**NOTICE! This is not the final text or textpart of my review and not final list of references. It is my understanding of review guidlines and I want to be sure that I have clear understood this guidline before I will start to rewrite my review. I hope we can discuss it during our Thursday skype meeting.**

**Plan of Literature Review**

***Introdution about microelectronics in modern life and microelectronic production***

"Microtechnology has offered Microelectronics, which has completely changed our way of life. Microelectronics is omnipresent in everyday life: at home, in our computers, our dishwashers, our cars, etc. Its applications are able to help us, take care of us, control things for us and much more! But now a new way of using microtechnology has risen. By including mechanical movable parts in integrated devices, the microactuators, we have opened a window to an extremely large applications fields. These new devices involving mechanical and electrical parts capable of acting on and sensing their environment are called **MicroElectroMechanical Systems** (or MEMS or Microsystems). Not a technology revolution, MEMS are more an evolution, that has taken place in our life, and will become more and more important.  
This section features microactuators basics, for design consideration, including electrostatics and MEMS based on thermal actuation, a sample micro-fabrication process, and describes MEMS commercially available applications that our current know-how allows." [1]

"Modern microelectronics technology today includes thin film, thick film, hybrid, and integrated circuits and combinations of these. Such circuits are applied in DIGITAL, SWITCHING, and LINEAR (analog) circuits. Because of the current trend of producing a number of circuits on a single chip, you may look for further increases in the packaging density of electronic circuits. At the same time you may expect a reduction in the size, weight, and number of connections in individual systems. Improvements in reliability and system capability are also to be expected.

Thus, even as existing capabilities are being improved, new areas of microelectronic use are being explored. To predict where all this use of technology will lead is impossible. However, as the demand for increasingly effective electronic systems continues, improvements will continue to be made in state-of- the-art microelectronics to meet the demands.

LARGE-SCALE INTEGRATION (lsi) and VERY LARGE-SCALE INTEGRATION (vlsi) are the results of improvements in microelectronics production technology. The picture below is representative of lsi. As shown in the figure, the entire SUBSTRATE WAFER (slice of semiconductor or insulator material) is used instead of one that has been separated into individual circuits. In lsi and vlsi, a variety of circuits can be implanted on a wafer resulting in further size and weight reduction. ICs in modern computers, such as home computers, may contain the entire memory and processing circuits on a single substrate.

Large-scale integration is generally applied to integrated circuits consisting of from 1,000 to 2,000 logic gates or from 1,000 to 64,000 bits of memory. A logic gate is an electronic switching network consisting of combinations of transistors, diodes, and resistors. Very large-scale integration is used in integrated circuits containing over 2,000 logic gates or greater than 64,000 bits of memory.

The purpose of this section is to give you a simplified overview of the manufacture of microelectronic devices. The process is far more complex than will be described here. Still, you will be able to see that microelectronics is not magic, but a highly developed technology.

Development of a microelectronic device begins with a demand from industry or as the result of research. A device that is needed by industry may be a simple diode network or a complex circuit consisting of thousands of components. No matter how complex the device, the basic steps of production are similar. Each type of device requires circuit design, component arrangement, preparation of a substrate, and the depositing of proper materials on the substrate.

The first consideration in the development of a new device is to determine what the device is to accomplish. Once this has been decided, engineers can design the device. During the design phase, the engineers will determine the numbers and types of components and the interconnections, needed to complete the planned circuit." [2]

***Modern microelectronics. Speed, complexity, equipment cost***

"As the size of these devices continues to decrease, so does the need for increasingly powerful measurement techniques rise to analyze ever more densely populated circuit boards. At smaller scales, the effect of every imperfection becomes magnified, while new design complications, such as electrostatic forces, begin to have a measurable impact on performance." [3]

"Moore’s Law is a computing term which originated around 1970; the simplified version of this law states that processor speeds, or overall processing power for computers will double every two years. A quick check among technicians in different computer companies shows that the term is not very popular but the rule is still accepted.

To break down the law even further, it specifically stated that the number of transistors on an affordable CPU would double every two years (which is essentially the same thing that was stated before) but ‘more transistors’ is more accurate.

