Smart Micro Irrigation System using Microcontroller in SSEC Campus, Bhavnagar.

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Abstract -. This paper center around a keen water system framework which is financially savvy and a working class rancher use it in homestead field. Today we are living in 21st century where mechanization is assuming essential job in human life. Robotization enables us to control machines programmed control. It give comfort as well as decrease vitality, proficiency and efficient. Today businesses are use robotization and control machine which is high in expense and not appropriate for utilizing in a ranch field. So here we likewise structure a shrewd water system innovation in minimal effort which is usable by Indian ranchers. The targets of this paper were to control the water engine naturally and select the heading of the progression of water in pipe with the assistance of soil dampness sensor. At last send the data (task of the engine and course of water) of the ranch field to the versatile message and g-mail record of the client.

Key Word - Soil moisture sensor, Electromagnetic valve, Temperature sensor, Relay, Microcontroller, and GSM Module.

I.INTRODUCTION

In the India agriculture is main source of food production to increasing demand of human population. Agriculture also has a major effect on economy of the country. In agriculture, irrigation is a one method that growths the crop production. Usually farmers visit their farm occasionally for check the moisture level of soil and the require water is pumped by pump/motor to irrigate the farm. In agriculture, two things are very important, 1) Fertility of soil 2) Moisture content in soil. Nowadays for irrigation many techniques are available which are used to reduce the dependency of rain. And many of that technique are driven by electrical power scheduling. The regular irrigation methods in India like Flooding or Channel, etc. Takes many times and effort mainly when a farmer need to irrigate many farms which is spread in different geographical areas. Usually farmers are there in farms to do irrigation process. Nowadays farmers want to continue their irrigation activity along with other occupations. By using of automation and sensor based in irrigation system makes farmer work being much easier and no periodically supervision required.

In this system a microcontroller8051 which control the system and the moisture sensor give the moisture note to microcontroller which gives command to relay to on/off the solenoid valve or electromagnetic valve and also give command motor to start/off watering. The Indian farmers want cheap and easy to handle user friendly sensor based automated irrigation system. Water is a most valuable resource so the use of water is properly utilized. In the agriculture lots of amount of water are used and the irrigation is process which consuming a too much time and it's must carrying on a timely basis. The aim of the project is to develop a smart irrigation system. This measures the moisture of the soil and automatically turns on or off the water supply system and which helps to reduce the scarcity of water.

II.IRRIGATION IMPORTANCE

Water system is characterized as "Falsely providing and deliberately isolating of water for agribusiness and agriculture so as to get higher or subjectively better generation". Water is basic to plant development and for millenniums. Effective ranchers have utilized diverse techniques to apply water to their yields. The atmosphere and area of India makes storm questionable. For the most part have four months for rainstorm and the rest of the months are having no downpour. So water system is fundamental for farming. Indian economy depends on farming. A huge segment of Indian populace relies upon agribusiness. Without water system agribusiness is beyond the realm of imagination in dry zones or amid the long stretches of deficient precipitation. Normally, for the rural exercises crosswise over differing areas, there is a requirement for legitimate water system framework.

III.METHOD OF IRRIGATION

The many types of methods are used to irrigating farm field for different type's crop field. Many of them which are used by Indian farmers it is channel system, drip system, sprinkler system. Channel system is a traditional method of irrigation. But nowadays sensor based irrigation system it is a new irrigation method for irrigating farm automatically. Irrigation classified into mainly three types.

A. CHANNEL SYSTEM

It is the most important form of irrigation in several parts of world mostly in developing countries. It is cheaper and had greatest advantage in the river valley regions. The principal method used for improving the growth of the crops in India is Channel irrigation system. In India, U.P. stands first use of channel irrigation, followed by Punjab and Haryana. After wells and tube wells, channel irrigation is the second most important irrigation source. However, this method is only that area where the availability of water is more in this method the water transmit to crops or plants by channel the huge amount of water is wasted by this method.

Figure 1
CHANNEL SYSTEM IRRIGATION (Source: www.123rf.com)

B. SPRINKLER SYSTEM

Sprinkler water system framework is brilliant water system framework which is lessen the measure of water which is squander by utilizing of a custom water system strategy on the planet. In the sprinkler water system strategy the water is apply to plans or harvests as precipitation or splash. Fundamental points of interest of this framework are it very well may be utilized in under condition where customary strategies are not effective. This strategy is progressively valuable under after circumstance.

