

The Future of Industry 4.0: Intelligent Machining

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Abstract- The industry 4.0 is approaching automation in almost every process related to machining. But even in this automation there are chances of error due to human interference in the programming related for the process. This encourages the need for 'INTELLIGENT MACHINING'.

Intelligent machining includes machine learning which is a strong algorithm due to which the machine learns from its past experiences and corrects its mistakes on its own and takes corrective action which further reduces occurrences of error.

Keywords- Intelligent sensors ,machine learning , programming ,decision making

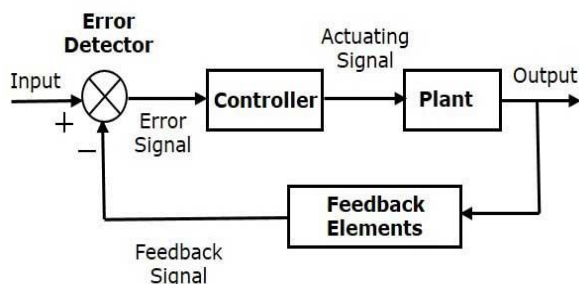
I. INTRODUCTION

In the industry the decision making were usually done by the programmer or the operator on his experience basis.

The operator used to check the suitable working condition for its fullest. Although some decision taken were correct but some of them were wrong which created errors in process.To neglect this errors in process we have introduced 'INTELLIGENCE MACHINING' which has elegant feature of self-decision making on required conditions.

This is done with the help of the intelligent sensors which are the main component of the machining.

BASIC THEORY



Following parts are included in the theory

- Reference signal
- Error detector
- Controller
- Process plant
- Sensors as feedback element

II. OBJECTIVE

The aim of 'INTELLIGENT MACHINING' is to maximize the productivity of the plant by reducing errors in the process and the time required for the product.

III. PROBLEMDEFINITION

In the industry 4.0 the decisions related to process were taken by the operator based on his/her experiences which leads to chances of error in machining.

In machining the wear of tool also takes place which tends to increase error which is not considered by the program in the automated machines.

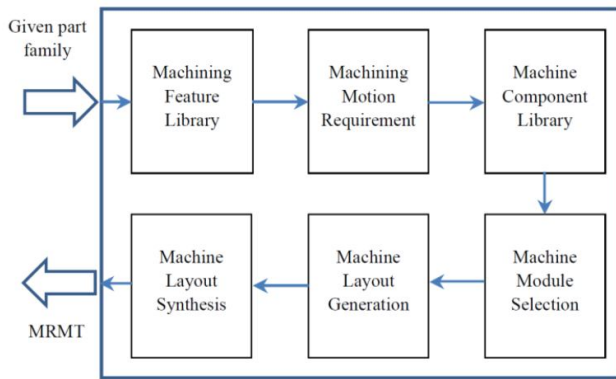
Thus 'INTELLIGENT MACHINING' is used as the main system in industry now a days.

IV. INTELLIGENT MACHINING

Processes, previously monitored and controlled by humans, are now being controlled and manipulated by smart sensors and actuators in this generation of manufacturing.Intelligent machines use sensors and data to get various aspects of manufacturing processes to maximize operations efficiencies.

The main components of INTELLIGENT MACHINING are:-

1. Sensors
2. Data acquisition system
3. Machine learning



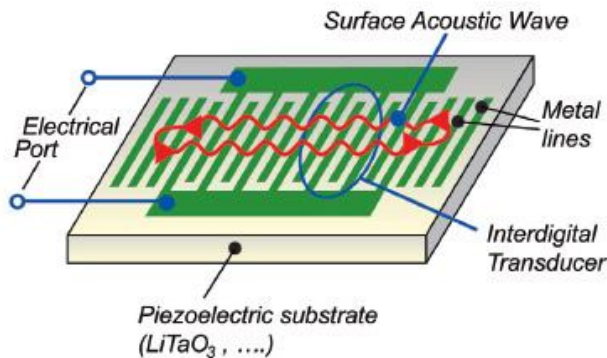
V. CONSTRUCTION

INTELLIGENT SENSORS:- Sensors collect data from the various parameters in the process. Intelligent sensors have an advantage over traditional sensors of that they can be modified according to the requirement of the process through the controller itself thereby reducing the setting time required for the traditional sensors.

