

u-Manufacturing needs M2M (Machine to Machine) for Ubiquitous Computing World

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Abstract: Core position of the M2M (Machine to Machine) is device integration fusion using an emerging wireless and next generation internet technologies as well as IEEE 802.x, Bluetooth, Zigbee, DMB, Wibro etc. for ubiquitous environment that is complementary with IT839 strategy from Ministry of Information & Communication. This paper define and deploy about major functional requirements of M2M devices and middleware for how to it works, worldwide M2M technology trend & activities with its current & future application in manufacturing area that is called u-Manufacturing (Ubiquitous Manufacturing).

Keywords: M2M (Machine to Machine), Ubiquitous Manufacturing, IEEE 802.x, Bluetooth, Zigbee, DMB, Wibro, IT839, IP v6

1. INTRODUCTION

At the center of the IT industry lays networks, and based on which compatibility of IT equipment and software and ensured. Telecommunication services, infrastructure, equipment, software and contents are the element that comprises vertical and horizontal value chains of the IT industry. In according with such a unique value chain, IT839 strategy was set forth.

Under the value chain, the introduction of 8 new services will prompt investment into the building of 3 essential networks. And these networks will pave the way for the 9 new sectors to grow fast, creating synergy effect as shown of figure 1. [1]



Fig. 1 IT 839 Strategy

The IT839 strategy aims to realize a ubiquitous world by forming the mutually developing structure among the introduction of new services, construction of infrastructures, and the new growth engine sectors.

However, the IT839 strategy will be able to serve its purpose as a national strategy when we focus on not only developing the industry and economy, but also making efforts to have these new services, infrastructures and new growth engine industries contribute to demolishing the walls between generations, classes, and regions, and ultimately getting a

competition advantages of manufacturing industry that moving to u-Manufacturing environment.

2. e-MANUFACTURING: MEANS AND DEFINITIONS

e-Manufacturing is a transformation system that enables the manufacturing operations to achieve predictive near-zero-downtime performance as well as to synchronize with the business systems through the use of web-enabled and tether-free (i.e. wireless, web, etc) infotronics technologies. It integrated information and decision making among data flow (of machine/process level), information flow (of factory and supply system level), and cash flow (of business system level).

e-Manufacturing is a business strategy as well as a core competency for companies to complete in today's e-business environment. It is aimed to complete integration of all the elements of a business- including suppliers, customer services network, manufacturing enterprise and plant floor assets with connectivity and intelligent computing to meet the demands of e-business/e-commerce practices that gained great acceptance and momentum over the last decade. e-Manufacturing is a transformation system that enables e-Business systems to meet the increasing demands through tightly coupled supply chain management (SCM), enterprise resource planning (ERP), and customer relation management (CRM) systems as well as environment and labor regulations and awareness. [2]

e-Manufacturing includes the ability to monitor the plant floor assets, predict the variation of product quality and performance loss of any equipment for dynamic rescheduling of production and maintenance operations, and synchronize with related business services to achieve a seamless integration between manufacturing and higher level enterprise systems. Dynamically updated information and knowledge about the capabilities, limits and variation of manufacturing assets for various suppliers guarantee the best decisions for outsourcing at the early stages of design. In addition, it enables customer orders autonomously across the supply chain, bringing unprecedented levels of speed, flexibility and visibility to the production process reducing inventory, excess capacity and uncertainties.

The intrinsic value of an e-Manufacturing system is to

enable real-time decision-making among product designers, process capabilities, and suppliers as figure 2. It provides tools to access life cycle information of a design or changes take weeks or months to be validate product attributes within hours using the actual process characteristics and machine capabilities. It also provides efficient configurable information exchanges and synchronization with various e-business systems.