- Topography is unpredictable.
- Slopes are inordinate.
- Soil is erosive.
- Soil is too much porous or impermeable.
- Depth of soil is shallow over rock or sand.

In this framework, the expense of land readiness and lasting water conveyance arrangement of channel or courses is less. Anyway there is the extensive introductory interest in the buy of siphoning and sprinkling gear.

Figure 2
SPRINKLER SYSTEM IRRIGATION (Source: www.civildigital.com)

C. DRIP IRRIGATION

Drip irrigation is also called trickle irrigation. It is the mostly used micro irrigation system in the world wise especially in that area where the availability of water is low and in arid or semi-arid area. The method is developed by Israel and todays it is become more popular in the world. In India it is mostly used in Gujarat, Maharashtra, Kerala and Karnataka. In drip irrigation is fully satisfy the name of this method. In this method water is directly applied near the roots of plants or crops. Water is applied to plants and crops in the form of drop. The special outlet device is used for water application called an emitter or a dipper. The emitters are connected with nozzles and it's placed near the root of the plants and it's supply water drip by drip at a very slow rate, varying from about 2 litter/hour to 10litter/hour. The water applied is just sufficient to keep the soil moisture within the desirable range for the plants growth

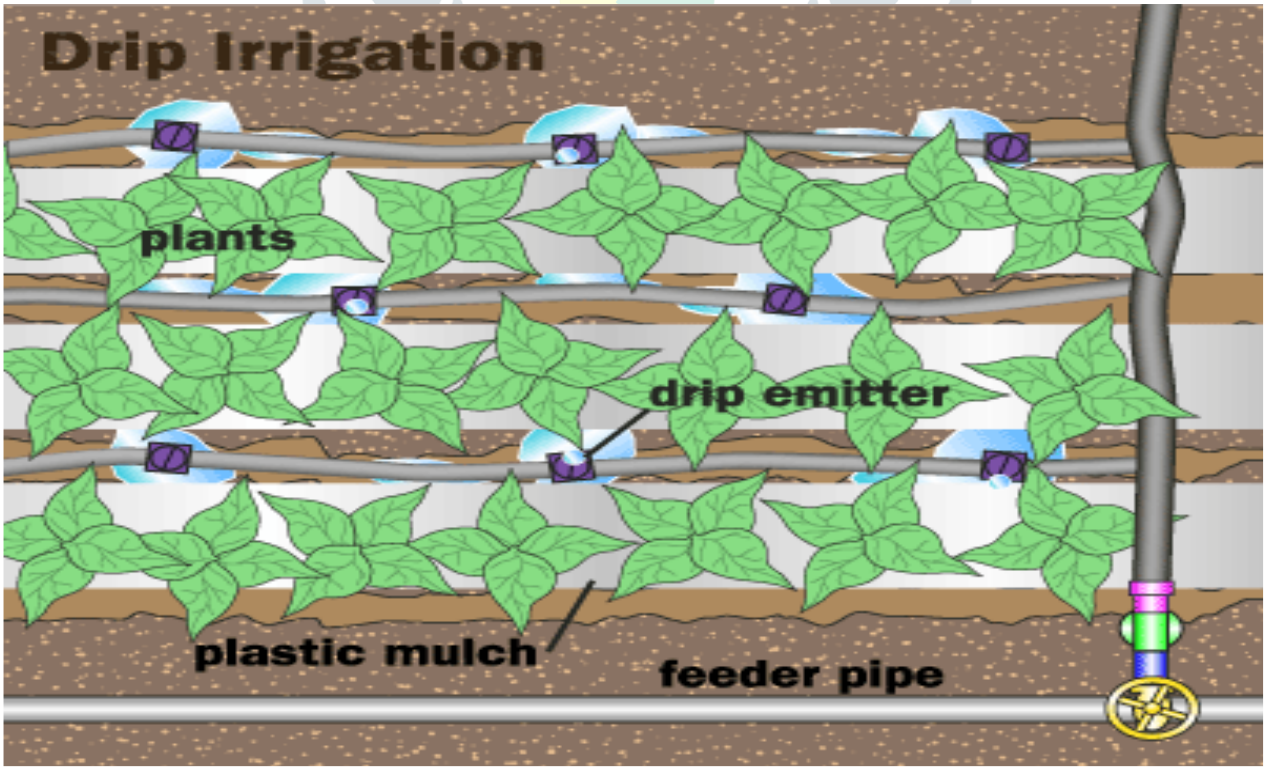

Figure 3
DRIP SYSTEM IRRIGATION (Sources:www.netafimindia.com)

