IJCSE International Journal of Computer Sciences and Engineering Open Access
Review Paper Volume-5, Special Issue-2, Dec 2017 E-ISSN: 2347-2693

APPLICATION OF MEMS IN AUTOMOBILES INDUSTRY FOR INCRESAING THE SAFETY OF PASSENGERS

Gaurav Phulwari[1], Shani Khandelwal[2], Dhreej Singodia[3]

[1]Bhagwant University, Ajmer (Raj.) India
[2]ACERC, Ajmer (Raj.) India
[3]Bhagwant University, Ajmer (Raj.) India

Available online at: www.ijcseonline.org

Abstract:-The objective of this paper is towards decreasing the rate of accidents in our day to day life and increasing the safety of passengers, improving the security systems in case of vehicular theft action. Micro Electro Mechanical System (MEMS) are devices that consist of motionless or movable components with magnitude on the scale of a micrometer. One of majorly used device in MEMS is MEMS accelerometer for commercially purpose. These accelerometers typically consist of movable micro beams that determine acceleration in one or two orthogonal directions.

MEMS technology contains broad variety of MEMS sensors that is widely used in the automotive industries. MEMS market is the second largest market in the world. As compared to the previous sensors MEMS sensor have advantages like fuel utilization reduction, safety advancement and is economical to vehicles. MEMS uses in automotive industry are evaluated in present and future.

Keywords: - MEMS, technology, technology management, automotive industry, sensor.

1. INTRODUCTION

Micro Electro Mechanical System (MEMS) is a new way of unification of electronic and mechanical elements, sensors, and active elements on a silicon sub-layer containing the micro-fabrication technology; it provides the advantage of micro machined, microelectronic in various components. It has a tendency to hold a complete system on a single–chip.
Thus having a wide range of application. In current era of Electronic Technology "MEMS" have emerging in both qualitatively and quantitatively. The evolving technology used in vehicles has resulted in more safety and less fuel consumption, solving critical issues in developing countries. Figures 1 and 2 show traffic density, figure of accidents and injured or killed people; and standard fuel consumption over years in the India, respectively, but improvements have been shown with the passage of recent years to a great high, this is due to the improvement in the electronic systems of the vehicles. These electronic systems receive input from sensors, and rising shares of sensors are manufactured using MEMS technology. The MEMS sensors extensive advantages have many uses in the automotive industry, and now modern vehicle have at least 100 sensor nodes mostly are MEMS. In recent years hundred and thousands of MEMS sensors were in used.

Moreover the main applications of the MEMS technology in automobiles industry are for passenger safety purpose, rollover and skidding detection, tire pressure detection, electronic stability control of the vehicles, vehicle dynamic control, vehicle navigation system, antitheft systems etc. In this paper air bag for safety sensors are evaluated.