- *Types of the sensors are:-*

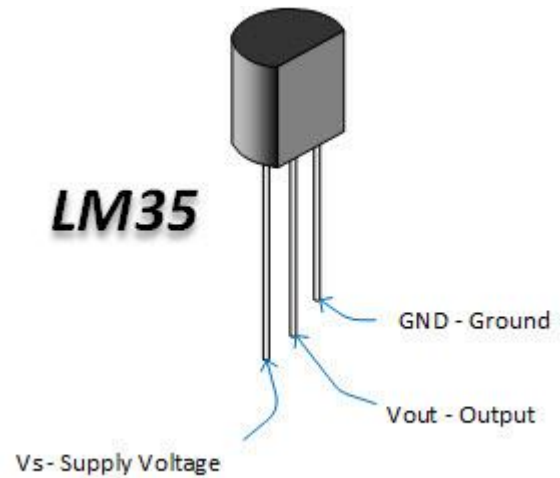
Acoustic sensors:-

These are the sensors used to convert noise/sound into electrical signal. Generally these sensors are used for checking of the tool wear.



Thermal Sensor:-

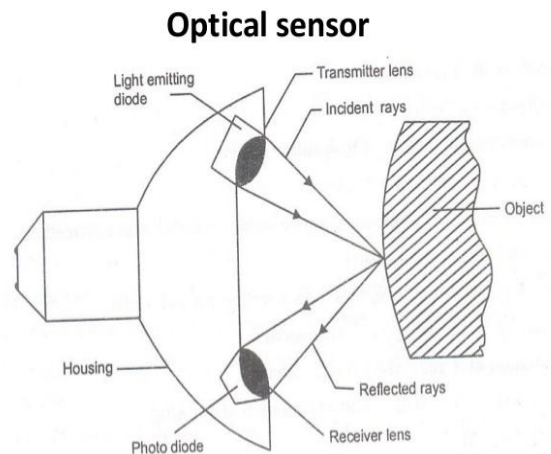
It is a type of a sensor used to convert the temperature being generated into electrical form. This sensor is generally used for measuring the temperature and supply the coolant accordingly.



This is very common type of a sensor used. There are many such sensor in which according to the requirement the are being selected such as thermocouple, RTD, etc.

Optical Sensor:-

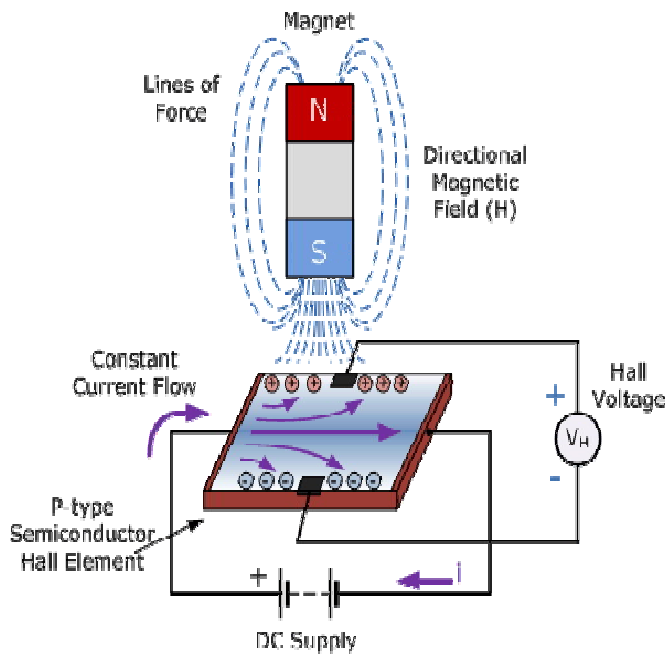
These types of the sensors emits light /rays and according the reflected rays the action is taken. These types of the sensors are generally used to detect whether the tool is present or absent.



It is very helpful sensor having various applications and that to it is cheap and efficient.

Magnetic Sensor:-

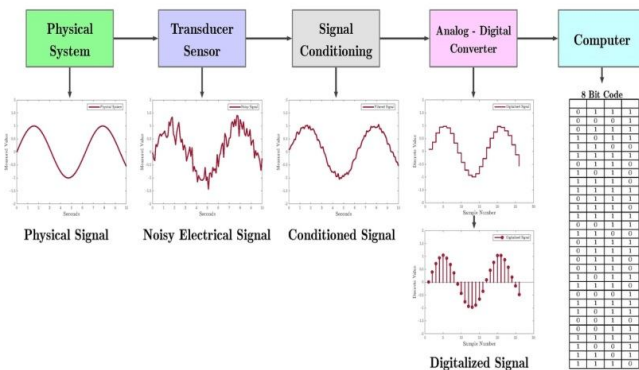
The type of the sensors are used to check whether any iron object is placed within the passage. Generally these sensors are used to measuring instruments.