D. SMART MICRO IRRIGATION SYSTEM

Above three systems are generally operate by a user. Smart irrigation system is controlled by sensors that means it's automatically control the total irrigation system. Whether the farmers is not present in the farm field then the system is send messages to the farmer about the information of farm field and the current situation of field like moisture and temperature. Due automation of system no workers are required for operating. Less amount of water waste by this method with compared to previous three methods. Commonly two types of controller used in smart irrigation system.

a. ET Controller

Evapotranspiration (ET) controllers, additionally alluded to as, climate based controllers, it should give the temperature information to deal with the water system plans. Evapotranspiration is the mix of vanishing from the dirt surface and transpiration by plant materials. These controllers accumulate neighborhood climate data and make water system run-time changes so the scene gets the proper measure of water. ET climate information utilizes four climate parameters: temperature, wind, sun oriented radiation and stickiness. It's the most exact approach to compute scene water needs.
There are three essential types of these climate based ET controllers:

- Signal-based controllers utilize meteorological information from a freely accessible source and the ET esteem is determined for a grass surface at the site. The ET information is then sent to the controller by a remote association.
- Historic ET controllers utilize a pre-modified water use bend, in view of notable water use in various areas. The bend can be balanced for temperature and sun powered radiation.
- On-site climate estimation controllers utilize climate information gathered nearby to figure consistent ET estimations and water as needs be.

b. SOIL MOISTURE SENSOR

Soil dampness sensor is give the thought regarding the sum water required for the water system Soil is vital normal asset which has been ignored in the past prompting unfavorable outcomes. To help effectively oversee water system frameworks, it is basic for ranchers to gauge soil dampness. This encourages ranchers to utilize lesser water for growing a harvest, consequently expanding the quality and yield of the harvest by improving the administration of soil dampness amid plant development. Anyway soil dampness sensors measure the volumetric dampness content in soil utilizing properties of the dirt like electrical opposition, collaboration with neutrons and dielectric consistent. Soil dampness and estimated property connection must be aligned. At the point when covered in the root zone of turf, trees or bushes, the sensors precisely decide the dampness level in the dirt and transmit this perusing to the controller. There are numerous sorts of various soil dampness sensors accessible in the market.

Figure 4
SENSOR BASED SMART IRRIGATION SYSTEM (Source:www.waterbee.com)

IV.NEED OF STUDY

In India, agriculture plays an influential role for development in food production and also for the economy and development of a country. Nowadays water availability is in stress because of population growth and overexploitation. Due to this demand for water is exceeding supply. We would face severe water scarcity if this rate of water is continues. So there is an urgent need to conserve water. By using the traditional irrigation method the water requirement of plants or crops farmer can't monitor. Sometime the soil has enough moisture the farmer still water provided. So the applied water is more than the required water so the additional amount of water becomes wasted. Hence a system is required to monitor the water requirements of the plant is needed. Also Smart Irrigation System installation means decreased operating expense by maintenance personnel.

V.STUDY AREA

This study is conduct by the Shantilal Shah Engineering College, which is located at Bhavnagar Gujarat, India. The area is select for Study which is located behind the Civil Engineering Department's Fluid Mechanics laboratory and the size of area is 21 X 21 Sqft. The soil in this area is impervious and bentonite clay. Total 16 plants are taken for study, out of them 8 plants are irrigated by Conventional method and remaining from the Smart Micro Irrigation Method. The 8 nos of KARANJ (Pongamia pinnata) and 8 nos of CHARAL (Holoptelea integrifolia) plants are taken for irrigation.

VI.SYSTEM IMPLIMENTATION

Total 8 plants are connected to 8 numbers of solenoid valves and 8nos of Soil moisture sensor, which are connect to relay. The relay is connecting with the microcontroller, Microcontroller8051 is used and it's connected with GSM modem. This is giving the information about the valve and motor status to farmer. Microcontroller receives the node from the sensor and the microcontroller decodes it. The motor is turn on/off as per water requirement to the plants. The moisture sensors help to regulating the motor as per water requirement to plants. In this project we have implemented sensors which detect the humidity in the soil (agricultural field) and supply water to the field which has water requirement. The aim of this system is to reduce the waste of water due to traditional irrigation system and reduce the presence of farmer in field.