If you were to look at processor speeds from the 1970’s to 2009 and then again in 2010, one may think that the law has reached its limit or is nearing the limit. In the 1970’s processor speeds ranged from 740 KHz to 8MHz; notice that the 740 is KHz, which is Kilo Hertz – while the 8 is MHz, which is Mega Hertz.

From 2000 – 2009 there has not really been much of a speed difference as the speeds range from 1.3 GHz to 2.8 GHz, which suggests that the speeds have barely doubled within a 10 year span. This is because we are looking at the speeds and not the number of transistors; in 2000 the number of transistors in the CPU numbered 37.5 million, while in 2009 the number went up to an outstanding 904 million; this is why it is more accurate to apply the law to transistors than to speed." [4]

*To sum up, we can say that in conditions of modern production high efficiency and profitability is possible only under conditions of careful planning, continuous monitoring and early detection of defects. All these aspects are possible through the use of remote monitoring systems such as Manufacturing Execution System.*

***About MES***

**Manufacturing Execution Systems** (MES) are [computerized](http://en.wikipedia.org/wiki/Information_technology) systems used in [manufacturing](http://en.wikipedia.org/wiki/Manufacturing). MES can provide the right information at the right time and show the manufacturing decision maker "how the current conditions on the plant floor can be optimized to improve production output."[[1]](http://en.wikipedia.org/wiki/Manufacturing_execution_system#cite_note-1)MES work in real time to enable the control of multiple elements of the production process (e.g. inputs, personnel, machines and support services).

MES might operate across multiple function areas, for example: management of product definitions across the [product life-cycle](http://en.wikipedia.org/wiki/Product_life-cycle_management), resource [scheduling](http://en.wikipedia.org/wiki/Scheduling_(production_processes)), order execution and dispatch, production analysis for [Overall Equipment Effectiveness](http://en.wikipedia.org/wiki/Overall_equipment_effectiveness) (OEE), and [materials track and trace](http://en.wikipedia.org/wiki/Track_%26_Trace).

The idea of MES might be seen as an intermediate step between, on the one hand, an [Enterprise Resource Planning](http://en.wikipedia.org/wiki/Enterprise_Resource_Planning) (ERP) system, and a [Supervisory Control and Data Acquisition](http://en.wikipedia.org/wiki/SCADA) (SCADA) or [process control](http://en.wikipedia.org/wiki/Process_control) system on the other; although historically, exact boundaries have fluctuated. [5]

***About Data Collection***

Important part of mes is data collection. For data collection, a special device is usually used, and a suite of software (server with a database).

Data Collection helps streamline employee data collection processes to:

* Reduce payroll expenses by systematically eliminating early clock-ins or late clock-outs.
* Better monitor labor distribution and costs across disparate business areas or clock-in and clock-out points.
* More easily comply with union rules, labor laws, company rules, work councils, and other regulations.
* Ensure employees comply with established schedules.
* Improve building security and reduce payroll risks caused by buddy punching and other issues.
* Enhance employee morale by holding all workers to the same clock-in and clock-out standard.

Data Collection helps accurately record time and labor data in real time by providing:

* **A record of every punch**—Enforce badge, schedule, and job assignments.
* **Real-time employee activity information**—Collect granular labor metrics information like work orders, department, or cost center activity in real time.
* **A record of the nonpunches**—Know who didn't show for the current shift or what jobs may not be finished based on the employee activity information.
* **Flexible deployment options**—Choose physical clock hardware or a virtual clock that uses an existing device or an external server. Configure punch types, labor metrics, and validations to match your business need.
* **Flexible and secure operations**—Collect data even if your network is down. Authenticate employee identity at the time of punch. Enhance security, using your existing ID methods [6].

*In the end, it is obvious that data collection is one of the most effective ways to improve the performance of modern production. Development of such a system is relevant and will be implemented in my dissertation.*

1. <http://matthieu.lagouge.free.fr/mems/>
2. <http://www.learn-about-electronics.com/modern-microelectronics.html>
3. <http://www.nikonmetrology.com/en_US/Oblasti-primeneniya/Kontrol-kachestva-materialov/Mikroelektronika/>
4. <http://www.mooreslaw.org/>
5. <http://en.wikipedia.org/wiki/Manufacturing_execution_system>
6. <http://www.infor.com/product_summary/wfm/data-collection-mfg/>