ISSN: 2456-9348
Vol (01) _Issue (05) Impact Factor: 4.520

iJETRM
International Journal of Engineering Technology Research & Management

Cost Reduction and Increasing Production of agriculture Using IOT

Dinesh Sharma
*1, Department of Computer Science and Engineering, Amity University Madhya Pradesh-474011

ABSTRACT

Internet of Things is a technology quickly catching in the field of agriculture because rainfall and climate changes have been erratic over the past decades. Farmers require new ideas and technological improvement to help growth of agriculture production and cost reduction. Many mechanical innovations brought in 19^{th} and the 20^{th} century, like harvester, mini tractor, trolley, pipes, sprays, sprayer pump. Today production of agriculture is not up to the mark and cost of farming increasing day by day. So IoT is the growing technology for increased agriculture production at a minimum cost.Offering high-precision crop control, useful data collection, and automated farming techniques, there are clearly many advantages a networked farm has to offer. This paper present wireless network and sensor technology integration with IoT, how implement IoT in agriculture for gathering real-time data and integration of existing IoT solutions by open IoT architectures, platforms and standards.

Keywords: IOT, Sensor Technology, Wireless Network, Agriculture and Internet.

I. INTRODUCTION

Food is the basic need of human being for survival and agriculture is the main source of Indian farmers for livelihood. In last few year every government focusing on growth of agriculture production because there is not much crop production in agriculture field .Food price regularly increasing because not much growth in crop development. Many different techniques and tools are available for the growth of farming. According to survey of UN agriculture organization the world need to produce 68% more food in 2055.To fulfill this demand agriculture organizations and farmers adopting Internet of Things for improving production and analytics. In current scenario Internet of Things impact on increasing productivity and cost. Diseases or climate change, fertilizer abuse, water waste, soil fertility are main factors for responsible of growth of agriculture. It is necessary to make effective intervention in field of agriculture and the solution is Wireless sensor networks with integration in IOT. It has powerto change the growth in agriculture and gives great contribution to more production in agriculture. The web of things includes a three-level framework. It incorporates recognition layer, organize layer and application layer. Recognition layer incorporates sensor bits. Data correspondence innovation (ICT) empowered gadgets, sensor bits are building squares of sensor innovation. It incorporates cameras, RFID labels, sensors and sensor organize used to perceive questions and gathering ongoing data. The system layer is a framework of the IOT to acknowledge all inclusive administration. It coordinates towards the blend of the observation layer and application layer. The application layer is a layer that joins the IOT with the innovation of particular industry. The web of things practically connected in every aspect of industry, including brilliant agribusiness, shrewd stopping, keen building ecological observing, social insurance transportation and some more. Among them, agribusiness is one of the vital regions which target a great many individuals.

II. INTERNET OF THINGS (IOT)

The Internet of things (IoT) is the most efficient and important techniques for development of solutions to the problems. IoT evolve from different building blocks which includes lots of sensors, software’s, network components and other electronic devices. Also it makes data more effective. IoT allows to exchange the data over the network without human human involvement. In Internet of things, we can represent things with natural way just like normal human being, like sensor, like car driver etc. This thing is assigned an ip address so that it can transfer data over a network. As per the report generated by Garner, at the end of 2016 there will be 30% rise in count of connected devices as compared to 2015. He further says that, this count will increase to 26 billion by 2020[1]. The IoT technology is more efficient due to following reasons:

1. Global Connectivity through any devices.
2. Minimum human efforts
3. Faster Access
4. Time Efficiency
5. Efficient Communication

The Internet is the global system of interconnected computer networks that use the Internet protocol suite(TCP/IP) to link billions of devices worldwide. Nowadays over 46% of the world population uses the Internet[3]. It has had a revolutionary impact on culture and commerce, including the rise of near-instantcommunication by electronic mail, instant messaging, voice over Internet Protocol (VoIP) telephone calls,two-way interactive video calls, social networking, and online shopping sites. Moreover, Internet connectivitybecame the norm for many business applications and is today integral part of many enterprises, industrialand consumer products to provide access to information. However, the Internet usage still primarily focuseson human interaction and monitoring through apps and interfaces. IoT is the next stage of the Internet inwhich also physical things communicate.

