IOT Based Vegetable Production and Distribution through Big Data Application

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Abstract- *The new concept of Big Data and its multiple reimbursement have being used in the fresh nutrition-based vegetable production and distribution system in order to generate a healthy food recommendation to the end user and to provide different analytics to develop the system efficiency. The new concept Internet of Things (IoT) is included in the Big Data approach of the system to use its profit, particularly automation, to add much more accurate data to the system to provide to the user a much comfortable experience. The IoT Concept is bridging the real world with its virtual image, where devices located in different areas could swap information each other without any type of supervision. But, spite of all the benefits that IoT could bring to society, the security of the information as well as privacy must be strongly imposed and managed in this new environment with unique characteristics. In this proposed work, we make a particular approach and security estimation of the use of IoT to provide automatic data to the system.*

Keywords- Big Data, IoT, Data Analysis, Automation, Environment.

I. INTRODUCTION

Although there is no a common contract regarding the IoT definition, we could express it as the effortlessly integration of internet-based sensors and devices in a broad network area that cooperate with a much more sophisticated Personal Area Network, allowing us to recognize, in a much more comfortable and detail manner, the environment surrounding us and interchanging information with this environment in an automatic manner. The impact of the investigate outcome will be strong from the user point of view, due that the different potential applications like: health, agriculture, intelligent services, etc. IoT research is still in its early life but since its beginnings it represents a challenging explore scenario due to many issues from the technical area (wireless communications) to a much more theoretical one about applicable law and ethics. Different organizations around the world have released efforts towards the consistency of IoT, Table 1 shows some of them together with some of its characteristics, some being more successful than other but in the wide spectrum, there is no general agreement towards a one single IoT approach [31-34].

II. PROTECTION IN IOT

As IoT is in its early life, the same happens with the problem of securing the exchanged information in the wireless networks that represent the central part concept of IoT. In Table 1 we observed some approaches made by different worldwide organizations towards the development of a benchmark to be used under the unique characteristic that represents the wireless networks in IoT. But consistency could not include securing the exchanged information. IoT, because of its wireless character, is extremely susceptible to different attacks, specially leaves dropping in addition to the physical security issue, due that some devices could be most of the time unattended after installation. For the objectives of our project is essential to make safe the exchanged information in order to ensure users will not oppose using our system, moreover to accept and use the automation and constant automatic updates provided by the IoT environment.

III. PROPOSED WORK

The fresh nutrition-based vegetable production and distribution system is a project being developed under the found of NEDO in Japan, that is the Governmental Organization in charge of the promotion of addressing energy and global environmental problems, and the improvement of Japan's Industrial competitiveness, through research and development, not only in Japanese territory but also abroad. [22].

The project is based on the following objectives:

- To provide a healthy proposal to the user.
- To use local vegetables producers food inventory as reference for the suggestion system
- To help local vegetable producers to locate their products in a more efficient manner
- The healthy suggestion provided to the user will be based on: fresh vegetables or a food prepared using these vegetables by a local restaurant
- To deliver the suggestion (fresh vegetables or meal) to the end user through a local transportation company

Table 1. Characteristics of standardization efforts

Standard	***Objective***	***Comm. Range(m)***	***Data rate(Kbps)***
ZigBee	Based on the IEEE 802.15 Standard, designed to deliver a low cost, low data rate, long battery life communications under a reliable network.	10 ~ 100	~ 10^2
GRIFS	Support action project founded by the EU to maximize the interoperability of RFID	~ 1	~ 10^2
EPCglobal	RFID technology integration into the electronic product code (EPC) framework	~ 1	~ 10^2
6LoWPAN	Low power IEEE 802.15.4 devices integration into the IPv6 networks	10 ~ 100	~ 10^2
Wireless Hart	Developed as a multi-vendor, interoperable wireless standard, Wireless HART was defined for the requirements of process field device networks.	10 ~ 100	~ 10^2

