IOT and Industry 4.0: The Industrial New Revolution

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IOT and Industry 4.0: The Industrial New Revolution

Marcelo T Okano
Marcelo.okano@fatec.sp.gov.br
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The world is undergoing constant transformations that somehow change the trajectory and history of humanity. We can illustrate with the first and second industrial revolutions and the information revolution. The introduction of the Internet of Things and Services into the manufacturing environment is ushering in a fourth industrial revolution: Industry 4.0. The objective of this study was to analyze the novelty of the theme Industry 4.0 related to IOT through a systematic review *in the Web of knowledge base. The results showed the institutions that research the theme, the researchers' network of relationships, etc. We can conclude that the theme is important, but the scientific production is still small, appearing now the articles in congresses and magazines.*

1. Introduction

Internet of Things (IOT) can be understood as the ubiquitous and global network that helps and provides the functionality of integrating the physical world. This is done through the collection, processing and analysis of data generated by IOT sensors, which will be present in all things and will be integrated through the public communication network. Some projections estimate that in 2020 the number of connected equipment will grow exponentially to 50 billion [1].

According to Haddara & Elragal [2], the world has had multiple industrial revolutions over history. The 1st industrial revolution was the mechanization of production using water and steam power; the 2nd industrial revolution introduced mass production with the help of electric power; and 3rd industrial revolution use electronics and IT to further automate production.

In the last years, the technological advances of ITCs provided a set of tools that changed our life as internet, robots, drones, IoT, and so on. Beyond all this, things communicate in a world-wide network: The Internet. This trend will certainly find its way also into industrial production, which will benefit increasingly from the advances in ICT and computer sciences [3].

The introduction of the Internet of Things and Services into the manufacturing environment is ushering in a fourth industrial revolution: Industry 4.0. This new type of industry is based on model of Smart Enterprise, i.e. Smart Factory [4].

The objective of this study was to analyze the novelty of the theme Industry 4.0 related to IOT through a systematic review in the Web of knowledge base.

2. Industry 4.0

In 2011, at the Hanover Fair, the term Industry 4.0 was first coined. In October 2012, the Working Group on Industry 4.0, presented a set of implementation recommendations to the German government. The term Industry 4.0 initiates from a project in the high-tech strategy of the German government. Such project advocates the computerization of the manufacturing industry. It is also known as the 4th industrial revolution. Precisely speaking, industry 4.0 is based on the technological concepts of cyber-physical systems, Internet of Things (Iota), which enables the Factory of the Future (Fofo) [2].

From this point onwards, companies have come up with solutions to this concept, supported by governments, mainly European (especially German), but also by countries such as the United States, Japan and China, indicating that this was an industrial and strategic era Industries.

According to Weyer et al. [3], in Industry 4.0, field devices, machines, production modules and products are comprised as Cyber-Physical Systems (CPS) that are autonomously exchanging information, triggering actions and controlling each other independently. Factories are developing into intelligent environments in which the gulf between the real and digital world is becoming smaller. The strong bias of the electro-technical and hierarchical world of factory automation will transition to smart factory networks, that enable dynamic re-engineering processes and deliver the ability to respond flexibly to disruptions and failures.

Central aspects of the Industry 4.0 can be further specified through three paradigms: The Smart Product, the Smart Machine and the Augmented Operator. The guiding idea of the Smart Product is to extend the role of the work piece to an active part of the system. The products receive a memory on which operational data and requirements are stored directly as an individual building plan. The paradigm of the Smart Machine describes the process of machines becoming Cyber-Physical Production Systems (CPPS). The third paradigm mentioned above, the Augmented Operator, targets at the technological support of the worker in the challenging environment of highly modular production systems [3].

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3. Internet of Things (IoT)

The Internet of Things (IoT) is a new paradigm that is rapidly gaining ground in the modern wireless telecommunications landscape, the concept is the widespread presence around us of a variety of things or objects - such as radio frequency identification (RFID) tags, Sensors, actuators, cell phones, etc. - that through unique addressing schemes can interact with each other and cooperate with their neighbors to achieve common goals. The main strength of the IOT idea is the high impact it will have on various aspects of everyday life and the behavior of potential users [5].