• *Data acquisition system:-*

DAS is mainly used for signal conditioning of the input signal that is being measured from the physical content and then giving output into numerical value for the computer (binary numbers).

Digital Data Acquisition System

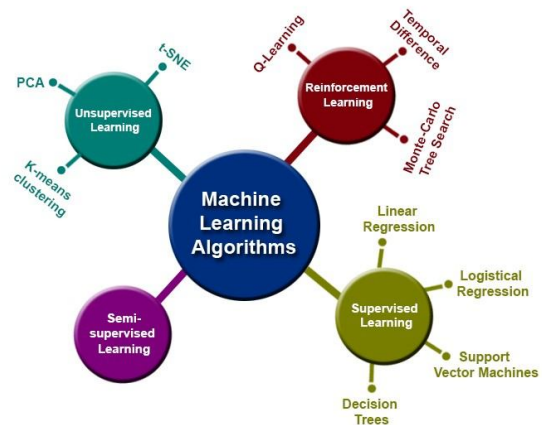


DAS is used for signal conditioning of the signal received from sensor and providing sequential filtered output signal to the controller .

• *Machine learning:-*

Machine Learning is defined as the study of computer programs that leverage algorithms and statistical models to learn through inference and patterns without being

explicitly programmed. Machine Learning field have undergone significant developments in the last decade

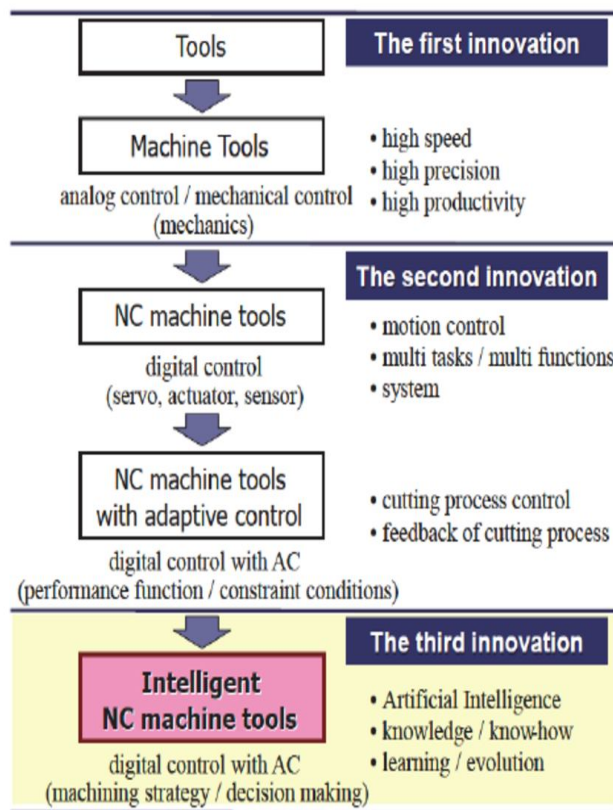


VI. PROPOSEDWORK

The intelligent sensors collect data related to the process parameters which is then signal conditioned and sent to the controller according to its preference. The machine learning algorithm then uses the collected data and the past experiences to select the most appropriate process to manufacture the product with maximum overall efficiency of the plant.

FUNCTION:-

1. The data collected by sensors is
2. The condition of tool
3. The profile of the product to be manufactured
4. Environmental conditions



It has been the most efficient way till date as the machine itself has to take the decisions according to its requirement. No human interference is required which ultimately results in the accurate process without occurrences of errors.

VII. CONCLUSION

The 'INTELLIGENT MACHINE' has become the new trends having lots of advantages mainly focusing on the productivity and the accuracy of the product. Due to the system the relation between the suppliers and the customers have be good resulting in n delay of any goods.

VIII. FUTURESCOPE

- Pre cooler in agriculture industries
- Industrial workshop
- Agro huts frames
- Laboratories
- CNC and VMC MACHINES to maintain high heat dissipation
- In control rooms for cooling of circuits.

IX. ADVANTAGES

- Productivity is boosted

- Predicted maintenance is done.
- Communication between supply chain and the customers is increased and thus result in no delay of any goods.
- Self-Decision making
- Good machining strategy
- Accuracy is minimized
- Evolution in market for maximizing profit

X. DISADVANTAGES

- Requires sensor and actuator for every element
- Cost of the system is increased
- Requires high computational power

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