Automation of Assembly Modelling Systems with IoT and Cloud Computing

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***Abstract*— BUSINESS markets have been globalized, and inter- and intra enterprises connections become forcefully attached. Within an enterprise, the departments like assembly, manufacturing, and marketing work concurrently to optimize products and manufacturing processes at the system level. Outside an enterprise, inter-enterprise collaborations aggregate all possible resources to make composite products. After the technologies of personal computers and the Internet, Internet of Things is the latest information technology that is systematically changing business paradigms. Many manufacturing paradigms, such as agile manufacturing and sustainable manufacturing, have been projected to meet these challenges. The functioning of a new paradigm relies on the infrastructure of information technology. IoT's influence in the manufacturing sector has yet been fully look at. Existing computer aided software tools complexity, dynamics, and uncertainties in their applications of contemporary enterprises. To attain this aim, the development of manufacturing system paradigms to identify the requirements of decision support systems in dynamic and dispersed environments. The present progress in IT overviews the next generation manufacturing paradigms and the relation of IT infrastructure and ESs is explored to spot the technological gaps in adopting IoT as an IT infrastructure of ESs. The acceptance of IoT and cloud computing in enterprise systems would overcome the complexity of existing model. IoT and cloud computing are planned to help a conventional assembly modeling system change into a complex system, which is able to deal with difficulty and changes routinely. To accomplish this goal, an assembly modeling system is automated, and the planned system include innovations like the modularized architecture to make the system robust, reliable, flexible, and expandable, the integrated object-oriented templates to make easy interfaces and reuses of system components and the automated algorithms to get back relational assembly matrices for assembly planning.**

***Keywords*— cloud computing, internet of things, assembly modeling.**

I. INTRODUCTION

The concept that envisions all objects around us as part of internet is the Internet of Things (IoT) . The IoT applied to smart homes or shopping scenarios makes it easy for people with impairments to bring out their daily behaviour. This increases their independence and self-assurance. Cloud computing is a model for requirement access to a shared pool of configurable resources. Cloud acts as a front end to access Internet of Things. Applications that communicate with devices like sensors have special requirements of huge storage to storage big data, huge calculation power to enable the real time execution of data, and high speed network to stream audio or video. Several daily usage algorithms and techniques have been developed for Internet of things. To be useful, these techniques must typically be combined with a cloud computing to effectively solve the assembly line problems.

A. Internet Of Things

The Internet of Things (IoT) is the interconnection of distinctively identifiable embedded computing devices within the existing Internet infrastructure. Typically, IoT is projected to offer highly developed connectivity of devices that goes beyond machine-to-machine communications (M2M) and covers a range of protocols. The interconnection of these embedded devices is expected to lead in automation in nearly all fields, while also allowing advanced applications like a Smart Grid.Things, in the IoT, can pass on to a wide selection of devices such as heart monitoring implants, automobiles with field operation devices or built-in sensors that assist fire-fighters in search and rescue. The present market examples include smart thermostat systems and washer/dryers that utilize wifi for remote monitoring.

The application of IoT are given below:

1) Monitoring Environment

Environmental monitoring applications of the IoT normally utilize sensors to support in environmental protection by monitoring water quality and can even include areas like watching the movements of wildlife and their habitats. Progress of resource constrained devices connected to the Internet also means that other applications like earthquake or tsunami early-warning systems can also be used by emergency services to give more efficient aid. IoT devices in this application typically span a large geographic area and can also be mobile.

2) Management of Infrastructure

Monitoring and controlling operations of urban and rural infrastructures like bridges, railway tracks, on- and offshore-wind-farms is a key application of the IoT. It can also be utilized for scheduling repair and maintenance activities in an proficient manner, by synchronizing tasks between different service providers and users of these facilities. Usage of IoT devices for monitoring and operating infrastructure is likely to improve incident management and emergency response coordination, and quality of service, up-times and reduce costs of operation in all infrastructure coupled areas. Even in areas such as waste management stand to benefit from automation and optimization that could be brought in by the IoT.