The model consists of services that are commodities and delivered in this way, cloud computing would provide the virtual infrastructure for such utility computing that integrates monitoring devices, storage devices, analytics tools, visualization platforms and customer delivery. The cost-based model offered by cloud computing will enable the provision of end-to-end services for enterprises and users to access applications from anywhere [6].

According to Weber [8], The Internet of Things, an emerging global Internet-based technical architecture facilitating the exchange of goods and services in global supply chain networks has an impact on the security and privacy of the involved stakeholders. Measures ensuring the architecture's resilience to attacks, data authentication, access control and client privacy need to be established.

There are several application domains that are impacted by the Internet. Applications can be classified based on the type of network availability, coverage, scale, heterogeneity and others. We classify as applications in four application domains: (1) Personal and Home; (2) Enterprise; (3) Public services; and (4) Mobile. This is represented in Fig. 1, which represents Personal and Home IOT in the scale of an individual at home, Enterprise IOT in the scale of a community, Utility IOT on a national or regional scale and Mobile IOT that is spread across other domains also due to the nature of connectivity and scale There is a huge crossover in applications and data usage across domains [6][9]

Figure 1 *Internet of Things Schematic Showing the end users and Application Areas Based on Data.[6]*

4. Methodology

According to the purpose and purpose of this project, the research adopted the qualitative approach. The form of logical reasoning used was the inductive method. In relation to the nature of the sources used the research is classified as bibliographic rather than experimental.

The bibliographic research was carried out with two purposes: to gather knowledge about the concept of structured and unstructured data that compose the health area and to find primary studies on the subject.

The bibliographic research was performed according to the systematic review method. According to Sampaio and Mancini [10], the systematic review is a formal method for the synthesis of information available in primary studies that are relevant to the set of research questions. According to Kitchen an et al. [11], the systematic review is characterized by the adoption of a methodology for the identification, analysis and interpretation of all the available evidence during the research, so that it is free from bias and can be repeated if necessary.

Sampaio and Mancini [10] presents three steps for the systematic review: planning, execution and reporting. The planning stage basically consists of the definition of research questions and the elaboration of the review protocol. The review protocol defines exactly how each step of the search is performed so that it can be reproduced.

The research is performed in the execution stage following the steps established in the review protocol and its results are presented with the preparation of the report.

A survey on IoT and Industry 4.0 was the basis of the theoretical basis for the analysis and construction of the project.

The quantitative analysis of the results found with the systematic review provided an overview of the existing studies on IoT and Industry 4.0, as well as their importance.

5. Results

For the selection of these articles, a search was made in the Web of Science databases, considering the key words IoT, Internet of Things and Industry 4.0. We found 118 papers related to the theme proposed for this article, the papers found are in Table 2.

