Applicability Of Wireless Sensor Networks & Iot In Saffron & Wheat Crops: A Smart Agriculture Perspective

Mohammad Wasi Rasooli, Brij Bhushan, Nagesh Kumar

Abstract: Agriculture plays an essential role in to develop any country. Afghanistan depends a lot on agriculture because agricultural reports and statistics show that 80% of the Afghan population work in agriculture and livestock. The contribution of agriculture in Afghanistan's gross domestic product (GDP) is 31%. We can improve the sector of agriculture with the use of the internet of things based Smart Farming techniques it improves the whole agri-business by keeping an eye on the field in real-time. Sensors has a very vital role in for the interconnectivity and data gathering, IoT device not only provided new techniques for the farmers but it also increased the time-management of the farmers. With the use of the IoT's now farmers require lesser time on field as IoT powered devices are working for him/her. It reduced the workload of farmers as well as the wastage of many useful resources like water used for irrigation and electricity usage, as it required for the working of so many electrical appliances. IoT devices can easily be used to monitor the real time applications. IoT has the potential to new shape the world so that agriculture will be smart agriculture. We want to control everything from the far way, for example, irrigation, temperature, etc. so we have to use WSN, Wi-Fi or ZigBee modules for controlling the crops. This paper aims to address the use of Internet of Things in the field of agriculture sector.

Index Terms: Internet of Things, Wireless Sensor Networks, Smart Agriculture, Sensors.

1. INTRODUCTION

Basic need for any civilization is Agriculture products from the food we eat to cloths we wear agriculture is everywhere. Agriculture plays a vital role in developing any country it shaves the traditions and values of the country. It is the science, art, and occupation of growing crops, raising animals and developing the dirt. Agriculture process includes:

- Financing, Cultivation, processing, marketing, and distribution of generated agricultural products and crops;
- Small scale industries, agricultural farm production, service industries and supply;
- The use and conservation of water resources and land;
- Development and maintenance Of Related economic, sociological, political, environmental, and cultural characteristics of the food and fiber system.

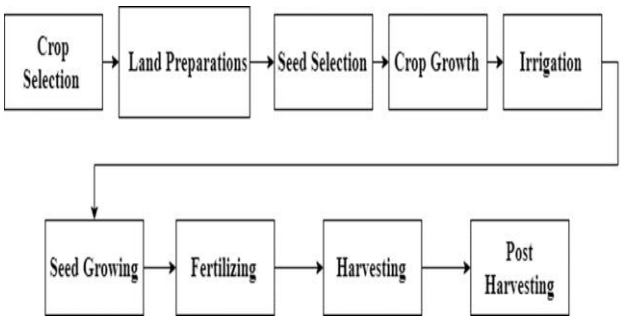

***Fig.1**. Block diagram for agriculture process*

As mentioned above 80% people depend on agriculture sector for food, income and perhaps it is the best possible option to build the country's economic infrastructure. The techniques which Afghanistan's farmers are using are traditional and passed down from generation to generation Afghanistan has a huge land area for cultivation of crops but due to the presence of terrorist groups, the people of Afghanistan are not able to utilize the available land for crop cultivation. Afghanistan has around 7.8 million hectares is arable lands [1]. Wheat is the most cultivated crop in Afghanistan which is followed by the corn, rice and barley. Cotton is also an important crop for Afghanistan it is also widely cultivated. On the basis of exports Afghanistan exports fruits and nuts. Fertile regions around Herat, southwest and north of the Hindu Kush in Afghanistan are well known for its unusually sweet melons and grapes, Raisins are also widely exported by Afghanistan to other counties apart from these other fruits which cultivated in Afghanistan are cherries, apricots, mulberries, figs and pomegranates. Afghanistan's main traditional agricultural mainstay depends upon wheat and cereal. According to the national wheat production in 2015 the production for wheat in Afghanistan was 4 million tons [2]. But this production is not enough Afghanistan requires additional two million ton of wheat to become self-sufficient, and this is predicted that by 2020 Afghanistan may accomplish its wheat requirements. Herat is the biggest saffron producer in Afghanistan. The saffron in this area has the best quality in the world. Saffron require between 7-8 pH soil and this soil is available in Ghoriyan. According to the Official figures cultivation of saffron has increased to 6200 hectares in 2018 and it is 21% more as compared to the last years data. Saffron is contributing economically very well to Afghanistan's economy, saffron sector added almost 35 million U.S. Dollars which equals to 2.6 billion of Afghanistan Currency in the year 2017 [3]. Saffron do not require more water than another crops. This crop is good challenge for Afghanistan country because Afghanistan do not have enough water resources. Mostly farms are in the villages or far away from cities that these villages or that far farmlands are insecure we have to find a good way for checking farms from far away and this is possible with the use of the Internet of Things (IoT). IoT helps in collecting, monitoring and analysing data related to crops even from a remote area. Smart agriculture use IoT and cellular wireless technologies for remote connectivity. With the use of IoT in the field of Agriculture it not only enabled farmers new techniques for farming but also reduced their workloads. On the other hand it also reduced the extravagant use of resources like electricity, water, soil and temperature etc and sensors involved in the agro business provided farmers a real