3) Industrial Applications

Network control and management of manufacturing equipment, asset management, or manufacturing process control bring the IoT within the kingdom on industrial applications. The IoT intelligent systems enable quick manufacturing of new products, vibrant response to product hassles, and real-time optimization of manufacturing production and chain networks and control systems jointly.

Digital control systems to automate process controls, and service information systems to optimize plant safety and security are within the purview of the IoT. It also expands itself to asset management via predictive maintenance, and measurements to make best use of consistency. Smart industrial management systems can also be integrated with the Smart Grid. Measurements, automated controls, plant optimization, health and safety management, are provided by a large number of networked sensors.

4) Management of Energy

Combination of sensing and actuation systems, associated to the Internet, is likely to optimize energy consumption as a whole.The expectation is that IoT devices will be integrated into all forms of energy consuming devices and be able to communicate with the utility supply company in order to effectively balance power generation.The devices would also offer the chance for users to remotely control their devicesvia a cloud based interface In fact, a few systems that allow remote control of electric outlets are already available in the market.

Energy management in home, the IoT is mainly appropriate to the Smart Grid since it provides systems to gather and act on energy and power-related information in an automated fashion with the aim to recover the,reliability,efficiency, and sustainability of the production and distribution of electricity. Using Advanced Metering Infrastructure (AMI) devices joined to the Internet backbone, electric utilities can not only gather data from end-user connections, but also deal with other sharing automation devices.

5) Medical and Healthcare Systems

To enable remote health monitoring and emergency notification systems, IoT devices can be used. These health monitoring devices can range from heart rate monitors and blood pressure to sophisticated devices capable of monitoring specialized implants, such as advanced hearing aids or pacemakers. Focused sensors can also be outfitted within living spaces to monitor the health and general well-being of senior citizens, while also guaranteeing that proper treatment is being administered and assisting people regain lost mobility via therapy as well. Other consumer plans to encourage healthy living, such as, joined scales or wearable heart monitors, are also an opportunity with the IoT.

B. Reference Architecture of Internet of Things (IoT)

To meet Internet of Thing devices with corporate IT solutions require a Reference Architecture for the Internet of Things (IoT). The reference architecture must include server-side devices, capabilities and cloud architecture necessary to interact with the devices. The IOT reference architecture is shown in Fig.1. A reference architecture should offer architects and developers of IoT projects with an effective starting point that addresses major IoT project and system requirements.

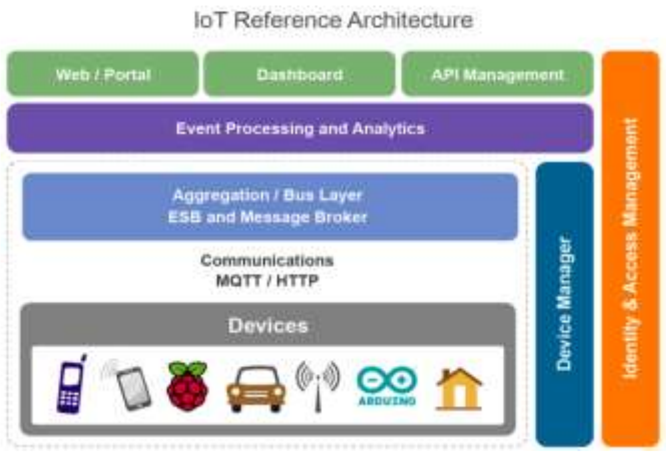

Fig.1 IOT Reference Architecture

C. Cloud computing

Cloud computing is computing in which big groups of remote servers are networked to permit centralized data storage and online access to resources or computer services. Clouds can be classified as private, public or hybrid.

