IoT Based Drip Irrigation System for Farming using Cloud Data

Kiran Kumar, Anitha G., D. Malathi Rani, Pallavi Paladugu

Abstract: ***The water resource for farming is very much important. In Olden days people used to supply water for irrigation through rivers, reservoirs, tanks, and wells for irrigation farming. Day by day some of such resources vanish and over the century, the population of India has become three times. Demand for food as growing population and the need for water for agricultural productivity is crucial. As a result of a severe shortage of water exists across parts of India. Though we have different solutions with which water and fertilizer utilization can be optimized still there are few gaps which need to be addressed to make the current systems more robust and backed by technology to get better yields. In this work, IoT based water conservation for farming using auomated drip irrigation system by considering scalability. Here for storing statics or parameters could storage is used. Based on these parameters dripping decisions (soil, moisture, and climate conditions) has been taken. The proposed solution is implemented and shown results with necessary parameters.***

Keywords: IoT, irrigation and dripping.

I. INTRODUCTION

Water plays a key role in the world in each domain. The population is increasing exponentials series as water conservation is also become more and more. Water usage is high informing fields. Many techniques are introduced to use water inefficient way for forming. As the world is entering new technologies, it's a mandatory or primary goal to trend up in agriculture [13[14] irrigation in India. Several kinds of research are tired of the sphere of agriculture. Most of the implementations came to signify the utilization of wireless sensing element in networks to collect the information from totally different sensors which are deployed at varied nodes and sends the sensing data through the wireless data transfer protocol. The obtained information from sensors gives knowledge regarding the assorted environmental and other influential factors. Watching those environmental parameter factors isn't the entire answer to extend the yield of crops to get better results. There is a range of different parameter factors that decrease outcome to a bigger extent. Thus, automation should be enforced in agriculture to overcome these issues. So, to supply an answer to any or all such issues, it is required to develop an Associate in a nursing integrated system which can watch out of all factors touching the outcome in each stage.

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However entire automation in agriculture isn't achieved and thanks to varied problems. Though it's enforced within the analysis level it's not given to the farming people as a product to urge advantages from such resources. Thus, this paper is to develop good agriculture based on IoT and given to the farming people. During this project, IoT technology helps in collection data regarding conditions like temperature, water-level, and wetness microcontroller [4][5][7]. IoT leverages farmers to urge connected to his farm from anyplace and anytime. Agricultural crop watching and management is done using Arduino Uno. Wireless sensing element networks are used for watching the farm conditions and small management areas are accustomed to control and alter the farm processes.

II. LITERATURE SURVEY

As per 2009 global judgment, around 15.9 million people are in South Africans [16][11] suffering from poverty; and out of those 15.9 million people 11 million people (69%) lives in remote areas. Households in these regions majorly depend on factors like subsistence farming, remittances from members working in far places (cities and mines). While on the other side most of the Zambia's [12][15] remote people derive their income from agriculture and they are considered as small holder households. IoTs can provide access to management of remote area transport, communication with wide services for knowledge on agriculture, weather to reduce risks. IoT's can also provide access to many agri[10] services and markets for production.

During 2009/2010 there's been an increase in agriculture production in Zambia and following are some of the comparisons: Increase in sunflower by 118%, soya beans by 50%, tobacco by 7% and wheat by 5%. Whereas agriculture irrigation sector is diverse in South Africa. It includes horticulture, animal, poultry production, dairy and fish farming. As per 2009 cousins, 4.7 million South Africans are employed with the help of agriculture and 4 million are engaged for their own consumption. To keep the track of agriculture, agro processing, irrigation system, transport planning management can be adopted by IoT.

About 90% of crop production is un-irrigated due to rain so rainfall is an important factor for crop selection in both Zambia and South Africa.

R.suresh[1].et al has studied and mentioned few points about using Rain gun farming system, which is used by GSM Based automated Irrigation Control. It is an Automatic microcontroller. This irrigation system will take area, only where there is more necessity of water thereby saving a huge quantity of water. They developed a software stack called Android which consist operating system,

Middleware level and key applications that would help them bring a change in environment of field resources.

To start developing android based applications on the Android platform, the Android SDK is having tools and APIs required to it. It is developed by Java programming language. The Mobile phones were almost become a important part of humans which is serving many needs to humans. GPRS feature in the mobile phone is used by this application as a solution as control system for agricultural irrigation. These irrigation systems can cover only lower range or small areas agriculture land it is not economically bearable.

