National Conference on Science, Engineering and Technology (NCSET – 2016)
Volume: 4 Issue: 6
ISSN: 2321-8169
53 - 56

Multiple Sensors Approach for Collision Avoidance System in Vehicle

[1]Anil Kumar Reddy.K,[2]Raghunath Reddy .M & [3]Abraham Sudharson Ponraj
Department of School of Electrical and Electronics
VIT UNIVERSITY
C1HENNAI, India
kommireddyanil94@gmail.com, raghunathreddyg1@gmail.com

***Abstract*—** This paper investigates different collision detection sensors available and gives a better approach to prevent collision of vehicles through multiple sensors approach. Which means combination of two or more different collision avoidance sensors. Collision avoidance sensors detect the surrounding vehicle distance, if vehicle is too near to the system then sensors senses give Alert to the driver. In this working of different sensors as collision detection sensors are studied and compared to give a better approach. In this project raspberry-pi is preferred as the control unit, for faster operation of system and easier interface with different collision detection sensors. The objective being to reduce the cost of the system and efficient working of collision avoidance system (CAS) in vehicles.

***Keywords*—** *Raspberry pi, Ultrasonic sensor, IR sensor, Vision system ,Capacitance sensor, Python, Raspian os.*

*****

I. INTRODUCTION

Collision warning and avoidance systems are used in modern automotive systems and development. Many techniques have found like radar systems, and sonar systems .Now a days we are look for a cheap and reliable solution in the context of the problem up to now collision avoidance system is in high cost vehicles only. A collision avoidance system (CAS) which would help to drivers and their vehicles avoid collision with obstacles or other vehicles. A collision avoidance warning system (CAWS) used as audio signals, motion media to communicate with the driver, should his vehicle be approaching an object at a pace that present cause for alarm. For this collision avoidance system we are using low cost sensor like Ultrasonic, IR sensor, Vision sensor..., etc. For detecting the vehicles and pedestrians surrounding that vehicle. In this project we have to place two combination of sensors which working on independently and efficiently along with Raspberry pi hardware. This is the advantage of this CAS, when sensor fails, second sensor works efficiently. Raspberry pi is credit card sized, low cost, open source hardware software device used. The aim of CAS, is to help to avoid collision where and when possible by giving the buzzer alert to the driver.

II. BLOCK DIAGRAM

A. system block diagram

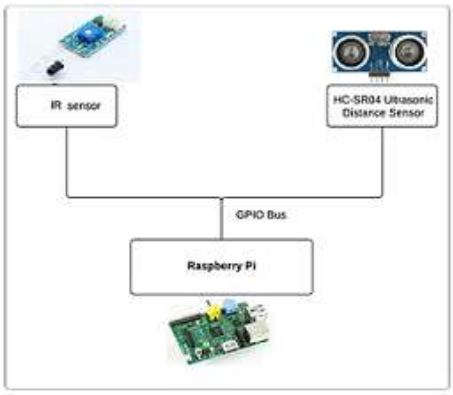

Fig: block diagram

Ultrasonic sensor provides an easy method of distance measurement. This sensor is perfect for number of applications that requires to perform measurements between moving objects. This sensor detects the objects with in 2cm to 3cm range alone.

IR sensor gives the readings that can be converted into distances easily. This sensor detects the object with in 3m-4m.long range IR sensor will detect up to 10m range alone.

When combining these sensors first IR sensor detects the object within range of 10m and alert to the driver. When driver will not wake up, again Ultrasonic sensor detects when vehicle reaches nearer, again warns the driver.

B. Hardware description

i. Raspberry pi:

The Raspberry Pi 2 Model B is using in this system. It would be like an credit card size, low cost, open source hardware software device.

Specifications:

- 900MHz quad-core ARM Cortex-A7 processor
- 1GB RAM
- 4 USB ports
- 40 GPIO pins
- Full HDMI port
- Ethernet port
- Combined 3.5mm audio jack and composite video
- Camera interface (CSI)
- Display interface (DSI)
- Micro SD card slot
- Video Core IV 3D graphics core

ii. Ultra sonic sensor:

These sensors are designed to generate high frequency sound waves and receive the echo reflected by the target. These sensors are used in a wide range of applications like detect the obstacles. The ultrasonic sound travels in the

 ISSN: 2321-8169
53 - 56

atmosphere and by striking with the target object, a fraction is reverting back. Once the ultrasonic waves are transmitted through the transmitter and echo is sensed by the receiver the distance can be calculated using this equation:
Distance = elapsed time x speed of sound/2

iii. Infrared sensor:
An infrared sensor measure the IR light that is transmitted in the environment to find objects by an IR LED. This type of sensor is very popular in navigation for object avoidance, distance measured or line following applications. This sensor is very sensitive to IR lights and sunlight, and this is the main reason that an IR sensor is used with great precision in spaces with low light. They are cheap sensors.