Table 2 *Papers Found in Systematic Review*

Title	Authors
Towards Industry 4.0-Standardization as the crucial challenge for highly modular, multi-vendor production systems	Weyer, Stephan; Schmitt, Mathias; Ohmer, Moritz; Gorecky, Dominic
Smart Manufacturing: Past Research, Present Findings, and Future Directions	Kang, Hyoung Seok; Lee, Ju Yeon; Choi, sangsu; Kim, Hyun; Park, Jun Hee; Son, Ji Yeon; Kim, Bo Hyun; Noh, Sang Do
An iot Architecture for Things from Industrial Environment	Ungurean, Ioan; Gaitan, Nicoleta-Cristina; Gaitan, Vasile Gheorghita
Scalability of OPC-UA Down to the Chip Level Enables Internet of Things	Imtiaz, Jahanzaib; Jasperneite, Juergen
Industry 4.0 as a Cyber-Physical System study	Mosterman, Pieter J.; Zander, Justyna
Software-Defined Industrial Internet of Things in the Context of Industry 4.0	Wan, Jiafu; Tang, Shenglong; Shu, Zhaogang; Li, Di; Wang, Shiyong; Imran, Muhammad; Vasilakos, Athanasios V.
Service Composition in the Cloud-Based Manufacturing Focused on the Industry 4.0	Pisching, Marcos A.; Junqueira, Fabricio; Santos Filho, Diolino J.; Miyagi, Paulo E.
Intelligent Predictive Maintenance (ipdm) for Elevator Service Through CPS, IOT& S and Data Mining	Wang, Kesheng; Dai, Guohong; Guo, Lanzhong
Introduction and establishment of virtual training in the factory of the future	Gorecky, Dominic; Khamis, Mohamed; Mura, Katharina
Using Smart Edge iot Devices for Safer, Rapid Response With Industry iot Control Operations	Condry, Michael W.; Nelson, Catherine Blackadar
Managing Innovative Production Network of Smart Factories	Veza, I.; Mladineo, M.; Gjeldum, N.
Towards Situation-Aware Adaptive Workflows sitopt - A General Purpose Situation-Aware Workflow Management System	Wieland, Matthias; Schwarz, Holger; Breitenbuecher, Uwe; Leymann, Frank
The Readiness of ERP Systems for the Factory of the Future	Haddara, Moutaz; Elragal, Ahmed
Industrial Revolution - Industry 4.0: Are German Manufacturing smes the First Victims of this Revolution?	Sommer, Lutz
Lab-on-Spoon - a 3-D integrated hand-held multi-sensor system for low-cost food quality, safety, and processing monitoring in assisted-living systems	Koenig, A.; Thongpull, K.
Smart Pipe System for a Shipyard 4.0	Fraga-Lamas, Paula; Noceda-Davila, Diego; Fernandez-Carames, Tiago M.; Diaz-Bouza, Manuel A.; Vilar-Montesinos, Miguel
A concept for context-aware computing in manufacturing: the white goods case	Alexopoulos, Kosmas; Makris, Sotiris; Xanthakis, Vangelis; Sipsas, Konstantinos; Chryssolouris, George
Research Challenges of Industry 4.0 for Quality Management	Foidl, Harald; Felderer, Michael
Hardware-Security Technologies for Industrial iot: trustzone and Security Controller	Lesjak, Christian; Hein, Daniel; Winter, Johannes
Wireless requirements and challenges in Industry 4.0	Varghese, Anitha; Tandur, Deepaknath
From Sensor Networks to Internet of Things. Bluetooth Low Energy, a Standard for This Evolution	Hortelano, Diego; Olivares, Teresa; Carmen Ruiz, M.; Garrido-Hidalgo, Celia; Lopez, Vicente
The cellular approach: smart energy region Wunsiedel. Testbed for smart grid, smart metering and smart home solutions	Kleineidam, Gerhard; Krasser, Marco; Reischboeck, Markus
Internet of Things and Edge Cloud Computing Roadmap for Manufacturing	Georgakopoulos, Dimitrios; Jayaraman, Prem Prakash; Fazia, Maria; Villari, Massimo; Ranjan, Rajiv
The Internet Information and Technology Research Directions based on the Fourth Industrial Revolution	Chung, Mihyun; Kim, Jaehyoun
A design automation approach for task-specific intelligent multi-sensory systems - Lab-on-spoon in food applications	Thongpull, Kittikhun; Groben, Dennis; Koenig, Andreas
A Real Time Object Recognition and Counting System for Smart Industrial Camera Sensor	Lee, Shih-Hsiung; Yang, Chu-Sing
Performance Modeling Extension of Directory Facilitator for Enhancing Communication in FIPA-Compliant Multiagent Systems	Kadera, Petr; Novak, Petr
Cyber physical systems for predictive production systems	Lee, Jay; Jin, Chao; Bagheri, Behrad
Critical infrastructures-cyber security requirements from a utility's perspective	Kleineidam, G.; Schmid, L. J.; Krasser, M.; Koch, B.
Using Industry 4.0 Technologies to Support Teaching and Learning	Wanyama, Tom