IoT combines the concepts “Internet” and “Thing” and can therefore semantically be defined as “aworld-wide network of interconnected objects uniquely addressable, based on standard communicationprotocols” [4]. The concept was first introduced by the MIT Auto-ID Center to label the development towardsa world where all physical objects can be traced via the internet by tagging them with Radio Frequency Identification (RFID) transponders [5]. In the meantime, the meaning is expanded towards a world-wide webof smart connected objects that are context-sensitive and can be identified, sensed and controlled remotelyby using sensors and actuators [6-8]. In the IoT every ‘thing’ is uniquely identifiable, equipped with sensorsand connected real-time to the internet. As a result, the Internet will be deeply embedded in the daily life ofconsumers and businesses. Invisible technology operates behind the scenes, dynamically responding tohow we want “things” to act. The IoT is expected to be the next Internet revolution. To date, the world hasdeployed about 5 billion “smart” connected things. Predictions indicate that there will be up to 50 billionconnected devices by 2020 and in our lifetime we will experience life with a trillion-node network [9].

III. LITERATURE ON IOT IN AGRICULTURE AND FOOD

Table 1 shows that in total 168 papers on IoT in agriculture and food were found in the Scopus databaseuntil 2015. The first conference papers were published in 2010 and the number of publications hasincreased rapidly to 43 papers in 2014. In 2015 slightly fewer publications were found, while the number ofjournal papers increased. This might indicate that the research on IoT in agriculture and food starts tomature.The book chapters are all published in non-agricultural book series. The journal papers include both genericjournals on information technology research and domain-specific journals on agriculture and food research.The first journal paper was published in the Journal of Software in 2011 [10]. The Transactions of theChinese Society of Agricultural Machinery published by far most of the journal papers [11-12], followed bythe Advance Journal of Food Science and Technology. The other journals published up to threepapers on the subject.

The literature on IoT in agriculture and food is very much dominated by Asian scientists, especiallyfrom China. Only 14 of the 168 reviewed papers are from non-Asian authors. IoT has become a hot topic inChina already in 2009 when the Chinese Premier Jiabao Wen called for a rapid development of IoTtechnologies [66]. China aims to set the pace in IoT since then, also in agriculture which is an importantsector in China. In other continents the concept of IoT was up to recently mainly adopted by non-agriculturalscientists.

Table 2 Application areas of the reviewed literature on agriculture and food in Scopus

Application Area	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Agriculture in general	**2**	**4**	**3**	**1**	**7**	**9**	**11**	**14**
Arable farming	**1**	**5**	**10**	**6**	**9**	**2**	**7**	**11**
Fishery and aquaculture	**0**	**0**	**1**	**1**	**1**	**0**	**1**	**2**
Food consumption	**0**	**0**	**0**	**3**	**2**	**0**	**5**	
Food supply chains	**2**	**9**	**10**	**14**	**17**	**16**	**15**	**17**
Greenhouse horticulture	**0**	**0**	**3**	**6**	**3**	**2**	**5**	**4**
Total	**5**	**18**	**27**	**31**	**39**	**29**	**37**	**37**

3.1 Application areas

Table 2 provides an overview of the application areas that were found in the papers. For each area weanalysed which theme it addressed and if a specific application was made *i.e.* a software- or hardwaresystem, method, etc. Generally, it can be concluded that the area of food supply chains is addressed mostfrequently, followed by arable farming. The frequency of references for fishery and aquaculture, foodconsumption, open air horticulture and livestock farming are relatively low. Each area was analysed in moredetail which is described below.For**agriculture in general**, several papers focus on precision agriculture [14] or sensing and monitoringthe production environment [13]. Others try to design a general management information systembased on IoT. Other relevant themes that are touched upon are: product quality improvement[45], food safety and traceability, water management , rural development , urbanagriculture and consumer interaction .