This irrigation system provides excess amount of water in the area of land. It uses the GSM to send the alert by an Android application. They said over-irrigation can cause leaching and loss of nutrients content in soil, to overcome these under irrigation they used a methodology. They promised that Microcontroller can increase the system Life and they can consume less power. This irrigation system lacks in extraordinary features and limited to automation of agricultural irrigation system.

Pavitra[2] et.al were stares the features of their system in GSM based Automatic Irrigation Control System for using of resources wisely and Crop execution using Android device.

System Features.

•Irrigation system supports water usage decision is used for monitor the entire area with GSM module.

• This Irrigation system consists of a sensor which wills always monitors the water level in the water tank and it provides an accurate quantity of water necessary for the plant.

It will also monitor the temperature, humidity and soil composition for growth of crop.

It is low of cost, low power consumption with the help of sensor which are controlled using GSM mobile. It will also use SMS to control and monitor those sensors.

Laxmi[3] et al. proposed Control System Using GSM and android for Efficient Usage of Water and Power for agricultural Irrigation. To turn motor on and off in irrigation Control System they are using Android and GSM for optimized usage of water and power. These valves can control by using controllers. By this irrigation system farmers will know the right amount of water to be applied at the right time, the valves is on and off without the labor. To limit over watering saturated soils and to avoid irrigating at wrong time farmers were using automation equipment which will improve adequate water and nutrients. These valves can be controlled by controllers. Mobile application is lack in features with an appropriate user interface. It is used to monitor and keep the moisture level regardless of time. The microcontroller [4] based irrigation system[5][7] work even in abnormal circumstances. By irrigation system plants get water at the proper time and this helps farmer to increase the production from 25% to 30%.

Robert G [6].et al published a paper on Remote Sensing[6] and Control of a agricultural Irrigation System **Using Wireless Sensor Network in Distributed manner in** which the construction of technical system is one of the best systems to monitor the window app field. Sensors that provide better wireless communication used in this system to cover wide area. On irrigation land sensors and internet technology is also mentioned in this. Data is measured efficiently for research work. Microcontroller [4] Based Automatic Plant Irrigation [5]System* Venkata Naga Rohit Gunturi[7].

This paper mainly focuses on automation of irrigation using IoT to save water and money. Microcontrollers are programmed to control complete system to provide signals to sprinkler. In wireless based drip irrigation automation technology has very much importance since it is operated with help of soil moisture sensors[8]. Whereas the wired technology i.e traditional method has many difficulties over large geographic areas.

IoT based irrigation system can be possible in future if different kinds of sensors are used in irrigation. In future this system can also be used to transfer pesticides and fertilizers by using other sensors and values.

Answer to all our energy need is solar power which is cost effective.

Advantage: it will help to reduce weed, time and to control diseases growth.

Disadvantage: This proposed solution is just limited to the automation of agricultural irrigation system and lacks in extraordinary features.

III. MOTIVATION

The current proposed project is very much important in the current context as there is a severe shortage of water across parts of India. Though we have different solutions with which water and fertilizer utilization can be optimized still there are few gaps which need to be addressed to make the current systems more robust and backed by technology to get better yields. The following limitations can be addressed with the proposed system.

- We will get high efficient water application only when its used properly.
- Supply in variation can be managed by considering proper values and drippers.
- There might be wastage in time, water if not maintained and installed correctly. Factors like soil, water, crop, land topography and agro-climate conditions must be studied properly.

IV. PROBLEM STATEMENT

We aimed to find a solution to issues which are of great concern to the society like effective utilization of fertilizers and natural resources like water.

economical solution which can bear wear & tear and all-weather conditions.

V. PROPOSED SOLUTION

In our proposed solution there are 3 phases:

1. Setup
2. Data collection
3. Decision making

1. **Setup**

Table- I: Setup

Sensor	Quantity	Purpose
soil sensor for moisture	20	To calibrate the soil moisture[8] precisely. This is very crucial to our project as this parameter is primary in decision making to control the actuator. We place multiple moisture sensors at different parts of the field.
Sensor for Temperature	10	To calibrate the temperature in the field precisely.
Humidity sensor	10	This is to calculate the air humidity which is also a required factor in the decision making to control the actuator.
Solar Radiation sensor	2	This is to calculate the solar radiation.
Wind speed sensor	2	This is to calculate the wind speed
Rain Measurement sensor	2	This is to calculate the quantity of rainfall. We need this parameter in the decision making to control the actuator.
Wind direction sensor	2	This is to calculate the wind direction. These parameters also play a considerable role in the decision making to control the actuator.