Field Study on the Application of a Simulation-Based Software Tool for the Strain-Based Staffing in Industrial Manufacturing	Gust, Peter; Muller, Ulf; Feller, Nico; Schiffmann, Michael
Application of a Simulation-Based Software Tool for the Prospective Design of IT Work Places	Feller, Nico; Amann, Andreas; Mueller, Ulf; Schiffmann, Michael; Kurscheid, Oliver; Gorzellik, Markus
Systems Engineering Requires Digital Twins of Machine Elements	Gruender, Willi Theodor
Multi-objective optimization and visualization for analog design automation	Kammara, Abhaya Chandra; Palanichamy, Lingaselvan; Koenig, Andreas
Key Design of Driving Industry 4.0: Joint Energy-Efficient Deployment and Scheduling in Group-Based Industrial Wireless Sensor Networks	Lin, Chun-Cheng; Deng, Der-Jiunn; Chen, Zheng-Yu; Chen, Kwang-Cheng
UML4IoT-A UML-based approach to exploit iot in cyber-physical manufacturing systems	Thramboulidis, Kleanthis; Christoulakis, Foivos
New Paradigm of Industrial Development of Germany - Strategy Industry 4.0	Belov, V. B.
Iot business models in an industrial context	Weinberger, Markus; Bilgeri, Dominik; Fleisch, Elgar
Study of sensing technologies for machine tools	Fujishima, Makoto, III; Ohno, Katsuhiko; Nishikawa, Shizuo; Nishimura, Kimiyuki; Sakamoto, Masataka; Kawai, Kengo
A Complex View of Industry 4.0	Roblek, Vasja; Mesko, Maja; Krapez, Alojz
Cyber Physical Security for Industrial Control Systems and iot	Kobara, Kazukuni
Device Data Ingestion for Industrial Big Data Platforms with a Case Study dagger	Ji, Cun; Shao, Qingshi; Sun, Jiao; Liu, Shijun; Pan, Li; Wu, Lei; Yang, Chenglei
Research and Design of RFID-based Equipment Incident Management System for Industry 4.0	Cao, Jiqing; Zhang, Shuhai
Industrie 4.0-From the perspective of applied research	Neugebauer, Reimund; Hippmann, Sophie; Leis, Miriam; Landherr, Martin
Logistics Response to the Industry 4.0: the Physical Internet	Maslaric, Marinko; Nikolicic, Svetlana; Mircetic, Dejan
SUPPORT OF INTEGRATED PRODUCTION MANAGEMENT IN DIGITAL ENVIRONMENT	Videcka, Zdenka
Mobile Services for Customization Manufacturing Systems: An Example of Industry 4.0	Wan, Jiafu; Yi, Minglun; Li, Di; Zhang, Chunhua; Wang, Shiyong; Zhou, Keliang
A New Approach of PHM as a Service in Cloud Computing	Terrissa, Labib Sadek; Meraghni, Safa; Bouzidi, Zahra; Zerhouni, Noureddine
A Holistic Approach To Innovations In Tourism	Ivanovic, Slobodan; Milojica, Vedran; Roblek, Vasja
Digital Service Innovation and Smart Technologies: Developing Digital Strategies Based on Industry 4.0 And Product Service Systems for the Renewal Energy Sector	Weiss, Peter; Koelmel, Bernhard; Bulander, Rebecca
Using autonomous intelligence to build a smart shop floor	Tang, Dunbing; Zheng, Kun; Zhang, Haitao; Sang, Zelei; Zhang, Zequn; Xu, Chao; Espinosa-Oviedo, Javier A.; Vargas-Solar, Genoveva; Zechinelli-Martini, Jose-Luis
From E-learning to Industry 4.0	Huba, Mikulas; Kozak, Stefan
Industry 4.0 as Enabler for Effective Manufacturing Virtual Enterprises	Ferreira, Filipe; Faria, Jose; Azevedo, Americo; Marques, Ana Luisa
Acoustic and Optical Sensing Configurations for Bulk Solids Mass Flow Measurements	O' Mahony, Niall; Murphy, Trevor; Panduru, Krishna; Riordan, Daniel; Walsh, Joseph
Tangible Industry 4.0: a scenario-based approach to learning for the future of production	Erol, Selim; Jaeger, Andreas; Hold, Philipp; Ott, Karl; Sihn, Wilfried
Internet of Things: A review from 'Farm to Fork'	Nukala, Revathi; Panduru, Krishna; Shields, Andrew; Riordan, Daniel; Doody, Pat; Walsh, Joseph
Wireless IEEE1588 over an Infrared Interface	Meier, Sven
Industry 4.0: A Review On Industrial Automation And Robotic	Bahrin, Mohd Aiman Kamarul; Othman, Mohd Fauzi; Azli, Nor Hayati Nor; Talib, Muhamad Farihin
Ipanera : An Industry 4.0 based Architecture for Distributed Soil-less Food Production Systems	De Silva, P. C. P.; De Silva, P. C. A.
From Simulation to Experimentable Digital Twins Simulation-based Development and Operation of Complex Technical Systems	Schluse, Michael; Rossmann, Juergen
Waste reduction possibilities for manufacturing systems in the industry 4.0	Tamas, P.; Illes, B.; Dobos, P.

