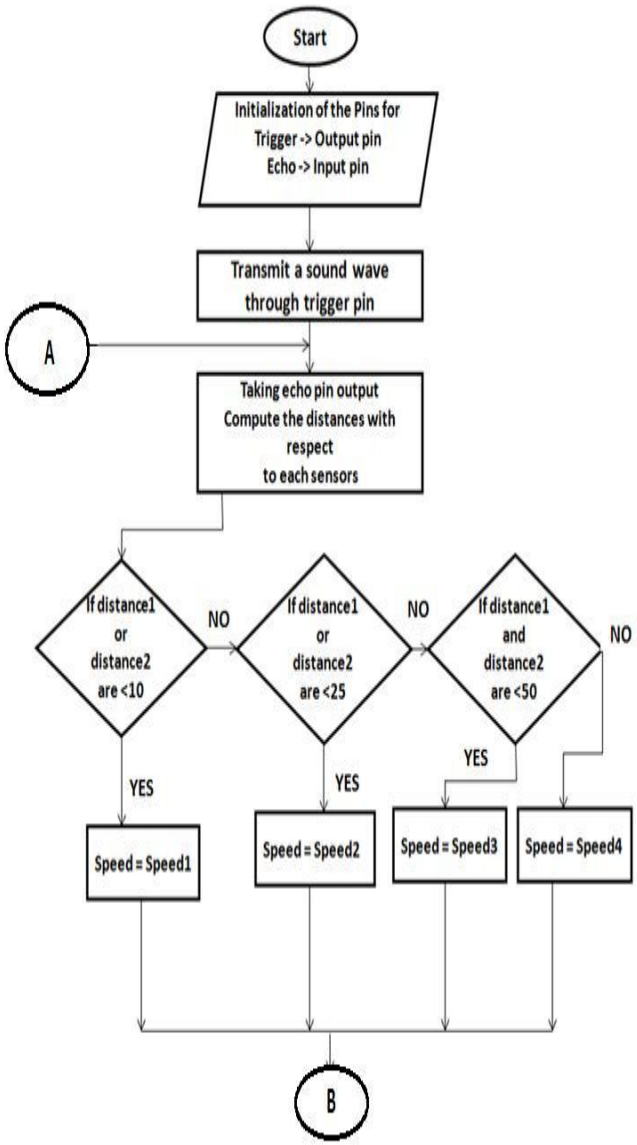
Speed of sound = 330m/s. hence d is calculated.

Taking the speed of the car, distance between the two cars, variation in further distances, and the speed of the car is computed. (Speed of the car = speed of the reference car).

To maintain distance 'x' the required speed of our car.

After calculating the speed, the speed of the car is either increased or decreased correspondingly.

2) Flow chart for Speed Controlling:-



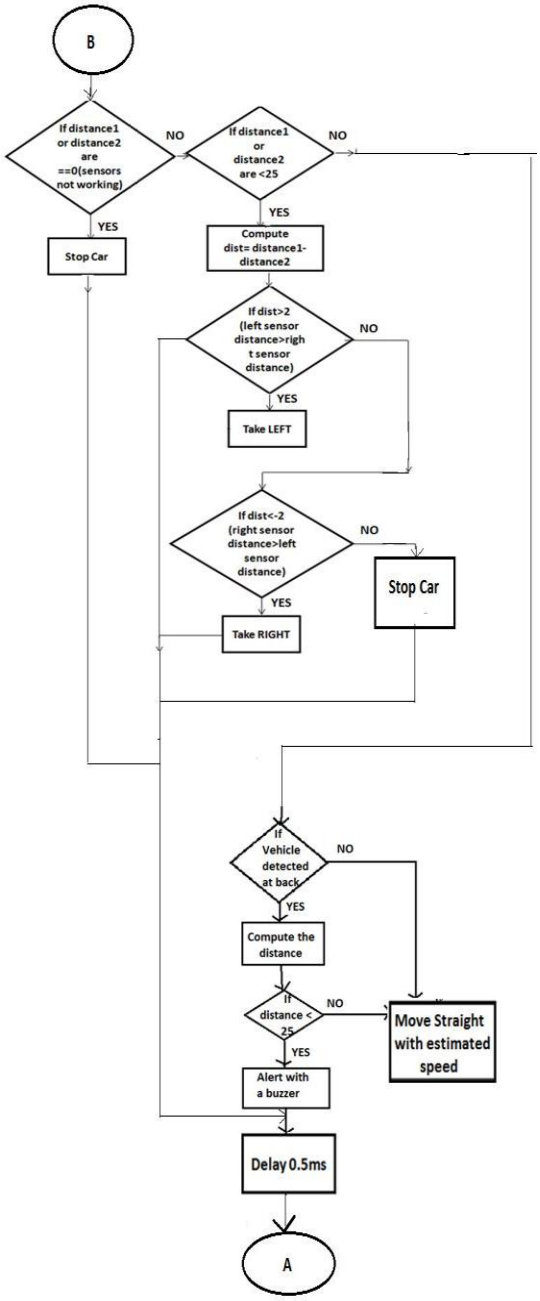


Fig. 3 Flowchart for Speed Controlling

3) Self-Navigation:- In this paper we use the GPS in Dijkstra's algorithm for finding the current location. By using this position we calculate the distance from source to every node in the graph. From this we also estimate the shortest path. Distance is given by a formula:

Distance= [(x2-x1)2 + (y2-y1)2+ (z2-z1)2]1/2 x, y, z are the coordinates of a position given by GPS.