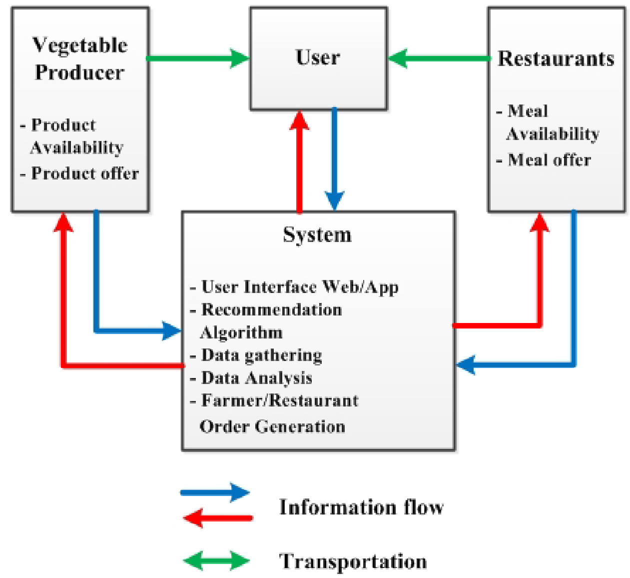

Figure 1. Simplified project information flow overview

The project uses a Big Data approach in order to compare the different databases needed to generate the healthy food suggestion to the end user. The result of the project represents a new approach towards the creation of a sustainable system where the main objective is to provide healthy food (vegetables) or a healthy meal to the user according to a pre-defined survey the user will fill [1-3].

The system has the following members:

1. The Final User
2. Local Vegetable Producers
3. Restaurants (who use the vegetables from the local producers)
4. The System itself which main element is the Big Data store unit and scrutiny capabilities

Figure 1, shows a simplified flowchart in which the information flow among the members is shown. The blue lines specify the information the system will receive, like:

1. From the vegetable producer, the system will receive periodic product availability updates.
2. From the user, the system will receive, through a web application, the different symptoms the user has.
3. From the restaurants, the system will receive the existing daily menu based on the vegetables produced locally

The red lines indicate the information the system will provide to the different members:

1. To the vegetable producer, the system will send an order to deliver the vegetables to the user.

2. To the restaurants, the system will send an order to deliver the food based on the vegetables produced locally.

3. To the user, the system will send first, the recommendation for the healthy food based on the symptoms previously introduced, and then the order confirmation The green line represents the transportation of the product to the user, whichever is the option requested.

The system functions are:

1. To gathered the following information: vegetable producer availability, restaurant menu availability, interact with and store all the information (symptoms) the user will provide, generate an acute food/meal recommendation.
2. To stored all the transaction information
3. Perform specific Big Data Analysis based on the data at rest and in movement
4. Through the results interpretation, improve the accuracy and effectiveness of the system

Using an IoT approach the system will become much more proficient in terms to predict other factors in addition to the suggestion itself. Figure 2 shows the IoT approach for the purposes of this scheme based on the information exchanged figure before mentioned.

Some of the IoT benefits are:

- Tracking of the product (vegetable or meals)
- Automatic record updates
- Automatic menu updates
- Real time data available to the system and users
- Checking on the vegetable status, for the system only

We are taking in consideration the most used IoT devices currently available in order to use them into our project, more devices/network could be included in the future according the project will require.

IV. SECURITY DEFINITIONS

For the project objectives, a general security IoT approach analyzed in order to provide procedure required for the proper implementation of the IoT approach in the system. The definitions are shown in Table 2.

