

# Cloud Technology on Agriculture using Sensors

A. S. R. Murthy\*, Y. Sudheer, K. Mounika, K. Sravya Rao and P. Durga Prasad

ECM Department, K L University, Vaddeswaram, Guntur – 522502, Andhra Pradesh, India;  
asrmurthy42@gmail.com, yadamreddysudheer@gmail.com,  
mounikakolli.123@gmail.com, sravya.kammila@gmail.com, tunna.panigrahy@hotmail.com

## Abstract

**Background/Objectives:** In this paper it offers a system that coordinates the sensor data to the cloud. There is an emphasis on using sensors in agriculture and offering a higher yielding crop capacity. **Methods/Statistical Analysis:** In this the need of the soil moisture is to sense the moisture. It makes the usage of soil moisture sensor to sense the moisture in the soil and a device that converts the input raw data to digital format. The received digital data is thus transferred to cloud. The method used for converting analog to digital is done by using myDAQ. The input is given to a computer, shows the data. The values that are displayed are in voltages, which are previously calibrated with sensor under different water-level conditions. **Findings:** Today there has been a lot of degradation in the cultivation as climate conditions have been changing continuously. Though there has been a development in productivity but there has been no improvement in the factors of agriculture. So a step needs to be taken to enhance these problems. The study shows us that how the technology can be increased to compensate this problem and overcome the various backdrops. **Applications/Improvements:** It can be further extended with implementation of GPS Technology and some of the sensors that can be used in future.

**Keywords:** Cloud Technology and myDAQ (Device used for Processing), IOT, Soil Moisture Sensor

## 1. Introduction

The main aim of the Internet of Things (IOT) is to provide the interconnected environment for the user. The data collected by the soil moisture sensors inserted in the soil are sent to the cloud after converting the analog information to digital information as shown in Figure 1.

It emphasis on Real Time Client-Server model in which the data is extracted in an automatic manner and placed in the big data .The exchanging of the information in the physical world is the next biggest step for the development in the communication field. We utilize a cloud administration for conveying a continuous ready framework. The framework is required to perceive an assortment of occasions that happen in the observed space and advice them a control focus progressively. Along these lines, it furnishes a control focus with a chance to assess the circumstance and make preven-

tive move if important. Sensors send the information to the cloud through cloud portals. The cloud portal extricates important information from crude sensor information and procedures the separated information for particular undertakings on a continuous ready framework. At that

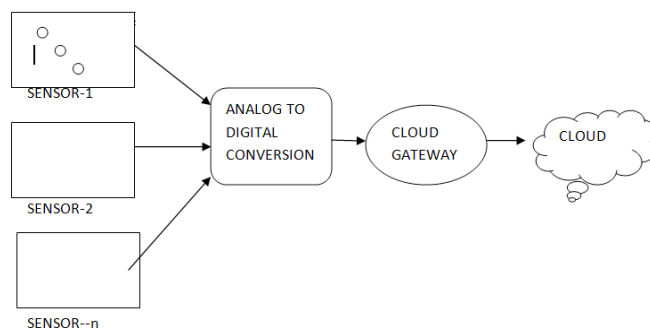


Figure 1. Block diagram of sensor cloud.

\*Author for correspondence

point, the cloud door advances and stores the handled information in distributed storage servers. The input information is broke down and if irregular article like a gate crasher is recognized, the examined information is sent to a control community for telling of the anomalous occasion. We execute a constant ready framework on top of a distributed computing stage. In the first place, we outline a continuous ready framework and characterize the construction modeling of a cloud passage. At that point, we execute the framework and the door1.

In this paper the discussion is about the data collected by using the sensors which is the semi-structured streaming data. In the agriculture farm physical sensors are placed on all the sides of the farm. The 3V's Volume, Variety, Velocity. In the early technologies the data is stored in only one database, in order to access the data which is stored in the database is difficult and it is a time taking process. To avoid this we populate the data using cloud technique. Cloud can be defined as the open-source framework which allows us to store and access the data. The data collected in the database can be classified into classes by using the classification technique. These outcomes are recommended for the best practices in the agriculture sector and for recommending the farmers for yielding the good results.

The farming technologies have been evolving over the years viewing the advancements in technology. Figure 2 shows the comparison of how technology is used today in farming and how it may be used in future.