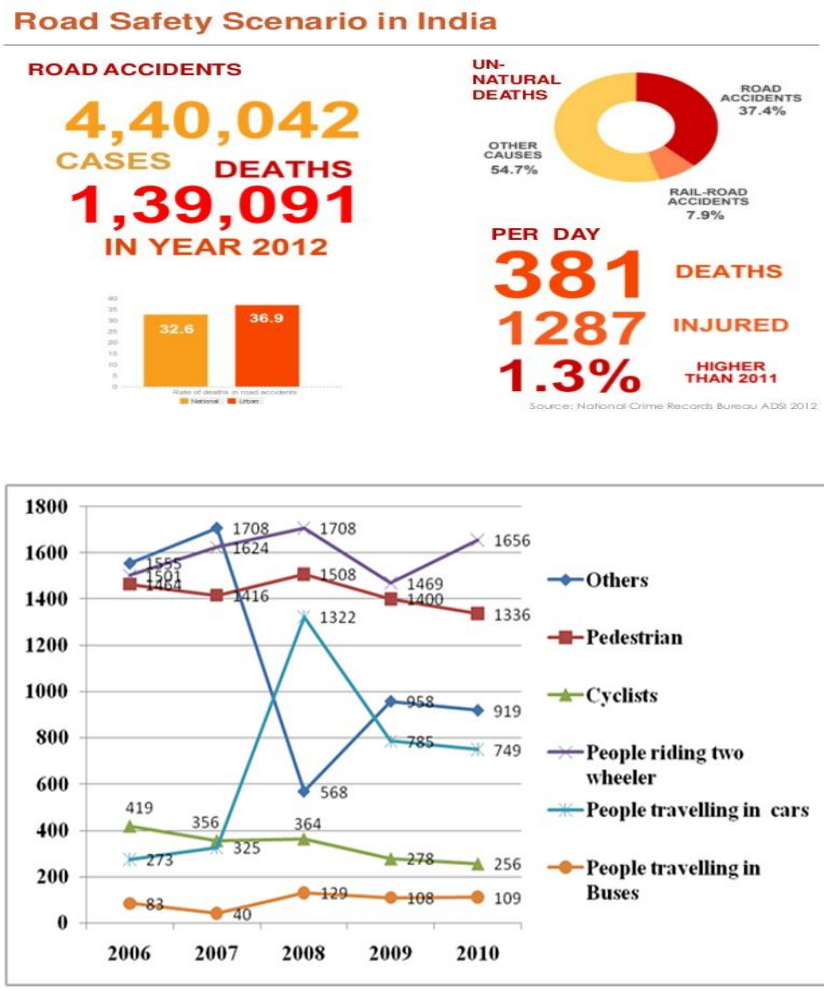


Figure 1: traffic density, no. of accidents, no. of people injured in INDIA

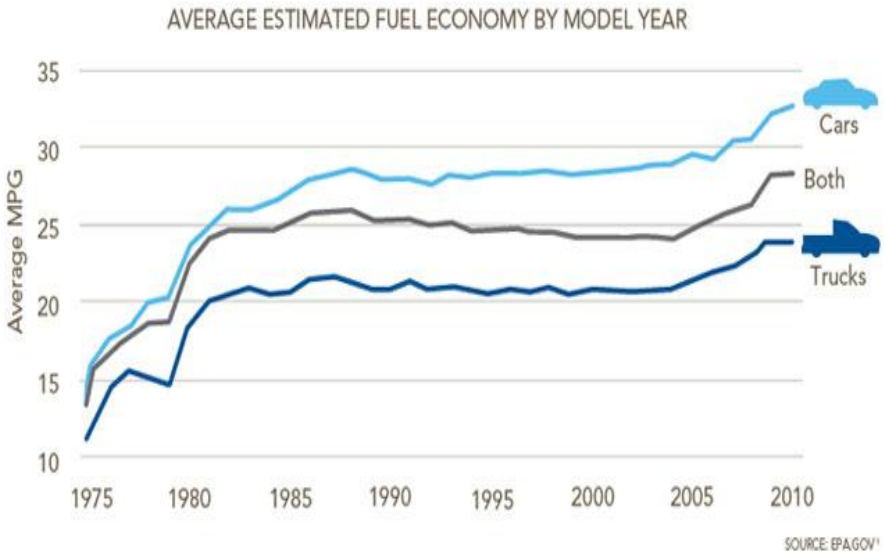
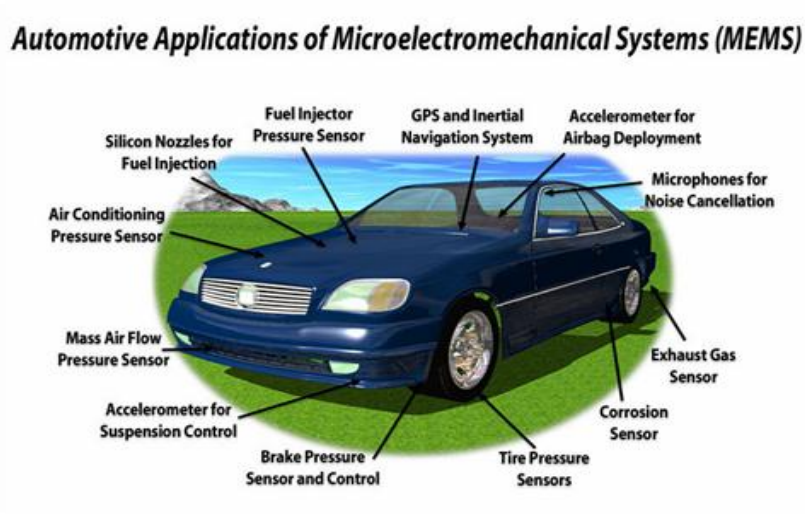


Figure2: average fuel consumption of INDIA

2. MEMS CATEGORIES

MEMS technologies can be generally divide into four groups: accelerometers, gyroscopes, and inclinometers; flow and pressure sensors; promising applications like the IR sensors for air quality measure and micro-scanners for means of transport displays etc.; as well as other applications such as the MEMS oscillators, and power scavengers for TMPS. In any of these the sub-divided application are used with different objectives. Figure 3 shows MEMS general technologies.