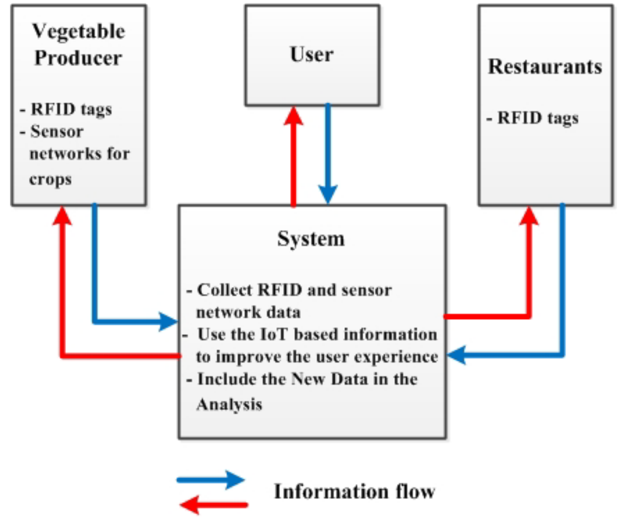

Figure 2. Information exchanged from the IoT point of view

Table 2. System Security Definitions

From	***To***	***Security Requirements***
Vegetable Producer	System	Remote Access User identification and authentication Device identification and authentication
System	Vegetable producer	Remote Access Device identification and authentication
Restaurant	System	Remote Access User identification and authentication Device identification and authentication
System	Restaurant	Remote Access Device identification and authentication
User	System	Remote Access User identification and authentication
System	User	Communication integrity

As we could monitor most of the system needs to be legitimate in order to provide a reliable information exchange. Using current technologies these requirements could be attainable but further analysis and research is required in the area of IoT security.

V. THREATS AGAINST IOT

For the specific purposes we focus on the security analysis on two main aspects: authentication and data integrity. Authentication and data integrity are two of the major problems related to IoT. Authentication is difficult in IoT due to its transportation requirements and servers that perform the authentication process through the information exchange with other nodes. In an IoT environment this could result not sensible due to that RFID tags cannot exchange too many messages with the authentication servers because their issues related to energy management and messages standardization, this issue applies as well to sensor networks. vigour issues are one of the most complicated to overcome in RFID networks as well as sensor networks, due that there are sprinkled over a wide area and sometimes unmonitored, energy management is a key factor in order to ensure a long device life as well as usability. In the same way, some authentication protocols could not be used due to their lack of standardization. In this circumstance, several approaches were developed for sensor networks. In these cases gateways that are part of the sensor networks are essential to provide connection to the Internet. In the IoT scenario sensor nodes must be seen as nodes in the Internet, therefore authentication is required in order to separate them from sensors in the same area but not belonging to the same network. In the case of RFID several approaches were presented, but most of them have serious issues, some of them mentioned in [30]. The "Man in the middle" attack is considered one of the major threats against wireless networks as well to IoT networks. Data integrity solutions should guarantee that the data in deal cannot be modified and the system must be able to detect this situation. Data integrity as an issue has been extensively studied for standard network applications and communication systems and premature results are related to sensor networks [29]. But, when a RFID networks with their own unique characteristics are included in the current internet Concept, unlike problems arise as well as unpredicted problems related to their use. Some approaches are developed or under research to solve the different new RFID related issues i.e. PC Global Class-1 Generastion-2 and ISO/IEC 18000-3, both of them working in different process to protect the device memory. These approaches also guzzle large amount of the resources in encryption processes needed. The main used resources are: energy and bandwidth, both of them in the destination. Therefore, even using these approaches specific related problems with RFID still remain.

VI. CONCLUSIONS AND FUTURE WORK

Farmers have been facing some problems regarding their production because of weather change, price instability and constant financial problems due to foreign competition. Therefore, an pricey service like this could be only available to big producers in which case, markets are completely ensured long time contracts. Academic and Company based research initiatives have shown different issues that jeopardized their continuity which affects directly to the farmer. Being the major issue in academic research: budget and availability of multidisciplinary human resources needed for the correct project development; and in the case of company based research, their cost, which could not be reasonable by the farmer. The current contribution of specialized members for each of the tasks related to the project increases its economical advantage without creating any issue to farmers the moment they will use the system. Big Data analytics allowed us to have a better understanding of the user needs and requirements regarding the project objectives. The new IoT parading is becoming a part of the current and future Internet. The current internet Concept will drastically change into a much more personalized qualified with our surroundings that will lead to much more richer experience. In the case of applications, is necessary to make a deep analysis of the requirements essential to be implemented, in order to specifically use what could result much more beneficial for a specific project purpose. In the case of our project, IoT could bring not only automatic updates regarding key issues of the project, but allow us to significantly improve the user experience through different new services. IoT Security as a new Concept and new potentially useful research area must address its security concerns in order to show a more reliable platform for the user that, currently, could resist a functional initiative. Due that a single security incident could spoil permanently the infinite benefits IoT could bring to the society.