Distance between each soil moisture sensor[8] vary from company sensor type.
The sensor we used requires 600m of distance between each.

2. Data collection

IoT interface will gather all the inputs from moisture sensor device and the other sensor devices and push it to the cloud. This interface is equipped with GSM or SIM based internet service and is solar powered[9] with battery backup that can last long for a few days. This will also provide the battery status of the device periodically based on which the farm owner will be notified to take appropriate action in the event of prolonged cloudy climate during rainy or winter season. The data collected from IoT interface is pushed into cloud infrastructure which undergoes on the fly processing and gets mapped or validated against the patterns that are developed by constantly churning the data in the Big Data platform.

3. Decision making

Based on the evaluation or matching of the processed data with the patterns in the cloud environment the instruction is sent to the actuator to control (on/off) the drip system. Only the information of Soil moisture sensor[8] and rain measurement sensor is enough to evaluate whether the farmer should ON/OFF the drip at low level. At high level data from all the sensors is used to evaluate the drip.
The main feature of this system is that it can help farmers to ON/OFF the drip with the help of a button in automated way.

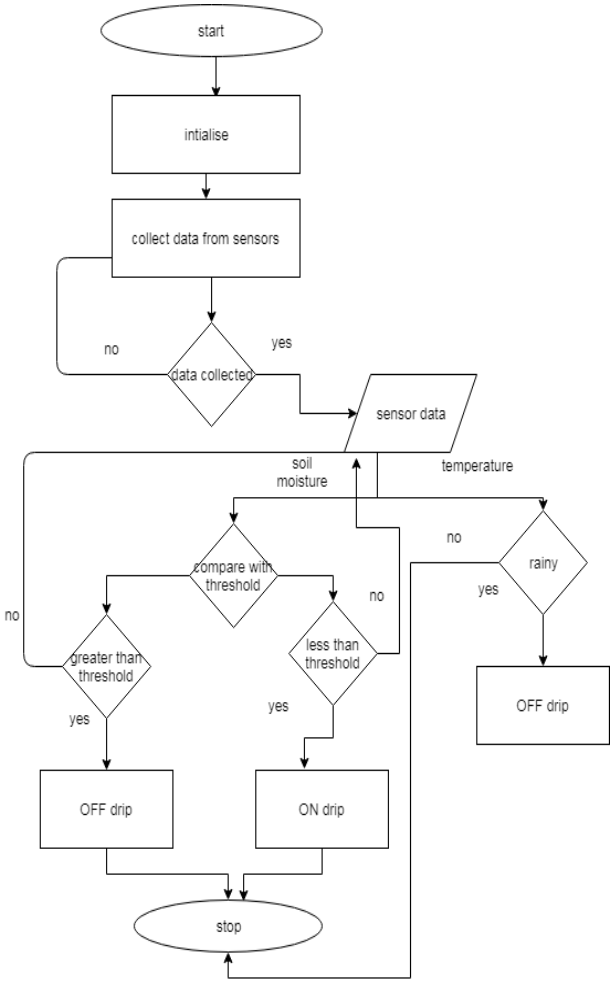

Fig. 1. Decision making for dripping

In this proposed system, the sensors for sensing moisture will send the parameter values at regular time duration. The IoT device i.e microcomputer will collect the parameter values from the sensors and then those values are sent database using a GPRS module. The data stored and will be also sent to the cloud. Along with-it information of those parameters at cloud server will analyze and generate the graph to make decision. The farmer will decide on ON/OFF the water flow based on the soil moisture [8] level. If the value is below the lower threshold value then drip must be ON to keep the moisture level, if the value is above the upper threshold value then drip must be OFF. The decision takes place as shown in figure 1.

In our proposed solution following components are used to collect the information for taking decision:

Soil moisture sensor:

This sensor is used to find out the moisture level of soil when soil is having water storage. If the water level in the soil is high, then it will help to OFF the drip and if it is low it will ON the drip.