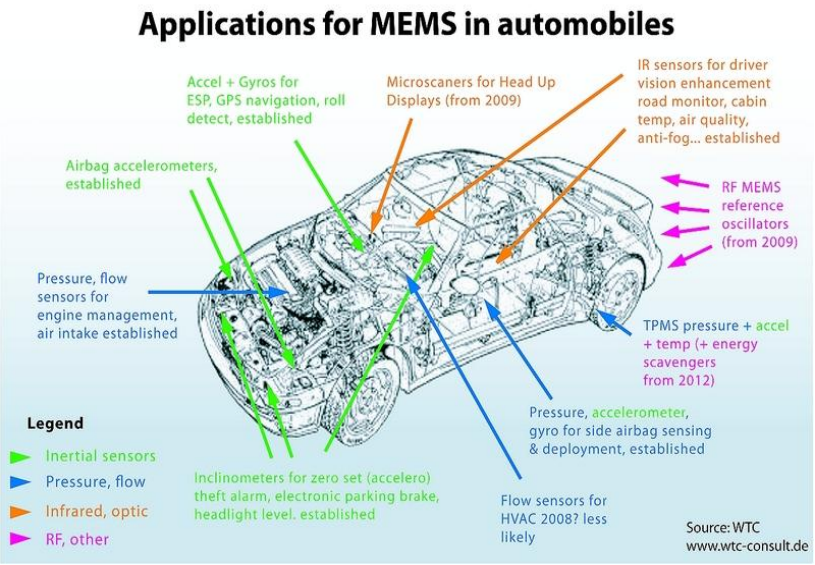


Figure3: MEMS general technologies

2.1 MEMS SENSORS FOR THE PASSENGER SAFETY SYSTEMS

During the decades of 1980's and 1990's air bag sensor have been installed in all the vehicles manufactured and marketed in the united states .Despite the effortless made of air bag sensors injuries still occurs due to air bag developers. The chip replaces the "G" switches in the air bag as the acceleration sensors. The "G" switches are expensive as well as their installment in different parts of vehicle increase its cost and decrease it's maximize usage. The accelerometer continuously measures the acceleration of the Vehicle and at a certain level where it exceeds the predetermined threshold, a microcontroller compute the accretion integral to know if a big change has occurred in vehicle acceleration or not .

If big change occurs, then the air bag opens as the MEMS accelerometer performs continuous measurement, all the "G" sensors can be replaced by the single MEMS module in the single MEMS module in the air bag control terminal. Due to this idea, the cost of air bags mechanism has reduces which results in the use of such systems in majority of vehicles another use of MEMS module is that they can be self tested with high reliability which further enables the air bag chip to investigate no matter the information gathered by air bag chips are reliable besides this, the decision making for the passenger side air bags is important as the distance between the passenger and side body is very less and hence the energy absorption is much less. The distance between passenger and the relevant air bad is also less which emphasis the use of MEMS resulting to which the vehicles with side air bags are provided with 2-4 more accelerometers.