REFERENCES

[1] Dennis A. Ludeña R. and Alireza Ahrary, "Big Data Approach in an ICT Agriculture Project", Proceedings for the 5th IEEE International Conference on Awareness Science and Technology (iCAST 2013), Aizu-Wakamatsu, Japan, pp. 261 – 264, 2013

[2] Dennis A. Ludeña R. and Alireza Ahrary, "A Big Data approach for a new ICT Agriculture Application Development", Proceedings for the 2013 International Conference on Cyber- Enabled Distributed Computing and Knowledge Discovery (CyberC 2013), Beijing, China, pp. 140 – 143, 2013

[3] Alireza Ahrary and Dennis A. Ludeña R., "Big Data approach to a novel nutrition-based vegetable production and distribution system", Proceedings of the The International Conference on Computational Intelligence and Cybernetics – CyberneticsCom 2013, Yogyakarta, Indonesia, pp. 131 – 135, 2013

[4] Research Trends: Special Issue on Big Data, Elsevier, Issue 30, September 2012

[5] A. Beyer Mark, D. Laney. "The Importance of 'Big Data': A Definition", Gartner, Jun. 21, 2012

[6] R. Magoulas, and B. Lorica, "Introduction to Big Data," O'Reilly Media, Sebastopol, CA, USA, February 2009.

[7] A. Adamas, “The Pathologies of Big Data”, Communications of the ACM, vol. 52, No. 8, Aug. 2009, pp. 36 – 44.

[8] D. Boyd, and K. Crawford, “Six provocations for Big Data”, A Decade in Internet Time: Symposium on the Dynamics of the Internet and Society, Oxford Internet Institute, Sep. 21, 2011, dx.doi.org/10.2139/ssrn.1926431

[9] L. Manovich, “Trending: The promises and the Challenges of Big Social Data”, Debates in the Digital humanities, ed. M.K. Gold, The University of Minnesota Press, Minneapolis, MN, Jul.15, 2011.

[10] B. Meeder, J. Tam, P. Gage Kelley, and L. Faith Cranor, “RT @IWantPrivacy: Widespread Violation of Privacy Settings in the Twitter Social Network,” Web 2.0 Security and Privacy, W2SP 2011, Oakland, CA, USA, May 26, 2011.

[11] D. Agrawal, P. Bernstein, E. Bertino, S. Davidson, U. Dayal, M.Franklin, J. Gehrke, L. Haas, A. Halevy, J. Han, H. V. Jagadish, A. Labrinidis, S. Madden, Y. Papakonstantinou, J. Patel, R. Ramakrishnan, K. Ross, C. Shahabi, D. Suciu, S.Vaithyanathan, J. Widom, “Challenges and Opportunities with Big Data,” Community white paper, Purdue University, West Lafayette, Indiana, US, 2011.

[12] M. Zimmer, “More on the “Anonymity” of the Facebook Dataset – It’s Harvard College,” MichaelZimmer.org Blog, Jun. 20, 2011.

[13] E. Troshynski, C. Lee, and P. Dourish, “Accountabilities of presence: reframing location-based systems”, Proc. of the SIGCHI Conference on Human Factors in Computing Systems (CHI '08), ACM, 2008, New York, NY, USA, 487 – 496. DOI=10.1145/1357054.1357133

[14] D. Bollier, The Promise and Peril of Big Data, The Aspen Institute, Communications and Society Program, 2010.

[15] B. Latour, “Trade’s idea of quantification”, The Social After Gabriel Trade: Debates and Assessments, Ed. M. Candea, London: Routledge, Jun. 19, 2011, pp. 145 – 162.