Today	Tomorrow
Electrical and mechanical	Information
Hardware oriented	Software oriented
Manual and on-site control	Automatic and remote control
Independent dumb machines	Networked smart machines
User and environment demanding	User and environment friendly
Unpredictable quality and quantity	Predictable in quality and quantity

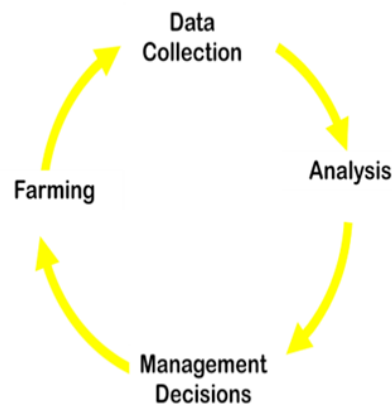
**Figure 2.** Evolving the farming technology.

So in order to meet the tomorrow requirements we can introduce the precision agriculture. Generally precision agriculture is defined as the sensors which are placed on all the corners of the farm and the data is collected by the sensors and will be transformed into the RDMS. Then the data will be populated into the cloud<sup>2</sup>.

## 2. Sensor Technologies

For the unique identification of the things in the internet, tags are useful which provides the static data. The sensor gives the correct report about the external environment without any human intervention. The sensors are the part of network and those are called sensor nodes. There are various sensor nodes in a network which are connected to each other in the two ways.

Figure 3 shows the process that collects data from soil moisture sensor to cloud via the cloud gateway. This project is cost-effective with all available components. Only the main thing that needs to be done is sensors that are to be placed correctly into the ground and calibrated accordingly to soil. A minimum of few sensors are connected to my DAQ and hence often provided a surface to access internet. The discussion is about the data collected by using the sensors which is the semi-structured streaming data. In the agriculture farm physical sensors are placed on all the sides of the field. These nodes will sense the soil and generate the huge data which will be transferred to nearest base to collect the data which holds 3Vs i.e., Volume, Variety, Velocity. To avoid this we populate the data using cloud technique<sup>3</sup>.



**Figure 3.** Process to obtain data from soil to cloud.

There will be certain conditions that the classification of the data can be done. These outcomes are recommended for the best practices in the agriculture sector and for recommending the farmers for yielding the good results. The best factors for adoption of technologies in agriculture and sensors induced in it.

### 3. Data Collection

Data collected by using the mapping of the boundary. By using the remote sensing also data can be collected. Data can be also the weather data. The data may belong to the sampling of any type of soil. The data can be collected by using condition of the crop. The data can be collected by monitoring the yield. By testing the irrigation also the data can be collected. The data can be collected on basis of moisture of the soil. By using the sensors placed on the corners of the farm we can collect the data. The above mentioned are some of the forms of the data collected<sup>4</sup>.

### 4. Determining Sensor Nodes

To calculate the sensor nodes required for a given crop field according to the proposed scheme for node deployment described, can be used to approximate it.

$$N_s S = N_c c \times 2 + [(f_1 w - 1) + ((N_1(c) - f_1 w \times (1 / f_1 w) \times 1) + ((N_1 c - f_1 w) \times (1 - 1 / f_1 w) \times 2)]$$

Where  $N_s$  is the number of sensor nodes,  $N_c$  is the number of carats and  $f_w$  is the field width in carats<sup>5</sup>.

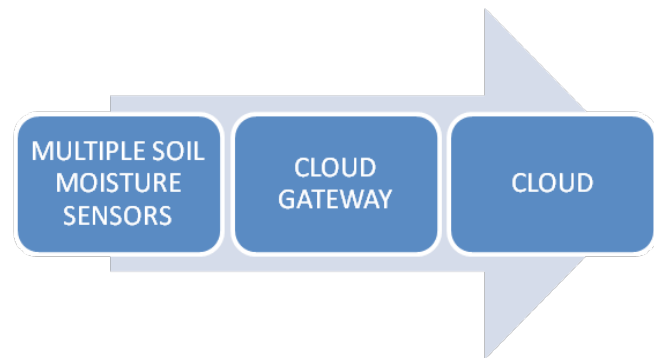
### 5. Analysis

In this analysis phase, the data which is collected in the data collection phase will be analyzed. Variability of the data is determined the possible causes of variability of the data can be analyzed. The analysis can be by considering the how much do measured soil and crop characteristics will be different. The analysis can be done by how much do the variations will affect the yielding of the crop or the quality of the crop can also be analyzed.

### 6. Management Decisions

In this management decision phase we will manage the data and take the decisions on the basis of the data which is analyzed in the analysis phase. The management decisions also includes that when the data is changed we can check whether the change of the inputs will change the yielding output. We can make decisions based on the quality of the crop that when we change the quality of the crop whether the input is effected or not it is also can be done in management decision. In management decision we can also check whether the changes take place in the

input are profitable or not. If there is any change occurred in the input we can take the decision how to implement the changes that takes place in the format of the input. Figure 4 depicts the flow of actions to manage the data depending on the management decisions.