In **arable farming** many papers are somehow dealing with monitoring & control using advanced IoT devices[15] sometimes supported by predictive crop growth models. Many are also focusinggetting information in general from fields or farmlands. Using these approaches, severalpapers are specifically applying IoT for sustainability management including ecology, biodiversity and naturalresources, *e.g.* water. Some papers are dealing with IoT and precision agriculture ingeneral and other themes that are occasionally mentioned are pest management by early warningsystems, agricultural machinery and data management.The few references for **fishery and aquaculture** are mainly focusing on (water) quality monitoring andsetting-up aquacultural information systems and one is particularly related to breeding .

Concerning **food consumption**, there is a focus on personalized or customized nutrition and productionbased on product contents. Other themes are diet monitoring systems , smart homeappliances and food waste management .Most of the references that deal with the **agri-food supply chain** are focusing on food safety & quality. This is probably due to the recent crises (*e.g.* baby milk powder) andfood scandals in China. Many were also developing a concrete monitoring system for that purpose[10]. Related to that some were specifically referring tohazard analysis and early warning systems [13]. Then there were a lot of references that dealt withtracking and tracing systems based on IoT [13, 15].Several references relate to (cold chain) logistics and condition monitoring.

Table 2. The Reviewed on Food and Agriculture

Dominant Research	2010	2011	2012	2013	2014	2015	2016	2017
Explorative	2	6	5	6	10	11	13	15
Review	0	0	0	1	2	1	4	6

Design	2	11	11	8	19	14	13	16
Implementation in prototypes and pilots	1	1	15	19	12	12	15	16
Total	5	8	31	34	43	37	45	53

3.2 Challenges ahead

Table 3 shows that the reviewed literature is dominated by papers that present an IoT system design or thatreport an IoT implementation in prototypes or pilots. Also a lot of explorative papers are found that discussthe opportunities of IoT in agriculture in general or in specific application areas. The papers that areaccessible to the authors do not include a systematic analysis of the problems and challenges concerningIoT in agriculture. Nevertheless, the challenges identified or discussed indicate that current IoT applicationsand technologies in the agri-food domain are still fragmentary, lack seamless integration and especially moreadvanced solutions are in an experimental stage of development. Operational applications are mainly usedby early adopters and still focus on basic functionalities at a high granularity level.

Important challenges to overcome this situation are:

- Ensuring the interoperability of a huge heterogeneity of IoT devices and data with open IoTarchitectures, platforms and standards, including the alignment of horizontal technical IoT standards and domain-specific (especially semantic) standards in the agri-food domain;
- Scaling-up the usage of interoperable IoT technologies beyond early adopters, especially by thesimplification of existing solutions and improving its affordability to ensure attractiveness and fitness foruse for the majority of farmers and food companies; for this reason alsoappropriate business models are needed that are suitable for (very) small companies and include asystematic economic analysis of the costs and benefits;
- Further improvement of IoT technologies to ensure a broad usability in the diversity of the agri-fooddomain, *e.g.* different climate conditions, crop and soil types;
- Development of IoT devices for harsh environments (open air, dirt, dust, moisture, animal manure, coldstorage, hot cleaning treatments, etc.) and for natural objects (plants, animals, sq. meters of soil,perishable food products), which have limited possibilities to embed IoT devices in the objectsthemselves; this holds in particular for devices that integrate recent technological advances, since therehas already made a lot of progress in the adaptation of more mature technologies to agriculture-specificrequirements;
- Ensuring reliable and stable wireless communication in remote areas (fields, stables, etc.) which oftenhave limited coverage and bandwidth;
- Development of energy efficient IoT technologies, including devices and connectivity components forrural areas;
- Analytics to combine object data with a wealth of (3rd party) archives such as historical and forecastedmeteorological data, satellite data, soil-, water- and air-analyses, logistic systems, and data on prices,retail, and consumers, diets, *etc.*;
- Availability of trustworthy security, privacy, and data ownership solutions that are appropriate fordynamic and complex networks of stakeholders, in which a huge number of very small firms and SMEson the one hand and large international corporations and authorities on the other hand, have tocollaborate.