A Perspective on Industry 4.0: From Challenges to Opportunities in Production Systems	Khan, Ateeq; Turowski, Klaus
Does Industry 4.0 Influence Efficiency of Financial Management of A Company?	Horak, Josef
Industry 4.0. The End Lean Management?	Martinez, Felipe; Jirsak, Petr; Lorenc, Miroslav
Intelligent Mailbox with Centralized Parallel Processing	Adeel, Muhammad; Rehman, Nabeel Ur
A Distributed Time Server for the Real-Time Extension of coap	Konieczek, Bjoern; Rethfeldt, Michael; Golatowski, Frank; Timmermann, Dirk
Iot-based Integration of IEC 61131 Industrial Automation Systems: The case of UML4IoT	Christoulakis, Foivos; Thramboulidis, Kleanthis
Industry 4.0 as a Part of Smart Cities	Lom, Michal; Pribyl, Ondrej; Svitek, Miroslav
Model-based representation of protection measures as Solution Patterns	Kliewe, Daniel; Anacker, Harald; Dumitrescu, Roman; Wegel, Arthur
Approach to Interconnect Existing Industrial Automation Systems with the Industrial Internet	Faul, Alexander; Jazdi, Nasser; Weyrich, Michael
A Concept for Self-Configuration of Adaptive Sensor and Information Fusion Systems	Fritze, Alexander; Moenks, Uwe; Lohweg, Volker
Test and On-Line Monitoring of Real-Time Ethernet with Mixed Pysical Layer for Industry 4.0	Fuchs, Stefan; Schmidt, Hans-Peter; Witte, Stefan
An Architecture based on iot and CPS to Organize and Locate Services An architecture focused on Industry 4.0	Pisching, Marcos A.; Junqueira, Fabricio; dos Santos Filho, Diolino J.; Miyagi, Paulo E.
Iot Sensing Parameters Adaptive Matching Algorithm	Qiu, Zhijin; Hu, Naijun; Guo, Zhongwen; Qiu, Like; Guo, Shuai; Wang, Xi
Investigated Information Data of CNC Machine Tool for Established Productivity of Industry 4.0	Chang, Wen-Yang; Wu, Sheng-Jhih
Industry 4.0-Potentials for Predictive Maintenance	Li, Zhe; Wang, Kesheng; He, Yafei
Logistics 4.0 Solution New Challenges and Opportunities	Wang, Kesheng
A Quality Pathway to Digitalization in Manufacturing thru Zero Defect Manufacturing Practices	Eleftheriadis, Ragnhild J.; Myklebust, Odd
Process Modeling for Industry 4.0 Applications Towards an Industry 4.0 Process Modeling Language and Method	Petrasch, Roland; Hentschke, Roman
The Digitization of Manufacturing and its Societal Challenges A Framework for the Future of Industrial Labor	Dregger, Johannes; Niehaus, Jonathan; Ittermann, Peter; Hirsch-Kreinsen, Hartmut; ten Hompel, Michael
Axiomatic design applied to the development of a system for monitoring and teleoperation of a cnc machine through the internet	Oliveira, L. E. S.; Alvares, A. J.
Evaluating four devices that present operator emotions in real-time	Mattsson, S.; Partini, J.; Fast-Berglund, A.
Project management for increasing logistics productivity in direction of industry 4.0	Marousek, Roman; Novotny, Petr
Product Lifecycle Management - How to adapt PLM to support changing product development processes in industry?	Bitzer, Michael; Vielhaber, Michael; Kaspar, Jerome
Industry 4.0 and cloud manufacturing: a comparative analysis	Liu, Yongkui; Xu, Xun
Hartkad: A P2P-based Concept for Deterministic Communication and Its Limitations	Konieczek, Bjoern; Skodzik, Jan; Danielis, Peter; Altmann, Vlado; Rethfeldt, Michael; Timmermann, Dirk
Socio-economic aspects of industry 4.0	Vacek, Jiri
Educating Engineers for Industry 4.0: Virtual Worlds and Human-Robot-Teams Empirical Studies towards a new educational age	Richert, Anja; Shehadeh, Mohammad; Plumanns, Lana; Gross, Kerstin; Schuster, Katharina; Jeschke, Sabina
Technological Theory of Cloud Manufacturing	Kubler, Sylvain; Holmstrom, Jan; Framling, Kary; Turkama, Petra
Designing of information systems in manufacturing with iot: introducing object-oriented rfid for control system	Kamigaki, Tamotsu
Digital Master as an Enabler for Industry 4.0	Biahmou, Alain; Emmer, Christian; Pfouga, Alain; Stjepandic, Josip
Industry 4.0 Implies Lean Manufacturing: Research Activities in Industry 4.0 Function as Enablers for Lean Manufacturing	Sanders, Adam; Elangeswaran, Chola; Wulfsberg, Jens
Product Lifecycle Management Enabled by Industry 4.0 Technology	Ferreira, Filipe; Faria, Jose; Azevedo, Americo; Marques, Ana Luisa
Software-Defined Cloud Manufacturing for Industry 4.0	Thames, Lane; Schaefer, Dirk
A maturity model for assessing Industry 4.0 readiness and maturity of manufacturing enterprises	Schumacher, Andreas; Erol, Selim; Sihn, Wilfried