**Figure 4.** Procedure for data management.

The productivity of the crop is dependent on many factors such as water input and nutrition. Also the drought conditions could prevail and affects the life of any crop and need some of the mitigate measures of any crop<sup>6</sup>.

### 7. Agriculture Sensor-Cloud Infrastructure

The structural planning of which is intended to bolster different farming applications (i.e., air/soil observing, social control for always keeping up the developing situations exact checking of the development status, rural observation and so on.) with an ease for the sensor gear and framework operation/administration.

The segments of the ASCI are sorted out in a various leveled way comprising of a physical sensor system (physical layer), virtual sensor cloud (virtual layer) and administration cloud (administration layer). The quantity of sensors in the physical sensor systems can be up to countless sensors and it changes relying upon the sort of the rural applications focused on. Every sensor hub is outfitted with different sensors (temperature, moistness, electrical conductivity and so on) and controllers (ventilation, watering system and so on). The physical sensors can be enlisted at the ASCI and they can be erased from the framework when required by the clients. The virtual sensor cloud virtualizes the sensors and controllers. A solitary sensor or a gathering of sensors can be virtualized as per the interest of the client<sup>7</sup>. This paper focuses on increased use of sensors and data collected by them. The use of sensors has been broadly increased. The sensor

web provides in gathering, sharing and analyzing of input data<sup>7</sup>.The food security is India's major concern which lead it be agriculture back-boned based country and also with this amount of population the productivity rates should be higher<sup>8</sup>.

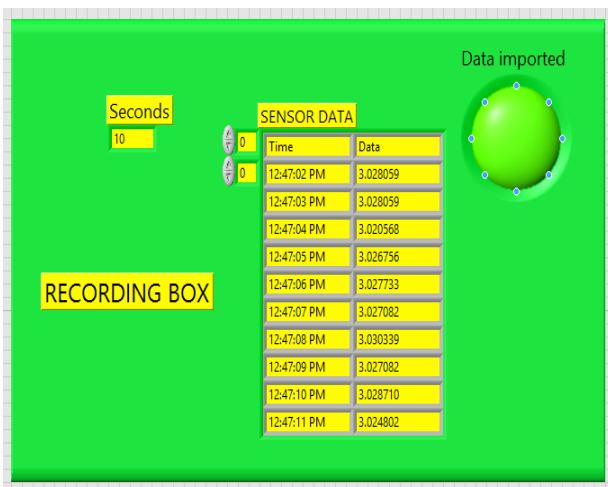
## 8. Implementation

Initially the data is reached from sensor, the raw data obtained is in the analog form and need to be converted to digital form. Hence the raw data is supplied to myDAQ which in turns to digital. The digital data is in the form of voltage value and depending on voltage value the percentage of moisture in the soil is calibrated. Initially the soil sensor is connected to multimeter to find out the moisture. The calibration of sensor values when tested is depicted in Table 1.

**Table 1.** Calibration of sensor values when tested

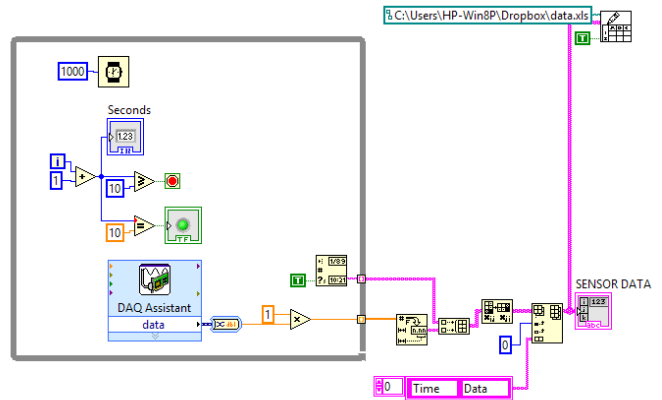
S. No.	Voltage (in V)	Percentage of Moisture(%)
1	0	0
2	1.62	30
3	3.95	50
4	4.01	70
5	4.2	100

Simulated software is used in turn for acquiring the data from sensor which is graphically programmed in Lab View software from National Instruments. Figure 5 is a screenshot from the software that shows the simulated data from the sensor.



**Figure 5.** Simulated data from sensor.

The graphical structure is connected within the software for the processing of the data, electronic gadgets that are to be used within the software are also developed using graphical representation and placed to a location where the data can be synced always in the excel sheet with the corresponding time and such that excel sheet is synced for a period of time. The graphical representation of the process as it is supposed to be executed in Lab View is depicted in Figure 6.