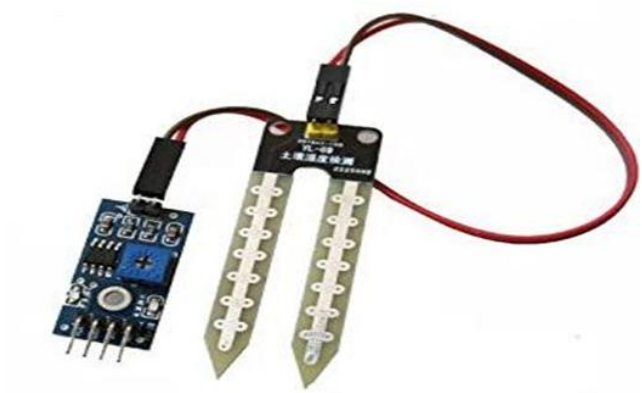

Fig. 1. Soil moisture sensor[8]

Temperature sensor:

This sensor is used to monitor the changes in the environment. If the temperature sensor detects that it is rainy it will help to OFF the drip.

Fig. 3. Temperature sensor

IoT Interface.

IoT devices are used to collect and process the data from sensors. Some of the IoT devices that can be used are Arduino, raspberry pi, etc.

Cloud Infrastructure.

Cloud is used for data storage and computation.

The proposed solution is having following steps phases to take final decision for dripping to the respective crop. The as follows Steps,

a. Initialize the process.
b. Collect the data from all sensors.
c. If data collected check the data corresponding to each sensor with their threshold values.
d. Based on the outset value of soil moisture sensor[8] is obtained is greater than the threshold the OFF the drip and if it is smaller than obtained ON the drip.
e. If it is rainy OFF the drip and if it does not then stop the process

VI. EXPERIMENTAL RESULTS

Table- II: Collected Data from sensors

So. No	Soil	Id	Temp	ID
1	500	45010	35	567045
2	502	45013	36.7	567078
3	495	45012	35	567021
4	499	45014	39	567037
5	495	45010	35.4	567012
6	501	45011	36	567037
7	502	45019	37	567022
8	504	45015	37.5	567034
9	497	45021	37.9	567021
10	497	45020	35.3	567014
11	502	45023	39	567018
12	500	45018	39.8	567015
13	501	45025	39.4	567013
14	495	45029	38	567011

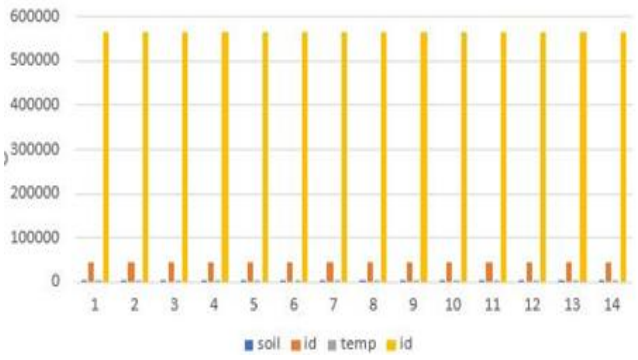

Fig. 4. Sensor data

VII. CONCLUSION

IoT based drip irrigation system for farming using cloud data is most useful for farmers. It can also reduce physical work in farm. Depending on the sensor data the farmer can ON/OFF the drip. There are many advantages for this system from previous drip irrigation systems. Monitoring and management of the crop will become easy with the help of this system. Apart from management of farm we can automatically ON/OFF the drip with the help of cloud data analysis. We are planning to develop application for both iOS and other operating system as future work by adding some more parameters.