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Enabling PROFINET devices to work in iot: characterization and requirements	Bellagente, Paolo; Ferrari, Paolo; Flammini, Alessandra; Rinaldi, Stefano; Sisinni, Emiliano
Ioti:Internet of Things Instruments Reconstruction Model Design	Qiu, Zhijin; Guo, Zhongwen; Guo, Shuai; Qiu, Like; Wang, Xi; Liu, Shiyong; Liu, Chao
A Modular Web Framework for Socio-CPS-Based Condition Monitoring	Fleischmann, Hans; Kohl, Johannes; Franke, Joerg
SCADA system design: a proposal for optimizing a production line	Ruiz Carmona, Jose Adrian; Munoz Benitez, Julio Cesar; Garcia-Gervacio, Jose L.
Exploring the Optimal Structure of a CNC Grinding Machine	Shen, Hui-Cun; Wang, Kun-Chieh
Using information entropy in smart sensors for decentralized data acquisition architecture	Mocnej, Jozef; Lojka, Tomas; Zolotova, Iveta
Maintenance 4.0 in Railway Transportation Industry	Kans, Mirka; Galar, Diego; Thaduri, Adithya
Mobility Governance-digitisation of transport in the context of Industry 4.0 and society's responsibility for sustainable mobility	Pfliegl, R.; Keller, H.
Which IT Governance for Distributed Intelligent Cyber-Physical Systems?	Margaria, Tiziana
Transforming to a hyper-connected society and economy - towards an Industry 4.0	Bauer, Wilhelm; Haemmerle, Moritz; Schlund, Sebastian; Vocke, Christian
Future IIOT in Process Automation - Latest trends of standardization in industrial automation, IEC/TC65	Sasajima, Hisashi; Ishikuma, Toru; Hayashi, Hisanori
Web & Android based File Sharing, Hardware Monitoring and Control	Rehman, Atiq Ur; Khan, Usman Ali; Sheikh, Usama; Nasruminallah; Sher, Madiha; Razzaq, Munaza; Riaz-ul-Hassnain, Syed; Bokhari, Syed Mohsin Matloob
Research and Practice on Aluminum Industry 4.0	Cao, Bin; Wang, Ziqian; Shi, Haibo; Yin, Yixin
The fourth ICT-based Industrial Revolution Industry 4.0 - HMI and the case of CAE/CAD innovation with EPLAN P8	Lukas, Dusko
Sub 10 mu W Wake-Up-Receiver Based Indoor/Outdoor Asset Tracking System	Robert, Joerg; Lindner, Thomas; Milosiu, Heinrich
Key Metrics and Key Drivers in the Valuation of Public Enterprise Resource Planning Companies	Trusculescu, Adelin; Draghici, Anca; Albulescu, Claudiu Tiberiu
Upgrading of textile manufacturing based on Industry 4.0	Chen, Zhen; Xing, Mingjie
Intelligent and self-adapting integration between machines and information systems	Kern, Heiko; Stefan, Fred; Dimitrieski, Vladimir
Applying actual development progress into education	Albrecht, Katharina; Anderl, Reiner
Cyber Physical Systems in the Context of Industry 4.0	Jazdi, N.
Autonomous and Flexible Multiagent Systems Enhance Transport Logistics	Gath, Max; Herzog, Otthein; Edelkamp, Stefan
Industry 4.0: The Growing Together of real and virtual Worlds The Internet of Things drives the fourth industrial Revolution	Jopp, Klaus
Performance Evaluation of MAC Algorithms for Real-Time Ethernet Communication Systems	Czybik, Bjoern; Hausmann, Stefan; Heiss, Stefan; Jasperneite, Juergen

