

# The State of Art of MEMS in Automation Industries

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## ABSTRACT

*In this paper we present the comparison of MEMS Technology with previous technology in automation industries. These comparisons make use in analyzing the production rate, cost, down time and energy wastage of an industry. The main objective of our comparison is to adopt and implement the MEMS technology to conserve energy as well as time. It makes direct effect on production rate of organization as we use MEMS /NANO sensors along with fuzzy logic which gives more accurate and efficient design. Furthermore, it uses datasheets of small scale industries in Aligarh which can take care of more reliable results. Comparison has been taken through original data which confirms the idea present in it. Through this study we analyzed that the implementation of automation increase production rate, plant capacity and at the same time conserve energy.*

**Keywords:** Automation, MEMS, Nano Sensors, Energy Conservation.

## 1. INTRODUCTION

Nowadays, Micro-Electromechanical Systems (MEMS) plays a key role in the field of automation industries. In the context of automation, electrical and mechanical systems are combined, controlled by microchips and fabricated on silicon wafers. The main components of automotive electronic control systems are Sensors and actuators [1]. So we require a control system for sensors and actuators design and it provide by MEMS/Nano technology. Similarly, growth through significant new technologies has been achieved with MEMS in an automation industry [2].

An influential business which leads to a new direction is an Industrial automation [3]. As new technologies come day by day, we have to make a prominent technology which has remarkable throughput among all technologies with small size and economical to an organization [4]. Hence, industries have started traversing new technologies and opportunities in the field of industrial automation; one such technology is micro electro mechanical systems (MEMS). Automation is use of various control system for operating equipment's such as boilers, machinery, switching networks, processes in factories and other application with minimal or reduced human interventions.

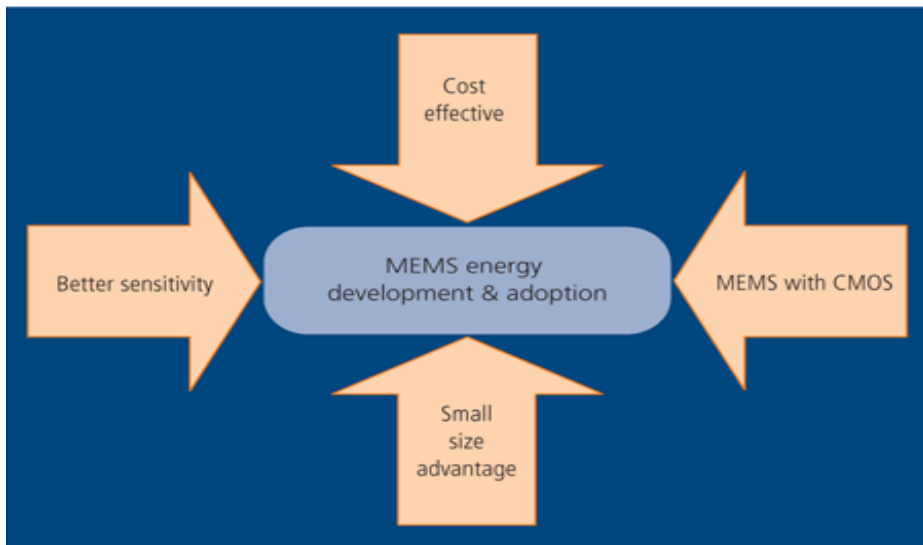
Present era can be defined as automation revolution, which is spreading in industries and industrial development and become a boon for it. Hence, a part of this Technology is MEMS which provides a new concept, new direction, new innovation and many opportunities.

Remainder of this paper is organized as follows. Second section discussed the basic mechanism of MEMS and its advantages. MEMS for industrial automation discussed in third section. Fourth section discussed the result & comparison analysis. Finally, last section concludes the paper.

## 2. MEMS MECHANISM AND ITS ADVANTAGES

A micro fabrication technology on common silicon substrate is being integrated with mechanical elements, actuators, sensors and electronics be called as micro electromechanical systems (MEMS) [5]. A numbers of methodologies along with tools together form a small structure in the dimensions of micrometre scale. The most important part of any system is brain, here are microelectronic integrated circuits. MEMS are eyes and the supporting arms associated with the microsystems to sense are control systems.

Mechanism of MEMS system describes the overall functioning of the systems. Information is gathered by sensors through environment with the help of mechanical, optical, thermal, chemical and magnetic phenomenon. And this information gives to the integrated circuits and these circuits make a control system to control various parameters which are responsible for the proper functioning of any micro electro-mechanical system.



**Fig.1: Flow view of the advantages of MEMS Technology.**

The Advantages with the use of these MEMS technology are easily shown with the help of fig.1. Here, sensitivity and the small size of the device are the key points of this technology [6]. As we all know the size of the device is too important for functioning of the device and sensitivity plays an important role in the better efficiency of any system.

### 3. MEMS FOR INDUSTRIAL AUTOMATION

The interdisciplinary nature of MEMS relies on engineering, design and manufacturing from a wide range of technical areas. These areas including material science, control systems, sensors, integrated circuits, mechanical and electrical engineering [7]. Despite all, MEMS requires microcontrollers which are dedicated to functioning of the design. With numbers of interdisciplinary areas, complexity of MEMS increases but accuracy also be increased. Control system plays an important role in designing these systems along with integrated circuits. Electronic integrated circuits fabricates at a very high cost, so cost of these devices slightly increases.

MEMS design is very sophisticated due to advanced semiconductors technology; it requires mechanical moving parts as well as electrical design of the device. It brings many technologies together in electronics like Complementary Metal oxide Semiconductor (CMOS), Bi-CMOS (Integration of Bipolar junction transistor and CMOS technology), Silicon on Insulator (SOI), Pipelining and fabricated on single chip.