Iv. Vision sensor:
A visual sensor network is a network of spatia-lly distributed smart camera devices capable of

Processing and fusing images of a scene from a variety of viewpoints into some form more useful than the individual images. Visual sensor networks are most useful in applications involving area surveillance, tracking, and environmental monitoring. The analysis using vehicle recognition through a scene, and even determine what they are doing so that certain activities could be automatically brought to the operator's attention.

III. WORK DONE

A. Installing Raspbian os

Raspberry pi is a credit card sized microprocessor available in different modules with different processing speed from 700mhz.Raspbian is more powerful and efficient operating system. It has thousands of prebuilt libraries to perform many tasks and optimize the operating system. This is huge advantage while building applications.

Step- 1:Downloading Raspbian and image writer

Here downloading the latest version of the Raspbian from the Raspberry pi official site and you need a image writer to write the sd card.

Step -2: writing the image

Insert the SD card into the laptop/pc and run the image writer. Once open, browse and select the downloaded Raspbian image file. Select the correct device,that is the drive representing the SD card. After that, click on the "Write" button. Once the write is complete, eject the SD card and insert it into the Raspberry Pi and turn it on. It should start booting up.

Step-3: Setting up the Pi

Raspberry Pi comes with a default user name and password and so always use it whenever it is being asked.
The credentials are:
Login: pi
Password: raspberry

Step-4: Updating the firmware

Updating the firmware is necessary because certain models of the Pi might not have all the required dependencies to run smoothly or it may have some bug. The latest firmware might have the fix to those bugs.

B. Ultra sonic sensor and PIR sensor

The main advantage of these two sensors are - i) By Ultrasonic sensor distance is to be measured. ii) By the PIR sensor vehicle is to be detected in a range. This combination approach is more effective for detecting vehicle while one of the sensor working fails.

Fig: working diagram of Ultrasonic + PIR sensor.

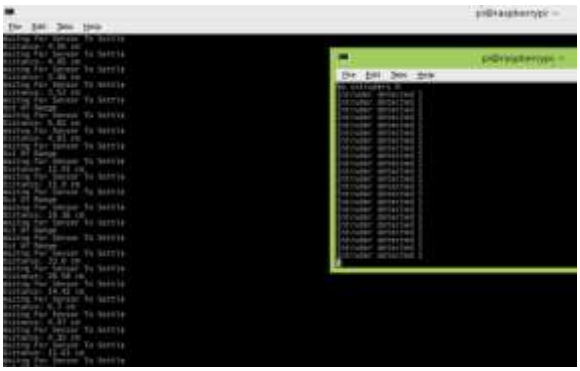

Fig: Ultrasonic + PIR sensor combination result.

C. Vision sensor and Ultrasonic sensor

Vision sensor observes the vehicle motion through open cv. It detects vehicle through canny edge detection algorithm in open cv environment with in a visible range. Threshold distance is given by the Ultrasonic sensor, and if vehicle reaches that threshold distance give intimation to the driver.

Fig: working diagram of Vision sensor + Ultrasonic sensor

 ISSN: 2321-8169
53 - 56

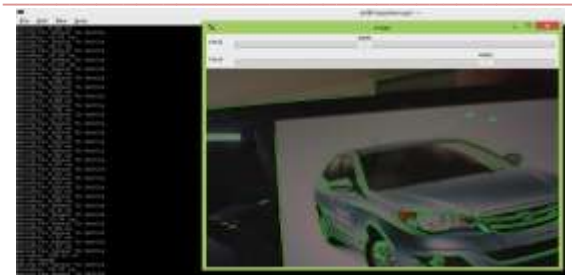

Fig: Vision sensor + Ultrasonic sensor combinational result.

D. Vision sensor and PIR sensor

Vision sensor observes the vehicle motion through open cv. It detects vehicle through canny edge detection algorithm in open cv environment with in a visible range. Threshold distance is given by the PIR sensor, and if vehicle reaches that threshold distance give intimation to the driver. Distance measurement is main disadvantage of this two sensor combination.

Fig: working diagram of Vision sensor + PIR sensor

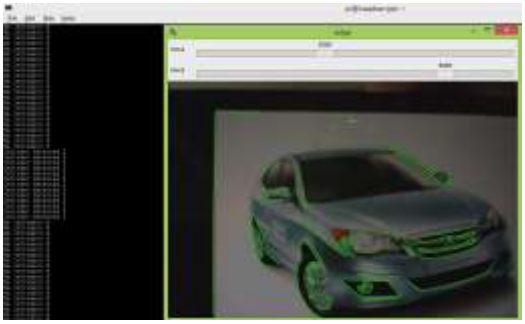

Fig: Vision sensor + PIR sensor combinational result.

E. Capacitance sensor

Capacitance sensor working alone is sufficient. This sensor senses vehicle while it touches, then only it give intimation to driver. This sensor is not sufficient for vehicle detection. While some one try to unlock vehicle door this sensor useful for intimation.