The criticisms about it are primarily focused on its social allegation. This happens when the owner of the remote servers is a person or organization other than the user, as their interests may point in different directions.Cloud computing offers the following services according to several fundamental models:

- Infrastructure as a service (IaaS)
- Platform as a service (PaaS)
- Software as a service (SaaS)

D. The Cloud Architecture

Cloud architecture is shown in fig.2.The systems architecture of the software systems involved in the release of cloud computing, typically involves multiple *cloud components* communicating with each other over a loose coupling mechanism such as a messaging queue. Elastic prerequisite implies intelligence in the use of tight or loose coupling as applied to mechanisms such as these and others.

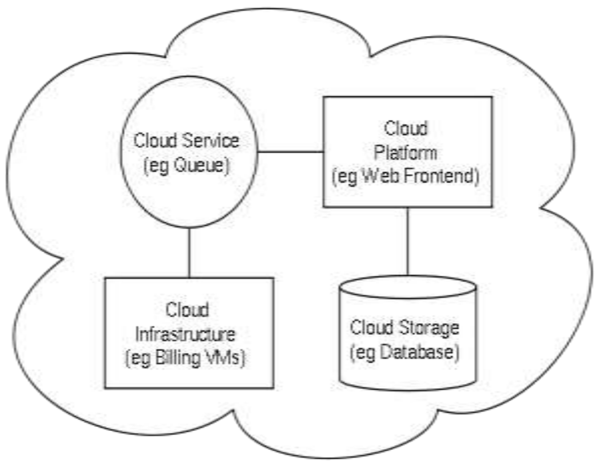

Fig.2.Cloud computing sample architecture

II. LITERATURE REVIEW

A. Components of Internet of Things

Mari Carmen Domingo et al [1] proposes different application scenarios to demonstrate the communication of the components of the Internet of Things. Currently, over a billion people including children are estimated to be living with disability. The lack of hold up services can make handicapped people overly dependent on their families, which prevents them from being cost-effectively active and publicly included. The Internet of Things can offer people with disabilities the assistance and support they need to achieve a good quality of life and allows them to participate in the social and profitable life. Several application scenarios of the IoT for physically challenged people are introduced. They illustrate the interaction of the different components of the IoT architecture.

*1) Shopping scenario:*The blind direction-finding system helps them to find their way in a store. The store's Resource Frequency Identifier system can use software to guide the visually impaired in shopping. RFID-tag based navigation systems proposed. The supermarket is divided into cells containing a shelf and passage way cells. RFID tags are distributed through the floor. The tag-IDs with in a cell is mapped to avigation information such as the type of a given cell and the types of neighboring cells. The monitoring station maintains a Bluetooth connection with the RFID reader of the user to keep track of his/her position any time using the mapping of tag-IDs with navigation information.

The speech synthesis and recognition module of the monitoring station enables the visually impaired person to say the section of the supermarket where he/she wants to go. The route to follow is obtained invoking web services through a WLAN connected to the Internet. As the visually impaired walks, routing directions from an android application are received through the headphone of the smart phone and played as voice messages. RFID tags attached to the supermarket products supply product data such as name, description and price. Sensor enabled RFID tags provide essential data such as temperature or shocks during transportation. The tag reader transmits the tag ID string to the monitoring station, which forwards it to the RFID server. Product information is returned from the RFID database to the monitoring station and played as voice messages.

2) Domestic environment: Smart home technology refers to the integration of technology and services through home networking for a better quality of living. Smart homes enable the computerization and control of the home atmosphere using multiple devices like automatic kitchen tools, light and door controllers, interior temperature controllers, water temperature controllers and home security devices. These home devices for automation and control are formed by sensors and actuators embedded in goods, home appliances or furniture. The sensors monitor the environmental conditions, process collected information and cooperate with other units through a wireless network. The collected information is then processed by a server to provide suitable services to the user. If events that give rise to alarm conditions are detected, actuators are triggered for handling the current emergency situation.

The integration of RFID in the smart home environment is also essential for identification and tracking purposes. A master–slave RFID architecture is proposed. Slave readers integrated in the home appliances communicate with mobile readers and a master reader, which is connected to a smart home server. Different master readers can communicate with each other and the mobile readers.