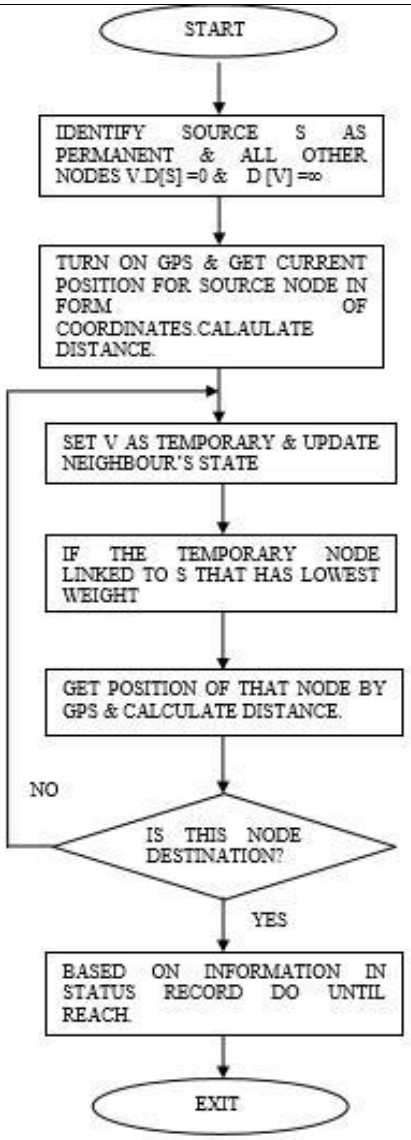


Fig. 4 Flowchart for Self-Navigation Algorithm

3) Temperature Controlling:-

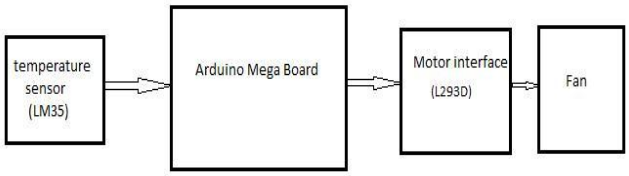


Fig. 4.4 Block Diagram of Temperature Controlling

Internal temperature is sensed using temperature sensor LM35 which gives output voltage proportional to temperature. The value obtained is compared with threshold value, if the temperature inside the car is greater than threshold, depending on the difference in the temperature, the fan speed is controlled.

The general equation used to convert output voltage to temperature is:
Temperature (^{o}C) = Vout * (100 ^{o}C/V)
eg:- if temperature is 32 ^{o}C then Vout =0.32V

Results

Initially computations of distance between reference and main car is done by using the distance formula. Using that distance, Speed of reference car is calculated. Speed controlling of the main car with respect to the variations of speed in reference Car is performed. The range of different speed over which our system varies is given in the tabularcolumn 1.

Sl. No	Range			Speed Value in Terms of percentage	Speed in terms of cm/0.5ms
	Distance 1	**Distance 2**	**Distance 3**		
1	0	0	0	0	0
2	X	X	1 to 10	0	0
3	1 to 10	1 to 10	X	40%	100
4	11 to 25	11 to 25	X	60%	150
5	26 to 35	26 to 35	X	80%	200
6	>35	>35	X	100%	250

Speed in terms of cm/0.5ms

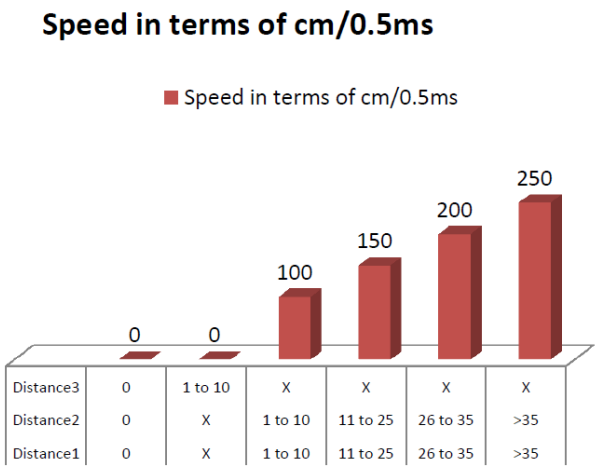


Table.1 Tabular Column for Speed Computation

Fig. 5 Graph for speed values tabulated (in cm/0.5 ms)