time data of their crops. The smart agriculture based on IoT is using data intelligence collected from various sensors and various parameters to take accurate actions and to better predict crop productivity and quality. Sensors plays a vital role in different applications sensors are embedded owner device to monitor various applications and these applications can be controlled with the help of mobile Phone apps. sensors are installed to measure so many parameters few of them are soil temperature, humidity, solar radiation, wind speed, direction of the wind, rainfall, leaf wetness etc. Nodes are deployed on the targeted area to form a network, these sensors gathers useful information at a regular interval of time performs computation, transmits all the data to the base station with the help of Internet and informs farmer about the results Sensor nodes are deployed in the land to farm a network, these sensors will collect data at regular interval of time, perform the computation and inform the farmer about the results.

1.1 Role of IOT in Smart Agriculture

Global population is about to touch 9.6 billion by 2050. as the population is increasing day-by-day to fulfill the requirements of food supplies farming industries needs to be enhanced. IoT can play a vital role in enhancing the agricultural business. IoT technologies will enable farmers to cultivate their crops with lesser effort and maximum productivity so that the requirements can be fulfilled with the limited amount of land available.

1.2 Wireless Sensor Network

WSN is a combination of so many sensor nodes deployed and grouped together to gather information and transmit that collection of information through wireless network. WSN are used to monitor the physical or environmental conditions like temperature, pressure, sound etc. Figure shown below shows different types of wireless sensor networks.

Based on literature survey, we found that WSN have

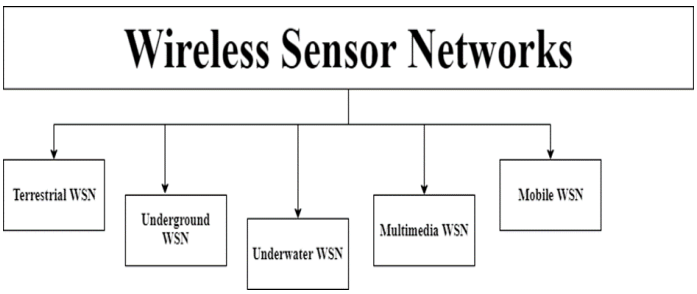

***Fig. 2**. Types Wireless sensor networks.*

Based on literature survey, we found that WSN have following limitations.

- Possess very little storage capacity
- Possess modest processing power-8MHz
- Works in short communication range
- consumes a lot of power.

Based on Literature survey, we found that WSN has following application as shown in the figure below.

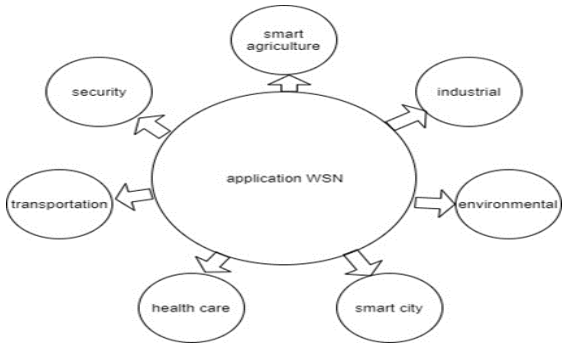

***Fig.3**. Applications of WSN.*

1.3 Wireless sensor network in smart agriculture

In precision agriculture with the use of technology it is possible to monitor and target specific crop. WSN technology is capable enough to implement the required smart devices. The smart devices are tiny in size, making it practical and cost effect to implement Precision Agriculture regardless of the growing area.

WSN applications for Agricultural:

- WSN equipped devices for Large area monitoring
- Forest / fields monitoring
- Fire prevention for Forest
- Biomass studies
- Tracking
- Crop Yield Improvement

Similarly, sensor have very important role to play in the field of wireless sensor networks. As all data gathering is done by sensor nodes, sensors used in smart agriculture to monitor the following parameters:

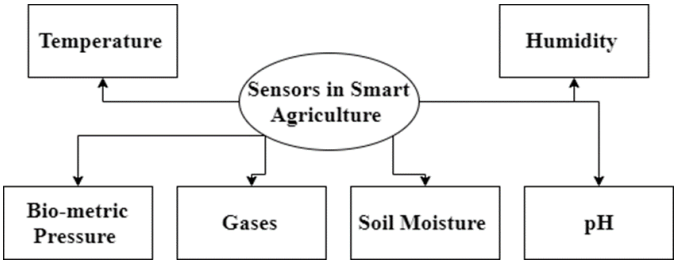

***Fig.4.** Role of sensors in smart agriculture*

Whereas when these sensors are embedded with microcontroller, then after processing the data received from the sensor deployed in the field the control network controlled by the microcontroller it is responsible to control the following parameters:

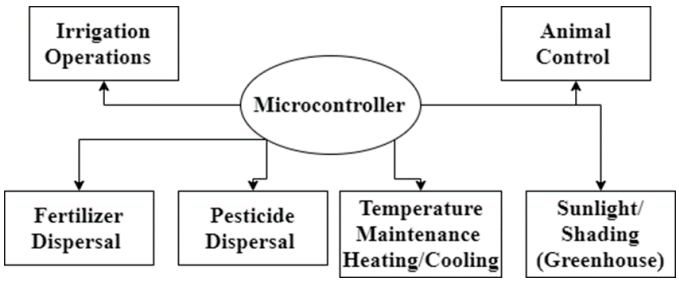

***Fig.5**. Parameters controlled by Microcontrollers in Smart Agriculture*

2 LITERATURE SURVEY

Author	Year	Title	Findings
Nikesh gondchawar et al.[4]	June 2016	IOT based smart agriculture	In this paper authors aims to change the traditional method of agriculture and provided an automation method using IoT and Smart GPS based remotely controlled robot to perform the following tasks. ➢ Spraying, ➢ Moisture Sensing ➢ Weeding ➢ Bird and Animal Protection etc.
Dr. N. Suma et al.[5]	2017	IoT based smart agriculture monitoring system.	Automated irrigation system is proposed in this paper, authors developed a smart irrigation system which is build using the following sensors: ➢ Temperature Sensor ➢ Soil Moisture Sensor. ➢ PIR Sensor. There system is capable of monitoring as well as to provide the automated irrigation when required.
Babanna Kumbar et al.[6]	November 2016	Smart irrigation system using internet of things	Authors proposed a system for smart irrigation using node MCU WIFI module Controlled and monitored by MQTT Server. On the hardware side the controlled a motor and two solenoid valves with the help of node MCU (ESP8266-12).
Hemlata Channe et al.[7]	June 2015	Multidisciplinary Model for Smart Agriculture using Internet-of-Things (IoT), Sensors, Cloud-Computing, Mobile-Computing & Big-Data Analysis	In this paper authors used five key technologies: ➢ Cloud Computing ➢ Internet of Things ➢ Mobile Computing ➢ Sensors ➢ Big Data Analysis With these technologies' farmers were able to implement proper fertilizers requirements for his crops in real time. This model will also facilitate farmers to estimate the total production of the crop. Similarly, farmers will also be informed about the various current running schemes by the government.
Abhijith H V et al.[8]	2017	Intelligent Agriculture mechanism using Internet of Things	In this paper authors proposed a system using simulations for IoT devices and with IoT devices they used data mining technique. To predict the results. They proposed that data gathered by the deployed sensor in an open environment can be fed to the data mining technique. To identify the parameters required for the better growth of the crops.
Anand Nayyar et al.[9]	November 2016	Smart Farming: IoT Based Smart Sensors Agriculture Stick for Live Temprature and Moisture Monitoring using Arduino, Cloud Computing & Solar Technology	A novel smart farming enabled IoT based Agricultural stick is proposed by the authors which will monitor the following parameters; ➢ Temperature ➢ Soil Moisture Content Arduino Mega is used to build the device and all the data gathered by the above said sensors will be transmitted to the cloud using ESP8266 wifi Module, whereas complete circuitry is solar power and works on solar energy. They have claimed that the results of this device are 99 % Accurate.
Prof. K. A. Patil et al.[10]	2016	A Model for Smart Agriculture Using IoT	In this paper authors have developed a system with ICT. Ubi-motes are used for the generation of data, and android based application is provided to the user for the control. The system provided solution for the following parameters: ➢ Temperature ➢ Fan Control ➢ Irrigation Control (Sprinkler Control) ➢ Moisture Monitoring for Soil ➢ Light Control