The systematic review yielded the following results

- Results found 118
- Sum of number of citations 95
- Average citations per item 0.81
- H-index 5

There has been a growth of productions in recent years, as can be seen in Figure 2.

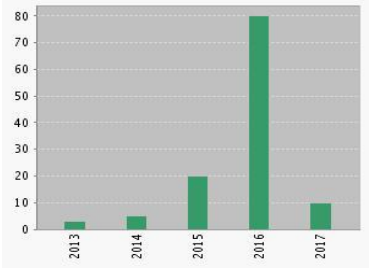

Figure 2 *Number of Productions Per Year*

The main publications were in Annals of Congresses (82), Scientific Journals (27) and reviews (2). And the main language and English. The ten most published authors are in Table 3. The universities that had more publications are in Table 4.

Table 3 *Top Ten Authors*

Author	Number of Papers
Wang Ks	3
Konig A	3
Wang X	2
Wang Sy	2
Wan Jf	2
Walsh J	2
Timmermann D	2
Thramboulidis K	2
Thongpull K	2
Sihn W	2

Table 4 *Top Ten Universities*

University	Number of Papers
Univ Stuttgart	5
Vienna Univ Technol	3
Univ Patras	3
Tu Kaiserslautern	3
Univ Sao Paulo	2
Univ Rostock	2
Univ Porto	2
Univ Novi Sad	2
Univ Erlangen Nurnberg	2
Univ Bayreuth	2

The most developed countries are in Table 5.

Table 5 *Top Ten Countries*

Country	Number of papers
Germany	42
Peoples R China	14
Czech Republic	7
Austria	6
Norway	5
Usa	4
Sweden	4
Japan	4
Taiwan	3
Spain	3

6. Conclusion

Research has shown that the industry theme 4.0 and IOT are relatively new, only items that address the two themes.

Where 82 were printed in Annals of Congress for news and only 27 were published in periodicals, other features of the theme are recent. The largest production of articles in the year 2016 is the main language and English and the country with the largest number of publications in Germany. An emerging country is China with

the largest number of productions and the authors who produced the most. We can conclude that the theme is important, but the scientific production is still small, appearing now the articles in congresses and magazines.

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