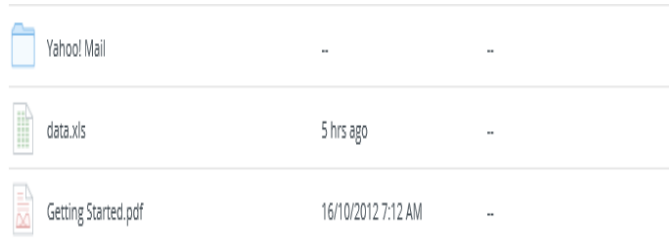


**Figure 6.** Graphical representation for process in LAB view software tool.

The experimental setup of our project is shown in Figure 7, where the sensor is connected to myDAQ.



**Figure 7.** Sensor connected to myDAQ instrument.



**Figure 8.** Data being uploaded to cloud in the form of excel sheet named as data.xls.

The data being is uploaded in the cloud as excel sheet cloud and updated after every time interval as shown in Figure 8.

Figure 9 shows the excel sheet that is uploaded in the cloud.

	A1	Time		
83	A	12:43:23 PM	3.03555	
84	Time		Data	
85		12:47:02 PM	3.028059	
86		12:47:03 PM	3.028059	
87		12:47:04 PM	3.020568	
88		12:47:05 PM	3.026756	
89		12:47:06 PM	3.027733	
90		12:47:07 PM	3.027082	
91		12:47:08 PM	3.030339	
92		12:47:09 PM	3.027082	
93		12:47:10 PM	3.02871	
94		12:47:11 PM	3.024802	
95	Time		Data	
96		6:22:38 PM	1.797906	
97		6:22:40 PM	1.798883	
98		6:22:41 PM	1.790415	
99		6:22:42 PM	1.782273	
100		6:22:43 PM	1.775433	
101		6:22:44 PM	1.767291	
102		6:22:45 PM	1.768919	
103		6:22:46 PM	1.76208	
104		6:22:47 PM	1.756869	
105		6:22:48 PM	1.748726	
106	Time		Data	
107		6:23:27 PM	0.049897	
108		6:23:28 PM	0.052829	
109		6:23:29 PM	0.050875	

**Figure 9.** Data acquired from sensors at different moisture levels at different time laps.

## 9. Conclusion

In this paper we considered the concept that as of today’s situation in India the agriculture is at the backward stage and whereas agriculture is the backbone of our country.

As there is a lot of migration from cities to towns and land in the villages is left behind without being cultivated. So in order to avoid this situation the agriculture is to be enhanced with technology that realizes the sensors with cloud and data storage in the cloud is taken into consideration and further action for the improvement of agriculture that empowers the green revolution.

## 10. Future Work

In future we would like to upgrade this project with GPS in order to have more reliable positioning of the soil when there is a larger area of cropping by the limited resources.

## 11. References

1. Parthiban P, Selvakumar S. Big data architecture for capturing, storing, analyzing and visualizing of web server logs. *Indian Journal of Science and Technology*. 2016 Jan; 9(4):1–9.
2. Yadav R, Rathod J, Nair V. Big data meets small sensors in precision agriculture. *International Journal of Computer Applications. Applications of Computers and Electronics for the Welfare of Rural Masses (ACEWRM)*; 2015. p. 1–4.
3. Patel A, Naringrekar S, Desai V. The Internet of Things - The reality of tomorrow. *International Journal of Science and Technology*. 2014 Oct; 2(11):155–60.
4. Swathi BS, Guruprasad HS. Integration of Wireless Sensor Networks and cloud computing. *IPASJ International Journal of Computer Science (IJCS)*. 2014 May; 2(5):49–53.
5. Jeong W, Nof, SY. Performance evaluation of Wireless Sensor Network protocols for industrial applications. *Journal of Intelligent Manufacturing*. 2008 Jan; 19(3):335–45.
6. Muruganantham M, Krishnaveni M. Water delivery performance evaluation of a tank irrigated system and best management practices for paddy Agriculture. *Indian Journal of Science and Technology*. 2015 Jul; 8(15):1–12.
7. Alamri A, Ansari WS, Hassan MM, Shamim Hossain M, Abdulhammed A, Anwar Hossain M. A survey on sensor-cloud: Architecture, applications and approaches. *International Journal of Distributed Sensor Networks*. 2013; 2013. 18 pp.
8. Shetty PK, Manorama K, Murugan M, Hiremath MB. Innovations that shaped Indian Agriculture—Then and now. *Indian Journal of Science and Technology*, 2014 Sep; 7(8):1176–82.