REFERENCES

1. R.Suresh, S.Gopinath, K.Govindaraju, T.Devika, N.SuthanthiraVanitha, "GSM based Automated Irrigation Control using Raingun Irrigation System", International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 2, February 2014.
2. Pavithra D.S, M. S .Srinath, "GSM based Automatic Irrigation Control System for Efficient Use of Resources and Crop Planning by Using an Android Mobile", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) Vol 11, Issue I, Jul-Aug 2014, pp 49-55.
3. LaxmiShabadi, NandiniPatil, Nikita. M, Shruti. J, Smitha. P&Swati. C, "Irrigation Control System Using Android and GSM for Efficient Use of Water and Power",International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 7, July 2014.
4. Shiraz Pasha B.R., Dr. B Yogesha, "Microcontroller Based Automated Irrigation System", The International Journal Of Engineering And Science (IJES), Volume3, Issue 7, pp 06-09, June 2014.
5. S. R. Kumbhar, Arjun P. Ghatule, "Microcontroller based Controlled Irrigation System for Plantation", Proceedings of the International MultiConference of Engineers and Computer Scientists 2013Volume II, March 2013.
6. Yunseop (James) Kim, Member, IEEE, Robert G. Evans, and William M. Iversen, "Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network", IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, Volume 57, Number 7, JULY 2008.
7. Venkata Naga RohitGunturi, "Micro Controller Based Automatic Plant Irrigation System", International Journal of Advancements in Research & Technology, Volume 2, Issue4, April-2013.
8. MahirDursun and SemihOzden, "A wireless application of drip irrigation automation supported by soil moisture sensors", Scientific Research and Essays, Volume 6(7), pp. 1573-1582, 4 April, 2011.
9. S. Harishankar, R. Sathish Kumar, Sudharsan K.P, U. Vignesh and T.Viveknath, "Solar Powered Smart Irrigation System", Advance in Electronic and Electric Engineering, Volume 4, Number 4 (2014), pp. 341-346.
10. AgriSETA, Sector Analysis agriculture, Department of Higher Education and Training, South Africa, 2010
11. Cousins, B., What is a smallholder? Class analytic perspectives on small-scale farming and agrarian reform in South Africa, http://www.plaas.org.za/pub2/downloads/wp16/
12. Milimo, J.T., Shilito, T., Brock, K., The poor of Zambia speaks, Zambia Social Investment Fund, http://www.worldbank.org/afr/wps/wp85.pdf, 2000
13. National Department of agriculture, http://www.nda.agric.za/docs/GenPub/DevStrat2007.pdf, 2007
14. Rouhani, Q.A., Brits, P.J., Report WRC: TT235/04, Rhodes University, 2004
15. Siegel, P.B., Poverty reducing potential of small-holder agriculture in Zambia: dualism and dualism within dualism, PVA Consultation workshop, Lusaka, 2005
16. 2011 Local Government Budgets and Expenditure Review, Republic of South Africa, 2011
17. Pragna, D.V.B., Laxma Reddy, D., Prasad, S.V.S. "IoT driven automated object detection algorithm for urban surveillance system in smart city" (2019) International Journal of Engineering and Advanced Technology, 8 (6 Special Issue 3), pp. 1687-1691.
18. Reddy, R.M., Rao, K.N., Prasad, S.V.S. "Traffic congestion monitoring and management by using IOT" (2019) International Journal of Innovative Technology and Exploring Engineering, 8 (9 Special Issue 2), pp. 688-689.
19. Jahan, S., Amareshwar, E., Prasad, S.V.S., Arulananth, T.S. "Raspberry Pi based water quality monitoring and flood alerting system using IoT" (2019) International Journal of Innovative Technology and Exploring Engineering, 8 (4S2), pp. 237-240.
20. Haribabu, P., Kassa, S.R., Nagaraju, J., Karthik, R., Shirisha, N., Anila, M. "Implementation of an smart waste management system using IoT" (2018) Proceedings of the International Conference on Intelligent Sustainable Systems, ICISS 2017, pp. 1155-1156. Cited 3 times.
21. Sri, B.D., Nirosha, K., Gouse, S. "Design and implementation of smart movable road divider using IOT" (2018) Proceedings of the International Conference on Intelligent Sustainable Systems, ICISS 2017, pp. 1145-1148. Cited 1 time.
22. Arun, V., Reddy, D.L., Srinivas, S. "Encryption standards for security system in energy harvesting for IoT requirements – Review" (2018) Proceedings of the International Conference on Intelligent Sustainable Systems, ICISS 2017, pp. 1224-1227.
23. Lakshmanachari, S., Srihari, C., Sudhakar, A., Nalajala, P. "Design and implementation of cloud based patient health care monitoring systems using IoT" (2018) 2017 International Conference on Energy, Communication, Data Analytics and Soft Computing, ICECDS 2017, pp. 3713-3717.
24. Snigdha, S., Haribabu, K. "IoT based security system using raspberry PI and mail server" (2019) International Journal of Innovative Technology and Exploring Engineering, 8 (11), pp. 1702-1704.
25. Pragna, D.V.B., Laxma Reddy, D., Prasad, S.V.S."IoT driven automated object detection algorithm for urban surveillance system in smart city" (2019) International Journal of Engineering and Advanced Technology, 8 (6 Special Issue 3), pp. 1687-1691.
26. Reddy, R.M., Rao, K.N., Prasad, S.V.S. " Traffic congestion monitoring and management by using IOT" (2019) International Journal of Innovative Technology and Exploring Engineering, 8 (9 Special Issue 2), pp. 688-689.