3. AIR BAGSENSOR

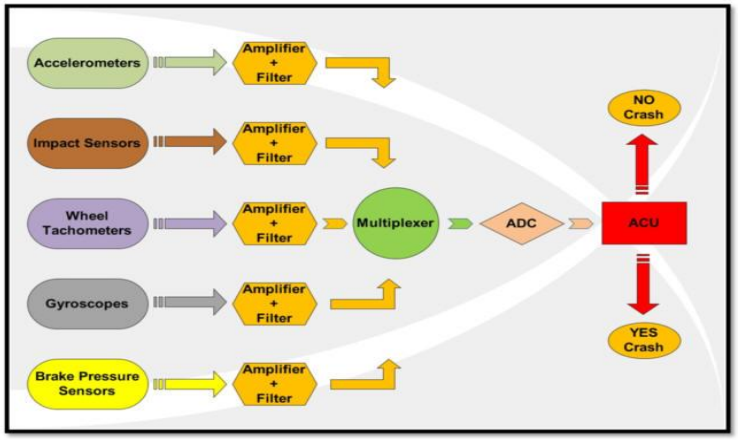


Figure 4: Block diagram of air bag sensor

The objective of our research paper was to explain the procedure of working of air bag sensor which is a vehicle safety device, whenever it is functionalized. In this figure4: paper we have studied various sensors with the help of modern automotive technologies-

- Accelerometers-measures
- increasing/decreasing of vehicles
- Impact sensors- detect collision
- Pressure sensor- detect physical pressure
- Tachometer-wheel speed sensors
- Brake pressure sensor-monitor brake
- Gyroscopes-devices that detect rollovers

Sensors are tiny devices that they produce relative fragile. The signals are amplified and analyses but may interfere and so they have to be filtered as well. The signal is sent to multiplexer and it possesses one signal at a time. The ADC converts analog signal to digital signal and sent to either green LED (NO AIRBAG) OR red LED (YES BAG).

4. CONCLUSION

In this paper we have introduced the application of MEMS and by comparing previous sensor we can say that MEMS sensors are more cost effective, safer and small which can be used in the cars. With the aspects of survey we can conclude that the uses of these sensors will increase for both safety requirements and government rules. The car engineers are enhancing the application of these sensors by the prospective of economic aspects. Therefore the MEMS market is improving in the automotive industry.

REFERENCES

[1] Nathanson, H.C., Newell, W.E., Wickstrom, R.A., Davis Jr., J.R.: The resonant gate transistor. IEEE Trans. Elec. Dev. 14(3), 117–133 (1967).
[2] Angell, J.B., et al.: Silicon micromechanical devices. Sci. Am. 248(4), 44 (1983).
[3] Petersen, K.E.: Silicon as a mechanical material. Proc. IEEE. 70, 420 (1982).
[4] Armbruster, S. et al.: A novel micromachining process for the fabrication of monocrystalline Si-membranes using porous silicon. TRANSDUCERS 2003. In: 12th International Conference on Solid-State Sensors, Actuators and Microsystems, Vol. 1, pp. 246–249. DOI: 10.1109/ SENSOR.2003.1215299.
[5] Kress, H.J., Bantien, F., Marek, J., Willmann, M.: Silicon pressure sensor with integrated CMOS signal conditioning circuit and compensation of temperature coefficient. Sens. Actuators A 25(1–3), 21–26 (1990).
[6] Herino, R., Perio, A., Barla, K., Bomchil, G.: Microstructure of porous silicon and its evolution with temperature. Mater. Lett. 2, 519–523 (1984).
[7]Allan, R., "MEMS: size Does Matter", www.electronicdesign.com/Articles/ArticleID/8984/8984
[8].Ernest,P.,"MEMS@Bosch: Automotive Application and beyond", BOSCH Co., www.mstbw.de/imperia/md/content/mstbw/bestpractice/bosch_mems_12_micromachine_symposium_ernst.pdf.
[9] Hayashi, M. and et. al., "Trends in Hitachi's MEMS Sensors for Automobiles", Journal of Hitachi Review , Vol. 58, No. 7,2009.
[10] Dixon, R., Bauhaus, J., "prospects of MEMS in automotive industry", Wicht Technology Consulting, Online Journal of MEMS Investor, www.memsinvestorjournal.com/2007/08/prospects-for- m.html.
[11] Weinberg, H., "MEMS sensors are driving the Automotive industry", Analog Devices Co., www.auto.sensorsmag.com.
[12] Keck, D.O., "Making Sense of Automotive Pressure Sensors", Silicon MicrostructuresInc.
[13]Amir Piltan, Reza Ghodzi "MEMS Technology in Automotive Industry: Trends and Application'',*1st international,5th National conference on management of technology,2011.*
[14]KlimValeyev, HesamAkarnejad,&Marco Tundo "Air bag Sensor'', IHS iSuppli Research,2011.