Prathibha S R et al.[11]	2017	IOT BASED MONITORING SYSTEM IN SMART AGRICULTURE	In this paper, authors have introduced a system for the monitoring of crops based on IoT. They have used CC3200 temperature and humidity sensor for the monitoring of the temperature and humidity moreover they have used a camera embedded with the temperature and humidity sensor, to capture the images of the crops time to time.
Amandeep et al.[12]	July 2017	Smart Farming Using IOT	This paper proposed two systems/blocks one is for the user control and another is the device which will be deployed in the field. They have proposed a remotely controlled vehicle which is able to perform the following actions: ➢ Soil moisture sensing ➢ Obstacle avoiding ➢ Cutter ➢ Sprayer Similarly the other block or system is to operate the irrigation system for the field it will automatically switch on and off the pump to control the irrigation water in the field.
M.K.Gayatri et al.[13]	2015	Providing Smart Agricultural Solutions to Farmers for better yielding using IoT	In this paper authors provided a model outline for the application of IoT in field of Smart Agriculture with respect to the traditional methods applied to the agriculture field. Moreover, they have studied about the various sensors used in the field of agriculture.
Soumil Heble et al.[14]		A Low Power IoT Network for Smart Agriculture	In this system authors have proposed a system working on low power IoT network they have used sensor built by them IITH mote as sink and sensor node. A low-cost sensor developed by them is able to sense the soil moisture and temperature content. Humidity, light sensor are used in the proposed work for the sensing of other parameters. Developed system is evaluated on the power consumed by the system. Test results showed that there system has 83% lifetime at a low cost.
Dr. Veena S et al.[15]	March 2018	The Survey on Smart Agriculture Using IoT	In this survey paper authors have studied various application of the IoT in smart agriculture and provided a survey on the smart agriculture. Later on in this paper they have provided a useful literature on wireless technology and IoT applications.
Chiyurl Yoon et al.[16]	February 2018	Implement Smart Farm with IoT Technolog	Authors proposed a system based on smart farm wired/wireless system with node and data base based on server. They have used Bluetooth and LPWAN for the communication processes.
Chayapol Kamyod et al.[17]	January 2018	End-to-End Reliability Analysis of an IoT based smart agriculture	In this paper authors concluded that it emphasizes the delay, throughput, and IoT server load due to which the overall reliability of the device/system may directly be affected. They have provided results on the basis of simulation done by them.
Dweepayan Mishra et al.[18]	May 2018	Automated Irrigation systm-iot based approach	This paper proposed a system for the irrigation, which will help in to reduce the manual work and moreover to provide monitoring over the water usage. Arduino kit is used to develop a device. Following are the hardware details authors have used to develop a device ➢ Arduino Kit ➢ Wi-Fi Module ➢ Moisture Sensor Irrigation System will automatically turns on or off depending upon the reading received from the soil moisture sensor.
Priyanka Padalalu et al.[19]	January 2017	Smart Water Dripping System for Agriculture/ Farming	In this paper authors have proposed a system for the automatic irrigation system using following sensor: ➢ Temperature ➢ Moisture sensor ➢ pH sensor they have used analog temperature sensor (LM35) range of this sensor is form -55 degree Celsius to +150 degree Celsius. For moisture detection they have used SM300 which provides readings from 0 to 60 % moisture content.
Jun Lin et al.[20]	July 2018	Blockchain and IoT based Food Traceability for Smart Agriculture	Authors have proposed a system based on LoRa IoT technology for the food traceability moreover they have introduced a blockchain based model for the same due to which a trustworthy system is generated for the process of smart agriculture

R. Nageswara Rao et al,[21]	April 2018	IOT BASED SMART CROP-FIELD MONITORING AND AUTOMATION IRRIGATION SYSTEM	Authors have introduced a IoT device to control the automation process based on Raspberry pi and cloud for data storage. Their system mainly focuses on moisture content and provides real time data. After having data from the sensor deployed to the field they are able to control the irrigation process of the field.
Sahitya et al.[22]	May 2017	IoT, Big Data Science & Analytics, Cloud Computing and Mobile App based Hybrid System for Smart Agriculture	Authors have proposed an AgroTick, an innovative hybrid system for smart agriculture. It is an Internet of Things based system which supports mobile interface. Designing of the system is done using cloud computing, embedded system ad big data analytics have been used to generate accurate data. Main focus is to create a network for farmers to share knowledge regarding agriculture. This system will address two key issues like ➢ Rainwater Harvesting ➢ Predicting effective use of the harvested rainwater.

3 CONCLUSION

With the help of WSN&IOT, we can develop the field agriculture [23]. These systems enable to check the quality of the soil and the growth of the crop in soil and with these system farmers are able to solve irrigation problems, temperature problems, humidity problems, etc. Available sensors for the agricultural parameters and microcontrollers can be easily interfaced with each other and with the help of Internet of Things, wireless sensor networks communication issues can also be reduced and a better communication path for the transfer of useful data be achieved between various nodes. So, farmers are able to control various agricultural equipment's and monitor their crop on smartphone or on computers. These systems offer a high application area to the users to improve their skill and output of the crops in better way. Use these systems help to increase the wheat and saffron production in Afghanistan in the future. IOT able to control the condition of the crop and crop growth also IOT able to check soil, temperature, humidity, etc.

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