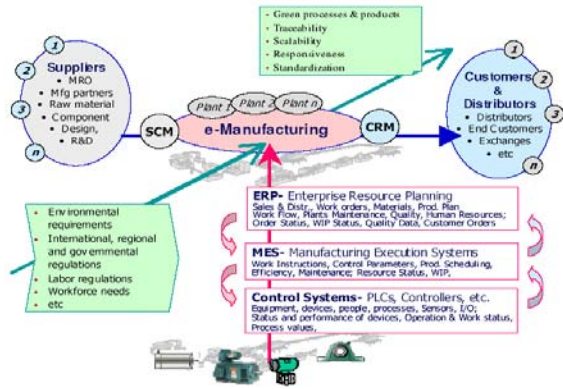


Fig. 2. e-Manufacturing system configuration

3. u-MANUFACTURING STRATEGY

For provides rapidly changing business environment needs enterprise management anytime, anywhere through key success factors as well as visibility, agility, effectiveness, and continue improvement with implement strategy including pilot project, standardization, research & development, enforce of manpower, and implementation methodology as show figure 3. [3]

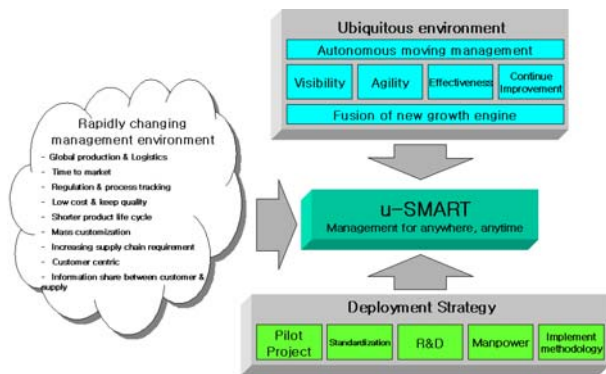


Fig. 3 Vision of u-SMART

u-SMART stand for Ubiquitous Small & medium business Mobile, Autonomous, Renovating Technology means that deploy for digitalizing of production processes including 4 M (Man, Machine, Material and Method) called Manufacturing IT (u-Manufacturing) integration and fusion to the emerging technology of next generation internet and wire/wireless.

It requires M2M device and its middleware system for real time data collection and control for 4Ms with IEEE 802.11x wireless and 10/100 wired Ethernet interface.

4. M2M- WHAT IT IS & WHAT IT DOES

M2M (short for machine-to-machine, man-to machine, and

mobile-to-machine) refers to the leveraging of machine connectivity, communications, and information technology to 1) automate and enhance business processes, and 2) enable or enhance value-added services. M2M solutions accomplish this by successfully integrating discrete company assets with existing IT systems, thereby facilitating the gathering and sharing of real-time information from every level of the organization as figure 4. [4]

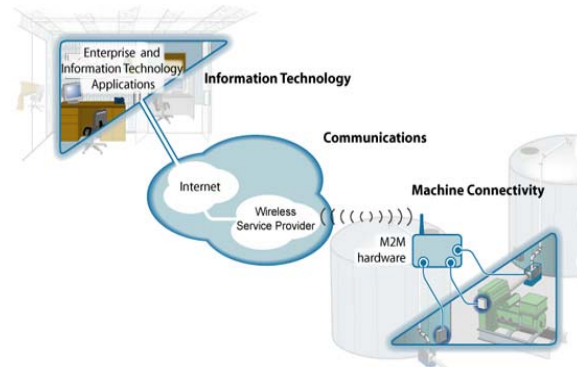


Fig. 4. M2M configuration

Most large organizations have established ERP (enterprise resource planning), SCM (Supply Chain Management), MES (Manufacturing Execution System) and other applications they rely on for enterprise planning initiatives. To offer any value, however, these applications need to be populated with up-to-the-minute, relevant, accurate data. When collated with other data gathered from every corner of the extended supply chain, this data creates a unique type of business intelligence that improves supply chain operations in a number of ways.

When deployed for the purposes of streamlining and improving the enterprise supply chain, M2M provides measurable ROI by helping to establish closer relationships with customers and suppliers and providing real-time visibility into key performance indicators. In a manufacturing environment, for example, M2M enables the sharing of real-time information between the various raw material suppliers, manufacturers, and distributors and greatly aids in ensuring the continuous availability of needed components and finished goods. Costs are reduced and inventories optimized through the better coordination of supply strategies, ordering, manufacturing runs, deliveries, and other business-critical processes.

5. IMPLEMENTATION CASES OF THE M2M

5.1. Production monitoring & control

Digitalizing production IT for studied & rapidly changing the 4Ms in production processes has 3 ways as well as 1) directly interface to fully automated device controller thru TCP/IP or serial communications, 2) Adding necessary sensors and directly interface to device controller thru TTL or 4-20MA current loop 3) data entry thru workers thru bar code reader or touch screen that is application software runs under enterprise servers. Such configuration has limited functionality for autonomous, intelligent, and knowledge based due to not intensive for production machines and providing emerging wireless and wired communication technologies.