[16] L. Gitelman, "Raw Data" Is An Oxymoron, Massachusetts Institute of Technology Press, 2013.

[17] P. Zikopoulos, C. Eaton, D. DeRoos, T. Deutsch, and G. Lapis, Understanding Big Data, McGraw-Hill, New York, 2012.

[18] World Summit on the Information Society (WSIS). The Tunis Agenda for the Information Society, United Nations, Nov. 18, 2005.

[19] R. Ito, A. Hashimoto, H. Okuda, T. Togami, T. Kameoka, N. Suzaki, H. Ithinokiyama, O. Hidekazu, M. Nishijima, M. Nakamura, A. Fujita, N. Numano, H. Yagyu, T. Kamiya, and H. Shima, “Advanced application of ICT to the sustainable production of excellent Japanese Mandarin”, Proc. AFITA 2010 International Conference, The Quality Information for Competitive Agricultural Based Production System and Commerce, Bogor, Indonesia, Oct. 2010, pp. 45 – 50.

[20] Y. Satake, and T. Yamazaki, “Using Food and Agriculture Cloud to Improve Value of Food Chain”, Fujitsu Sci. Tech. J. Vol. 47, No. 4, Oct, 2011, pp. 378 – 386.

[21] S. Wakana, and Y. Yaginuma, “Approaches to Creating Human- Centric Solutions”, Fujitsu Sci. Tech. J. Vol. 48, No. 2, pp. 129 – 134, 2012.

[22] New Energy and Industrial Technology Development Organization http://www.nedo.go.jp

[23] Fujitsu Launches New "Akisai" Cloud for the Food and Agricultural Industries http://www.fujitsu.com/global/news/pr/archives/month/2012/20 120718-01.html

[24] R. M. Savola and H. Abie, “Metrics-driven security objective decomposition for an e-health application with adaptive security management”. In Proceedings of the International Workshop on Adaptive Security (ASPI '13), Article No 6. ACM, New York, NY, USA

[25] S. Cirani, G. Simone and L. Ferrari, "Enforcing Security Mechanisms in the IP-Based Internet of Things: An Algorithmic Overview." Algorithms 6, no. 2: 197-226, 2013

[26] H. Ning and H. Liu, "Cyber-Physical-Social Based Security Architecture for Future Internet of Things," Advances in Internet of Things, Vol. 2 No. 1, pp. 1-7, 2012

[27] A. Sivabalan, M. A. Rajan and P. Balamuralidhar, “Towards a Light Weight Internet of Things Platform

Acrchitecture", Journal of ICT Standardization, Vol. 1, pp. 241 – 252, 2013

[28] R. H. Weber, "Internet of Things – New security and privacy challenges", Elsevier – Computer Law & Security Review, Volume 26, Issue 1, Pages 23-30, January 2010

[29] R. Acharya, K. Asha, "Data integrity and intrusion detection in wireless sensor networks", Proceedings of IEEE ICON 2008, New Delhi, India, December 2008.

[30] A. Juels, "RFID security and privacy: a research survey", IEEE Journal on Selected Areas in Communications, v.24 n.2, p.381- 394, September 2006

[31] C.Floerkemeier, R. Bhattacharyya, S. Sarma, "Beyond RFID", Proceedings of TIWDC 2009, Pula, Italy, September 2009.

[32] Jongwoo Sung , Tomas Sanchez Lopez , Daeyoung Kim, "The EPC Sensor Network for RFID and WSN Integration Infrastructure", Proceedings of the Fifth IEEE International Conference on Pervasive Computing and Communications Workshops, p.618-621, March 19-23, 2007

[33] Commission of the European Communities, Early Challenges Regarding the "Internet of Things", 2008.

[34] N. Kushalnagar, G. Montenegro, and C. Schumacher, "IPv6 Over Low-Power Wireless Personal Area Networks (6LoWPANs): Overview, Assumptions, Problem Statement, and Goals", IETF RFC 4919, August 2007