B .Integration of technologies and communication devices

Luigi Atzori et al [3] proposes the integration of several technologies and communications solutions for Internet of Things. As one can easily imagine, any serious input to the advance of the Internet of Things must necessarily be the result of synergetic activities conducted in different fields of knowledge, such as telecommunications, informatics, electronics and social science. Different visions of this Internet of Things pattern are reported and enabling technologies reviewed. The most relevant among them are addressed in details.

1) *Identification, sensing and communication technologies:* ‘‘Anytime, anywhere, any media” has been for a long time the vision pushing forward the advances in communication technologies. In this context, wireless technologies have played a key role and today the ratio between radios and humans is nearing the 1 to 1 value. However, the drop in terms of size, weight, energy consumption, and cost of the radio can take us to a new era where the above ratio increases of orders of magnitude. This will allow us to put together radios in almost all objects and thus, to add the world ‘‘anything” to the above vision, which leads to the IoT concept. Tags are characterized by a unique identifier and are applied to objects. Readers trigger the tag transmission by generating an apt signal, which represents a query for the possible occurrence of tags in the surrounding area and for the reception of their IDs.

Differently, in active RFIDs the battery powers the transmission of the signal as well. The coverage of the radio is the highest for active tags even if this is achieved at the expenses of higher manufacture costs. Sensor networks will also play a vital role in the IoT. In fact, they can cooperate with RFID systems to better track the status of things. As such, they can augment the awareness of a certain atmosphere and, thus, act as a further bridge between physical and digital world. Usage of sensor networks has been proposed in several application scenarios, such as ecological monitoring, e-health, quick shipping systems, military, and industrial plant monitoring.

2) Middleware: The middleware is a software layer or a set of sub-layers interposed between the technological and the application levels. Its feature of hiding the details of different technologies is fundamental to exempt the programmer from issues that are not directly pertinent to her/his focus, which is the development of the detailed application enabled by the IoT infrastructures. The middleware is gaining more and more importance in the last years due to its major role in simplifying the development of new services and the integration of legacy technologies into new ones. This excepts the programmer from the exact knowledge of the variegate set of technologies adopted by the lower layers. As it is happening in other contexts, the middleware architectures proposed in the last years for the IoT often follow the Service Oriented Architecture (SOA) approach.

The adoption of the SOA principles allows for decomposing complex and monolithic systems into applications consisting of an ecosystem of simpler and distinct components. The use of universal interfaces and standard protocols gives a horizontal view of an endeavour system. Thus, the development of business processes enabled by the SOA is the result of the process of designing workflows of matched services, which eventually are connected with objects actions. This facilitates the Interaction among the parts of an enterprise and allows for reducing the time necessary to adapt itself to the changes imposed by the market evolution.

C. Challenges and future research areas in the domain of IoT

DebasisBandyopadhyay et al [7] proposes the phrase Internet of Things. This will give abrupt access to information about the physical world and the objects in it leading to innovative services and increase in efficiency and productivity. This paper studies the up to date of IoT and presents the key industrial drivers, potential applications, challenges and future research areas in the domain of IoT. IoT definitions from different viewpoint in academic and industry communities are also discussed and compared.

*1) Key Technologies Involved in Internet of Things:*IoT can only be realized by helpful deployment of many technologies that covers the domain of software, hardware, and extremely strong applications around each domain of industry and operating sector. Some of the key technology areas that will permit IoT are: (i) identification technology, (ii) IoT architecture technology, (iii) communication technology, (iv) data and signal processing technology, (v) network discovery technology, (vi) software and algorithms, (vii) hardware technology, (viii) network technology, (ix) security and privacy technologies, (x) power and energy storage technology, (xi) relationship network management technology, (xii) discovery and search engine technology, and (xiii) standardization.