Independent running web enabled wireless M2M device and middleware system is able to fusions traditional interfaces such as serial communication, sensor I/Os with various protocols- OPC(OLE for Process Control), SECS/GEM (Semiconductor Equipment Communication Specification), MIMOSA (Machinery Information Management Open System Alliance), Field bus of CAN, Devicenet, etc and RFID, USN (Ubiquitous Sensor Network), Bluetooth, Zigbee, and PLC (Power Line Communication) interfacing emerging technologies and providing seamless central enterprise application by wired/wireless technologies including IEEE 802.x (refer to Figure 5)[5]

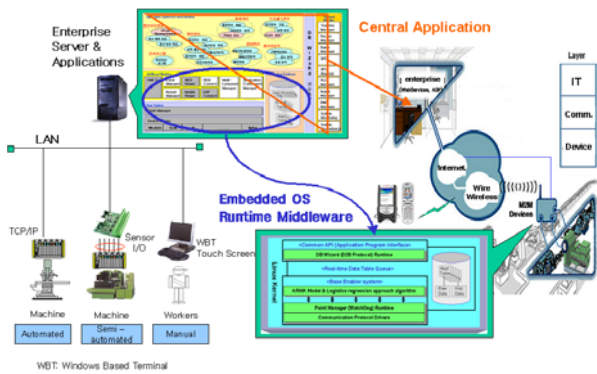


Fig. 5. u-Manufacturing configuration

5.2. Production equipment maintenance

Predictive maintenance of plant floor assets is a critical component of e-Manufacturing area. Predictive maintenance systems, also referred as e-Maintenance in this document, provides manufacturing and operating systems with near-zero downtime performance through use and integration of (1) real time and smart monitoring, (2) performance assessment methods, and (3) tether-free technologies. These systems can compare a product’s performance through globally networked monitoring systems to shift to the degradation prediction and prognostics rather than fault detection and diagnostics.

To get maximum performance from plant floor assets, e-maintenance systems can be used to monitor, analyze, compare, reconfigure, and sustain the system via a web-enabled and infotronics platform. In addition, these intelligent decisions can be harnessed through web-enabled agent and connect them to e-business tools (such as customer relation management systems, ERP systems and e-commerce systems) to achieve smart and effective service solutions. Remote and real time assessment of machine’s performance requires an integration of many different technologies including sensory devices, reasoning agents, wireless communication, and virtual integration and interface platforms. [6]

The core-enabling element of an intelligent maintenance system is the smart computational agent that can predict the degradation or performance loss (Watchdog Agent), not the traditional diagnostics of failure or faults. A complete understanding and interpretation of states of degradation is necessary to accurately predict and prevent failure of a component or a machine once it has been identified as a critical element to the overall production system.

The degradation is assessed through the performance assessment methods explained in the previous sections. A

product’s performance degradation behavior is often associated with multi-symptom-domain information cluster, which consisted of degradation behavior of functional components in a chain of actions.

The acquisition of specific sensory information may contain multiple behavior information such as non-linear vibration, thermal or materials surface degradation, and misalignment. All of the information should be correlated for product behavior assessment and prognostics

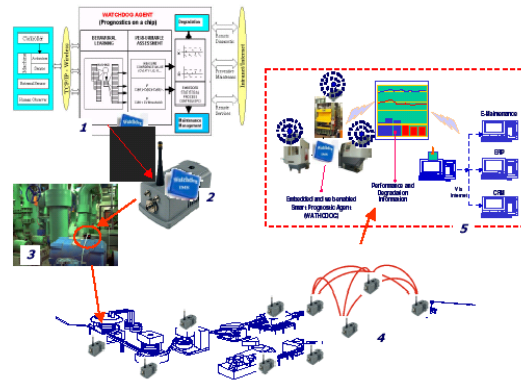


Fig. 6 e-Maintenance system

5. CONCLUSIONS

M2M is a major pillar that supports the success of the integration among e-Maintenance, u-Manufacturing and e-Business systems.

If implemented properly, manufacturers and users will benefit from the increased equipment and process reliability with optimal asset performance and seamless integration with suppliers and customers.

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