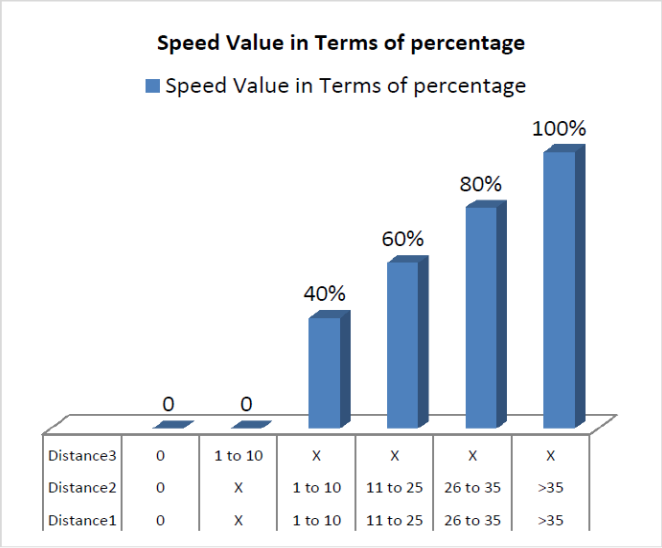


Fig. 6 Graph for different speed values in percentage

Internal temperature of the car is controlled by varying the speed of fan. Different values of temperature and corresponding changes in the fan speed is tabulated as shown in table 2. And Bar Graph is plotted for the tabulated values.

Sl. No	Temperature values	Speed of the fan in terms of percentage	Speed of the Fan in rotations per micro second
1	>40	100%	250
2	35 to 39	90%	225
3	31 to 34	80%	200
4	28 to 30	60%	150
5	25 to 27	40%	100
6	<25	20%	50

Table 2 Tabular Column for Temperature Controlling

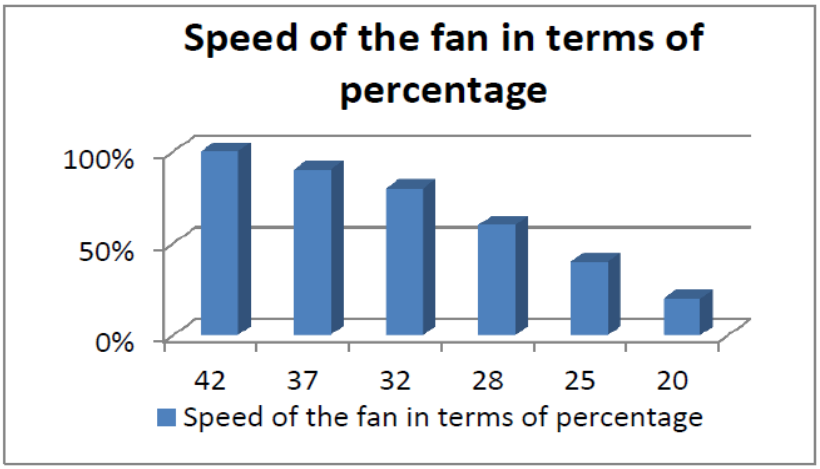


Fig. 7 Fan Speed controlling due to temperature variations (in percentage)

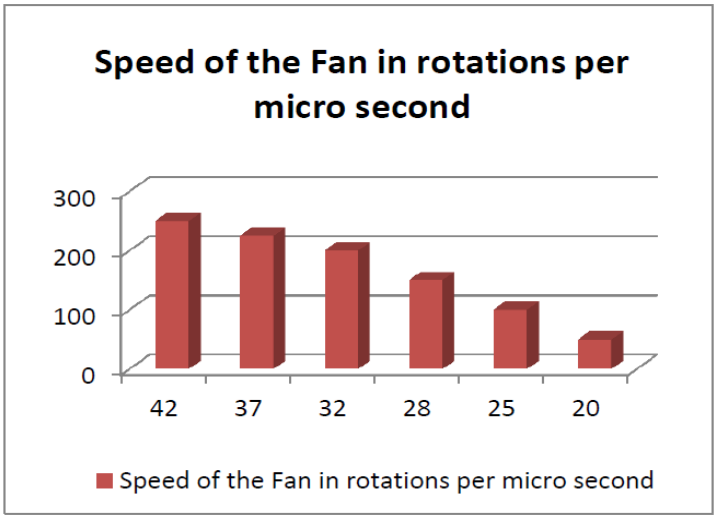


Fig.8 Fan speed controlling due to temperature variations (in rotations/us)

Conclusion

In this paper, the proposed model which includes Speed Controlling, Temperature Controlling, and GPS based Navigation was successfully developed. The Car was able to detect the obstacle and take necessary actions. It was also able to control the speed of the Car with respect to the front moving vehicle in order to maintain safe distance as well as to eliminate the intervention of driver. GPS based Navigation helped to self-direct to the predefined destination. Maintaining optimum temperature inside Car benefitted the user comfort. Integrating of overall software into one operational module resulted in a complicated design and a few errors. Many tests and debugging the program and design helped to improve the system in order to achieve project objectives.

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