2) Identification Technology: The function of identification is to map a unique identifier or UID, to an entity so as to make it retrievable and identifiable without vagueness. UIDs may be built as a single quantity or out of a collection of attributes such that the combination of their values is distinctive. In the vision of IoT, things have a digital identity, are identified with a digital name and the relationships among things can be specified in the digital domain. IoT deployment will require the development of new technologies that need to address the identity management, global ID schemes, , identity authentication and repository management encoding/encryption, using identification and addressing schemes and the creation of global directory lookup services and discovery for IoT applications with various unique identifier schemes.

3) Networking Technology: The IoT deployment needs developments of suitable network technology for implementing the vision of IoT to reach out to objects in the physical. Technologies like RFID, sensor networks and short-range wireless communication are means to achieve the network connectivity, while IPv6(Internet protocol version 6), with its extended address space, , connecting and tracking things. In IoT paradigm, scalability and cross platform compatibility between diverse networked systems will be necessary requirements. The network technologies have to offer solutions that can offer the viability of connecting almost anything to the network at a reduced cost.

In the IoT paradigm, the networks will dynamically change and continuously evolve. Also, the things will have varying degrees of autonomy. New things will possibly be added and the network topologies will be changing fast. In this scenario, automated discovery mechanisms and mapping capabilities are essential for efficient network and communication management. Without an automated discovery mechanism, it is impossible to achieve a scalable and accurate network management capability.

*4) Types of Data in the Internet of Things:*It is useful to classify data of the IoT into a number of categories. Some data is discrete and some continuous, some automatically generated and some an input by humans. Paper categorized the data into the following areas: RFID, address/unique identifiers, descriptive data, positional and environmental data, sensor data, historical data, physics models, and command data.

Radio Frequency Identification refers to identification and tracking using radio waves and is becoming a common place technology. RFID tags can be inserted into objects and used to transmit and receive information. The origins of RFID can be traced back to 1948, emerging from technology advances of World WarII. Some commercial applications appeared in the 1980s and standards started to emerge in the 1990s, with wider deployment, until now, where it is a part of everyday life.

Objects of the IoT will need to be uniquely identified with IP addresses. As the number of objects in the IoT grows, the number of required identifiers will grow. It is with the application of the IoT in mind, among other concerns, that Internet Protocol version 6 (IPv6) was specified to replace the current widely deployed Internet Protocol version 4 (IPv4). IPv4 is suffering from IP address exhaustion, which is the decreasing supply of unallocated IPv4 addresses. This depletion has been a concern since the 1980s, when the Internet started to experience dramatic growth.

Positional data provides the location of a particular tagged object either within a global positioning system (GPS) or within a local positioning system. GPS is implemented with multiple satellites sending signals to a controlling unit from which objects can ascertain their position through triangulation. Local positioning systems work in a similar way, with smaller coverage. Examples of local technology are cellular base stations, Wi-Fi access points, and TV towers.

Local positioning systems can be used in collaboration with GPS or sometimes instead of GPS. They can be used inside buildings or heavily built-up areas. In smaller areas, such as a room in a house, positional data can come from locally placed sensors and transmitters. Multiple sensors send signals to a smart object, which can then work out its location or the location of a collaborating object. Positional data will play an important part in the IoT given that its components maybe static or mobile. A very fine grained positioning remains a challenge and is being actively addressed by researchers.

The size and scale of the data in the IoT will be vast. Data will need to be managed via responsible local ownership. Local owners will decide which data and services to make available to the global network. Thus, the IoT may operate on more than one level: private and public. Users may join groups for access to certain privately owned data or may, on the other hand, access data publicly available over the public Internet. There may be differences in quality of data depending on ownership and level of care. Gradually trust and reputation systems will provide information to users on the quality of the data.