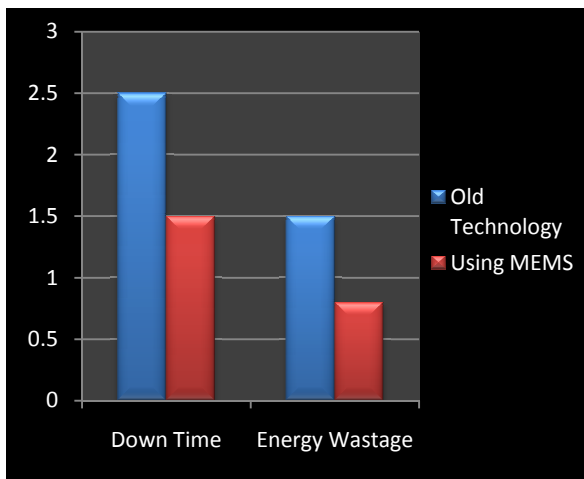
The sensitivity, reliability, scalability with cost effective design has offered by MEMS technology. It provides more opportunities in the field of automation. An industry relies on these technologies for higher throughput and production rate with less time. Humidity check control, pressure control and much such type of measurement meters has available in the markets for increasing the accuracy and quick in nature. As MEMS technology increases now-a-day, we studied this technology and conclude in the form of a table shown below. In this table, we justified that the increasing rate of MEMS technology in automation industries goes beyond nanotechnology by next decade.

**Table 1: Growth rate of MEMS technology from stabilizers to Nano-sensors.**

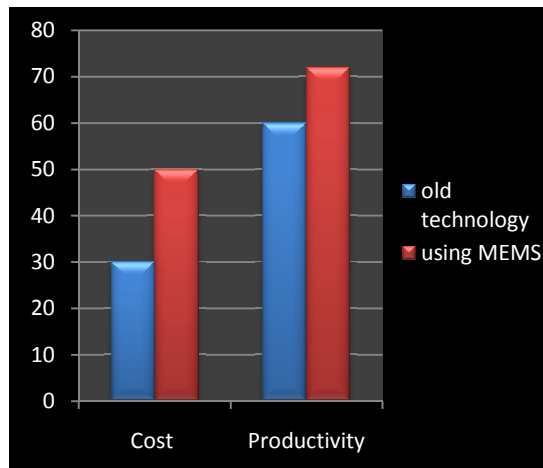
Years	2007	2008	2009	2010	2015
Applications	ABS (cars),electronic stabilization, low-end industrial application	Air condition, refrigeration and micro fluids	Large array and MEMS device on a single substrate	Desktop MEMS factory	Nano Manufacturing and Nano Factory

#### 4. RESULT ANALYSIS

With the help of this technology we compare many parameters in an automation industry. These parameters named as production rate, cost, down time and energy wastage in the small scale industry. Firstly we compared the down time and wastage of energy in a company with both technologies and shown with the help of graph as shown in fig.2. Similarly, fig.3. shows the comparison of the cost and the productivity of the industry.

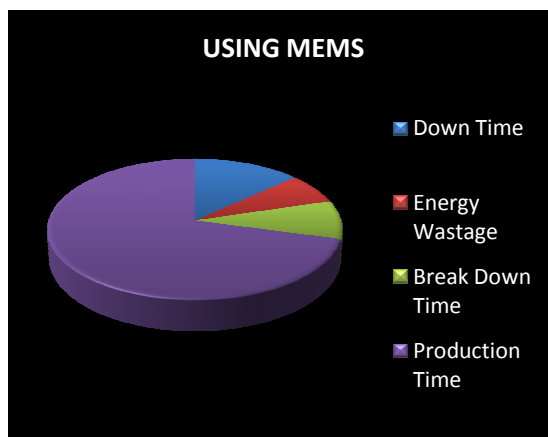
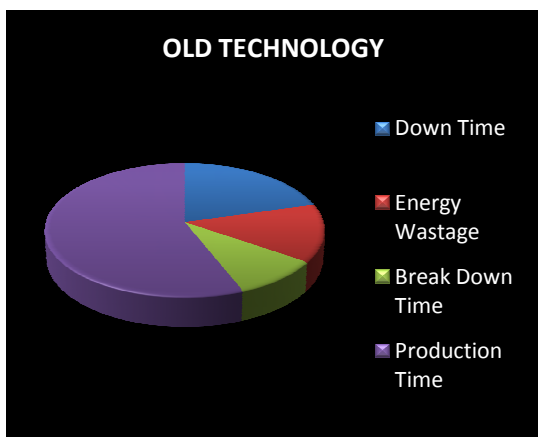


**Fig.2: Comparison of down time and Energy wastage**



**Fig.3: Comparison of Cost and Productivity**

Another comparison of these technologies is shown in fig.4 and fig.5. This comparison shows the reduction of break down time with energy losses in an industry.



**Fig.4. Comparison of various parameters between old technologies and MEMS**

These results of comparison show that MEMS technology provides a new concept, new direction, new innovation and many opportunities in automation industries. MEMS reduce the labor efforts, reduce production time, break down time and increase the overall productivity of an industry. These data has been taken from the small scale industries of Aligarh.

## 5. CONCLUSION

From this Study, following significant conclusions can be drawn.

1. The Total Productivity of an Industry was found to be increased upto 20 percent.
2. Improvement in Production rate was observed by applying Automation and MEMS technology over the previous technologies. With the application of MEMS we found an increment of 12-15% in Total Production rate.
3. The use of MEMS technology introduces compactness and reduces human efforts, with maximum accuracy and sensitiveness.

MEMS Technology is safe and secure and can be applied in Industries for achieving better Production Rates. Also, the technique requires less effort and is cost effective.

## 6. ACKNOWLEDGEMENTS

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