Fig: working of capacitance sensor

IV. CALICULATIONS

I Ultrasonic and Vision sensor calculations:

s.no	Absolute distance	Relative Distance	Efficiency	Accuracy	Time (tr)ns
1	50 cm	49.55cm	0.9871	0.5	230.7
2	75	74.2	0.9891	0.8	350.2
3	100	99.1	0.9892	0.9	560.8
4	125	124.1	0.9912	0.7	680.3
5	150	149.1	0.9941	0.9	808.4
6	175	174.4	0.9961	0.6	925.2
7	200	198.9	0.9945	1.1	1150.5
8	225	224.2	0.9961	0.8	1302.1
9	250	249.1	0.9964	0.9	1480..4
10	275	274.4	0.9978	0.6	1660.9
11	300	299.2	0.9971	0.9	1890.1
	Average			0.7909	1003.6

Table: accuracy and response time calculations

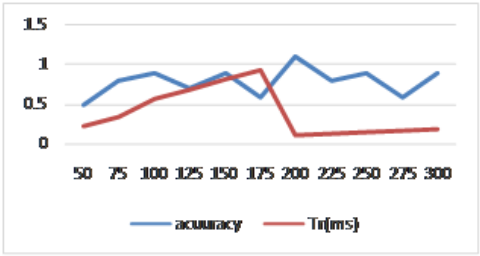

Fig: distance v/s accuracy, response time graph

II PIR sensor and Ultrasonic sensor calculations

S.no	Absolute Distance	Relative Distance	Efficiency	Accuracy	Time (tr)ns
1	50 cm	49.4cm	0.9881	0.6	220.7
2	75	74.4	0.9929	0.6	302.2
3	100	99.3	0.9930	0.7	60.2.3
4	125	124.2	0.9936	0.8	710.8
5	150	149.4	0.9961	0.6	902.9
6	175	174.2	0.9959	0.8	1001.9
7	200	198.2	0.9971	0.8	1260.2
8	225	224.2	0.9973	0.6	1409.2
9	250	248.9	0.9959	0.1	1656.2
10	275	274.5	0.9981	0.5	1780.8
11	300	299.3	0.9979	0.7	1920.2
	Average			0.6181	904.88

Table: accuracy and response time calculations

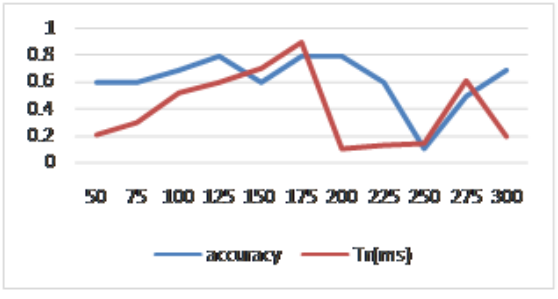

Fig : distance v/s accuracy, response time graph

III PIR sensor and Vision sensor calculations

In this combination distance is not measured by any one of the sensor. The average response time of the PIR sensor is about 0.3ms and Vision sensor time response is varies. These two sensor combination is not much accurate for detecting the vehicle.

V. CONCLUSION

By the sensor calculations

1. Ultrasonic sensor and PIR sensor are accurate and cost effective.
2. Ultrasonic sensor and vision sensor are more accurate compared to PIR, Ultrasonic sensor combination.
3. PIR sensor and Vision sensor are not much effective for vehicle detection.

By using this sensor combinations will proceed with antilock breaking system (abs) for reducing speed of vehicle

REFERENCES

[1] Ka C. Cheok, G. E. Smid, J. L. Overholt, Zhongming Pan, Christopher A.Warner ," Multi-Sensor based Collision Warning System"national automotive center, us army TACOm,waren,USA.

[2] Sudeendra kumar K., Leslin Verghese, K. K. Mahapatra "Fuzzy Logic based Integrated Control of Anti-lock Brake System and Collision Avoidance System using CAN for Electric Vehicles" IEEE Intelligent Transportation Systems Conference Proceedings-2010

[3] Vehicle Collision Avoidance System Chan yet Wong, Uvais qidwai, IEEE proceedings of Sensors-2004, Vol.1 page(s) 316-319.

[4] T. Yanagisawa, K. Yamamoto, and Y. Kubota. Development of a laser-radar system for automobiles. In R. K. Jurgen , editor, *Object Detection, Collision Warning and Avoidance Systems.*, pages 61–73. Society of Automotive Engineers, 1992.

[5] Catalog PING)))™ Ultrasonic Distance Sensor (#28015)

[6] Installation of open cv on raspberry pi, http://www.pyimagesearch.com/2015/10/26/how-to-install-opencv-3-on-raspbian-jessie/".

[7] Review on simple canny edge detection "http://docs.opencv.org/trunk/da/d22/tutorial_py_canny.html#gsc.tab=0 ".

[8] Finding response time through python programming, "http://stackoverflow.com/questions/3954900/is-it-possible-to-use-python-to-measure-response-time".