III. CONCLUSIONS

The overview of Internet of Things (IoT) and Cloud computing are discussed in the proposed study. IoT is applied to support decision-makings at all of domains and levels. IoT envisions all objects around us as part of internet. IoT can be a vital solution to address system complexity and uncertainties. Some enabling technologies are introduced to evolve conventional assembly planning system into an advanced IoT-based information system. An automated system for assembly modeling of complex products is discussed. Cloud computing is a critical technology to support decision making systems of IoT-based applications. Cloud acts as a front end to access Internet of Things. Applications that work together with devices like sensors have special requirements of huge storage to storage big data, huge calculation power to facilitate the real time processing of the data, and high speed network to flow audio or video. The proposed study resolves the challenges in generating assembly plans of complex products.

REFERENCES

[1] Ahmad S, TokhiMO and M.C. Domingo(2012),"An overview of the Internet of Things for people with disabilities", Journal of Network and Computer Applications, vol.35, pp 584-596.

[2] AlessioBotta, Valerio Persico and Walter de Donato(2011), "On the Integration of Cloud Computing and Internet of Things." IETE Technical Review, vno. 42, no. 7,pp. 394-409.

[3] Antonio Iera , GiacomoMorabito and Luigi Atzori(2010), "The Internet of Things: A survey," Science Direct Computer Networks vol.54 pp. 2787-2805.

[4] Anand R. Padwalkar and PrajaktaPande(2014), "Internet of Things –A Future of Internet: A Survey." International Journal of Advance Research in Computer Science and Management Studies, vol. 2, No. 2, pp. 354-361.

[5] Cooper J and James A(2010), "Challenges for database management in the internet of things", IETE Technical Review, vol. 26, no. 5, pp. 320-329.

[6] Chunhua Li, Haojing Huang, JieXin, Zhiming Cui, Shukui Zhang and Tianxu He(2014), "Constructing Topic Models of Internet of Things for Information Processing", The Scientific World Journal, vol. 48, no. 10, pp. 1-11.

[7] Debasis Bandyopadhyay JaydipSen(2011), "Internet of Things: Applications and Challenges in Technology and Standardization." Springer Science Business Media, LLC ,vol. 58, pp. 49-69.

[8] Duncan McFarlane , Lopez Damith C. Ranasinghe, Mark Harrison and Tomas Sanchez(2012), "Adding sense to the Internet of Things: An architecture framework for Smart Object systems", Springer-Verlag London Limited, vol. 16, pp. 291-308.

[9] Evan Welbourne, Garret Cole and Leilani Battle(2009), "Building the Internet of Things Using RFID The RFID Ecosystem Experience", Published by the IEEE Computer Society, vol. 09, pp. 49-55.

[10] Fei Tao, Li Da Xu and Ying Cheng(2014), "CCIoT-CMfg: Cloud Computing and Internet of Things-Based Cloud Manufacturing Service System.", IEEE Transactions on Industrial Informatics, vol. 10, no. 2, pp. 1435-1442.

[11] Huan Pei, Jiaerheng Ahati, Li Da Xu, Shifeng Fang and Yunqiang Zhu(2014), "An Integrated System for Regional Environmental Monitoring and Management Based on Internet of Things." IEEE Transactions on Industrial Informatics, vol. 10, no. 2, pp. 1596-1605.

[12] JayavardhanaGubbi, Marimuthu Palaniswami, Rajkumar Buyya and SlavenMarusic(2006)," Internet of Things (IoT): A Vision, Architectural Elements, and Future Directions", IEEE Communication Magazine vol. 44, pp. 115-121.

[13] Li Da Xu (2011), "Enterprise Systems: State-of-the-Art and Future Trends", IEEE Transactions on Industrial Informatics, vol. 7, no. 4, pp. 630-640.

[14] Nickolas j.g. falkner and Yongruiqin,Quan z. sheng (2014), "When Things Matter: A Data-Centric View of the Internet of Things", ACM Journal Name, vol. 10, no. N, pp 1-35.

[15] Zhuming Bi (2014), "Internet of Things for Enterprise Systems of Modern manufacturing", IEEE Transactions on Industrial Informatics, vol. 10, no. 2, pp 1537-1546.