IV. AGRICULTURE USING IOT

Agriculture is the main backbone of India's Economical growth. The most important barrier that arises in traditional farming is climatic change. The number of effects of climatic change includes heavy rainfall, most intense storm and heat waves, less rainfall etc. Due to these the productivity decreases to major extent. Climatic change also raises the environmental consequences such as seasonal changes in life cycle of plants. To boost the productivity and minimize the barriers in agriculture field, there is need to use innovative technology and techniques called Internet of Things. Today, the Internet of Things (IoT) is transforming towards agriculture industry and enabling farmers to compete with the enormous challenges they face. Farmers can get huge information and knowledge about recent trends and technology using IoT.

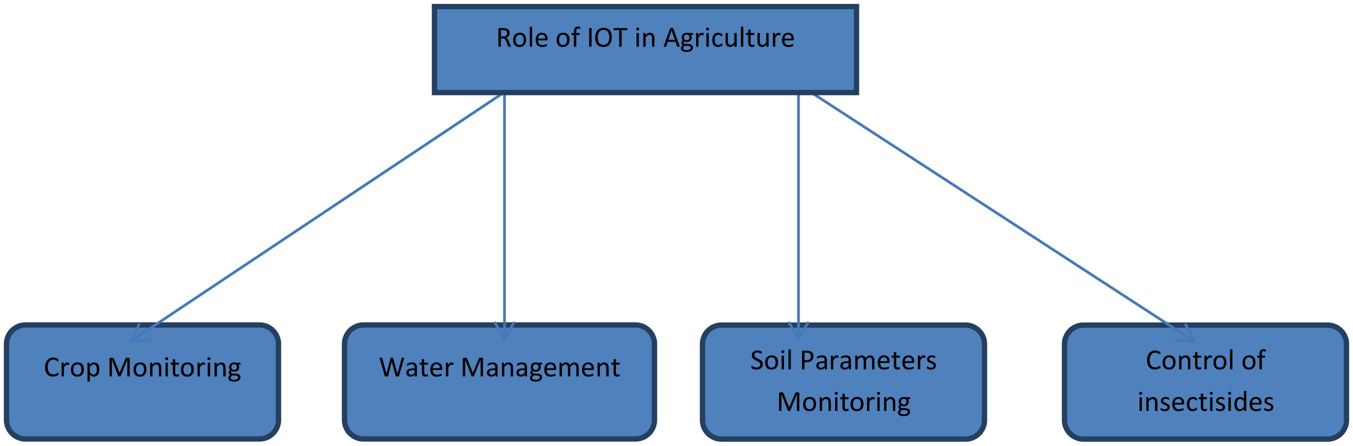

Figure 1: Role of IoT in Agriculture

The smart agriculture market is expected to reach $18.45 Billion in 2022, at a CAGR of 13.8%. BI estimates that 75 million IoT devices will be shipped for agricultural uses in 2020, at a CAGR of 20%. IoT devices can be of great help in enhancing the production and yield in the agriculture sector since these devices can be used to monitor soil acidity level, temperature, and other variables. Moreover, smart agriculture will help in monitoring livestock productivity and health as well. IoT sensors are capable of providing farmers with information about crop yields, rainfall, pest infestation, and soil nutrition are invaluable to production and offer precise data which can be used to improve farming techniques over time. Internet of things, with its real-time, accurate and shared characteristics, will bring great changes to the agricultural supply chain and provide a critical technology for establishing a smooth flow of agricultural logistics [4] . The key advantages of using IoT in enhancing farming are as follows:

1. Water management can be efficiently done using IoT with no wastage of water using sensors.
2. IoT helps to continuous monitor the land so that precautions can be taken at early stage.
3. It increases productivity, reduce manual work, reduce time and makes farming more efficient.
4. Crop monitoring can be easily done to observe the growth of crop.
5. Soil management such as PH level, Moisture content etc can be identified easily so that farmer can sown seeds according to soil level.
6. Sensors and RFID chips aids to recognize the diseases occurred in plants and crops. RFID tags send the EPC (information) to the reader and are shared across the internet. The farmer or scientist can access this information from a remote place and take necessary actions, Automatically crops can be protected from coming diseases[2].
7. Crop sales will be increased in global market. Farmer can easily connected to the global market without restriction of any geographical area.

V. CONCLUSION

Farming will play vital role in next few years in country. Thus there is need of smart farming. Internet of Things will help to enhance smart farming. IoT works in different domains of farming to improve time efficiency, water management, crop monitoring, soil management, control of insecticides and pesticides etc. It also minimizes human efforts, simplifies techniques of farming and helps to gain smart farming. Along with these features smart farming can help to grow the market for farmer with single touch and minimum efforts.

REFERENCES

[1]. Sundmaeker, H., et al., Internet of Food and Farm 2020, in Digitising the Industry O. Vermesan, Friess, Peter, Editor. 2016, River Publishers. p. 129-150.

[2]. Pérez-Freire, L., et al., Smart Farming and Food Safety Internet of Things Applications – Challenges for Large Scale Implementations. 2015, AIOTI WG06.p. 49.

[3]. InternetWorldStats. World Internet Usage and Population Statistics. 2015 [cited 2015 December 14th]; Available from: http://www.internetworldstats.com/stats.htm.

[4]. Infso, D. and EPoSS, Internet of Things in 2020: A roadmap for the future. 2008, European Commission DG Infso& European Technology Platform on Smart Systems Integration.p. 32.

[5]. Schoenberger, C.R., The internet of things. Forbes, 2002(3/18).

[6]. Atzori, L., A. Iera, and G. Morabito, The Internet of Things: A survey.Computer Networks, 2010.54(15): p. 2787-2805.

[7]. Kortuem, G., et al., Smart objects as building blocks for the Internet of things IEEE Internet Computing, 2010. 14(1): p. 44 - 51.

[8]. Porter, M.E. and J.E. Heppelmann, How Smart Connected Objects Are Transforming Competition. Harvard Business Review, 2014(November): p. 65-88

[9]. Castaneda, C. Internet of Things to Become Cornerstone of Excellent Customer Service, Finds Frost & Sullivan. 2015 [cited 2016 June 29th].

[10]. Duan, Y.E., Research on integrated information platform of agricultural supply chain management based on internet of things.Journal of Software, 2011.6(5): p. 944-950.

[11]. Li, H., et al., Aquiculture remote monitoring system based on IOT Android platform.NongyeGongchengXuebao/Transactions of the Chinese Society of Agricultural Engineering, 2013.29(13): p. 175-181.

[12]. Li, Z., et al., Forewarning technology and application for monitoring low temperature disaster in solar greenhouses based on Internet of Things.NongyeGongchengXuebao/Transactions of the Chinese Society of Agricultural Engineering, 2013.29(4): p. 229-236.

[13]. Sun, X., Y. Yang, and H. Guo, Applications of near field communication of internet of things in supply chain information system of agricultural products.NongyeGongchengXuebao/Transactions of the Chinese Society of Agricultural Engineering, 2014.30(19): p. 325-331.

[14]. Wu, Q., et al., Intelligent micro-irrigation system based on internet of things in arid area.NongyeGongchengXuebao/Transactions of the Chinese Society of Agricultural Engineering, 2012.28(1): p. 118-122.

[15]. Yan, B., P. Shi, and G. Huang, Development of traceability system of aquatic foods supply chain based on RFID and EPC internet of things.NongyeGongchengXuebao/Transactions of the Chinese Society of Agricultural Engineering, 2013.29(15): p. 172-183.