The model implements on the field on 7th March 2019. It is located at Fluid Mechanics laboratory of civil engineering department. First of all 8 tubes laid on study area particular one for one plant. The numbering of plants is given in zigzag way and solenoid valve number is start from 1 to 8 (left to right in this image) and soil moisture sensors are placed near the plant. The storage tank used for water distribution and accurate measurement of water consumption has size 1.0 X 1.0 X 0.50 cum. having capacity of 500 liter. Water to the plant is supply through this tank. The tubes and soil moisture sensors wire is covered by earth for proper care against the sun heat.

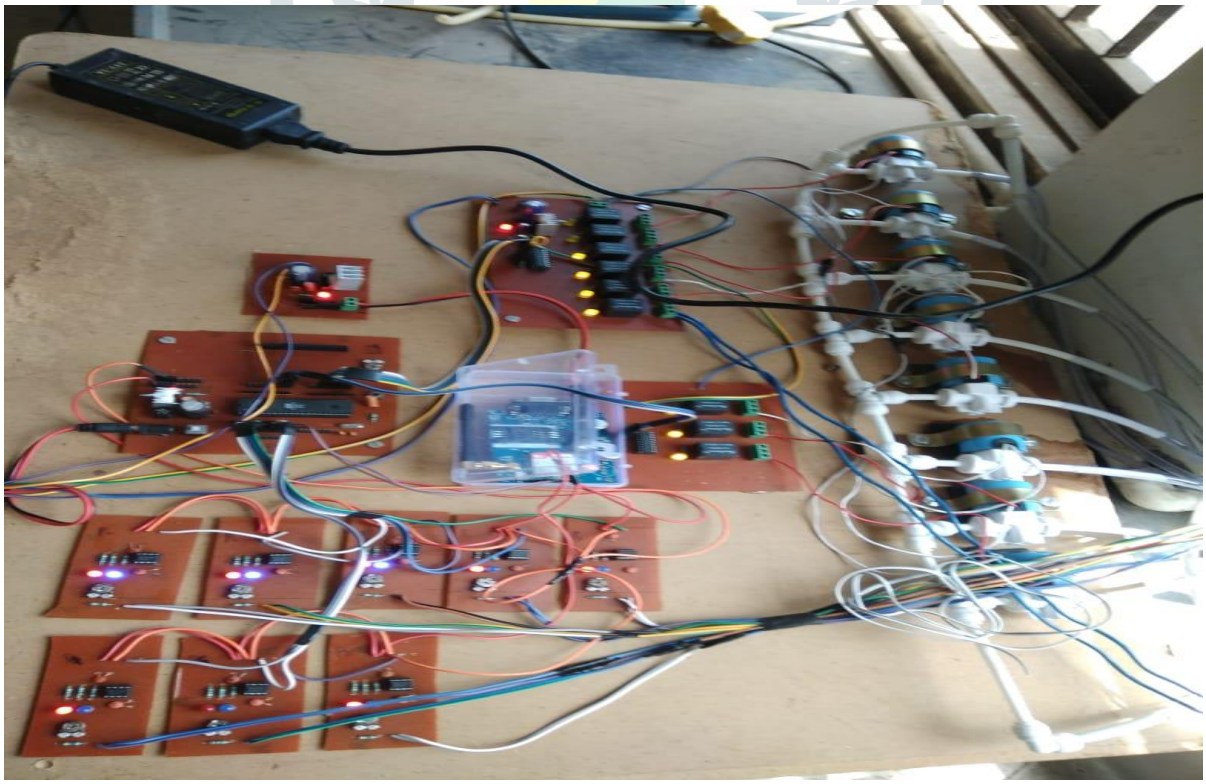

Figure 5
SNART MICRO IRRIGATION SYSTEM ON SITE

Figure 6
DRIP IRRIGATION TUBE AND SOIL MOISTURE SENSOR ON FIELD

Figure 7
SOIL MOISTURE SENSOR ON FIELD

VII.SYSTEM WORKING

In this system two sensors are used 1) Soil moisture sensor which used to measure the moisture in the soil, 2) Temperature sensor which used to measure the temperature. In this system microcontroller8051 is used the control the system and the GSM module is used for mobile communication. First the sensor gives a reading or node to the system or controller. This is an input data and the controller check if the moisture and temperature are over then the required moisture (6 mm) and temperature (25°C) of the plant then the microcontroller gives output the motor and pump. So which plant required the water their valve is opened and water is applied to the plant if the moisture level is reach the required moisture level then the pump automatically OFF. The relay is used for operating the valves and motor and also indicates which valve is opened and which plants have sufficient moisture in the soil and also indicated motor is ON/OFF. GSM module is used to send the message about the valves condition right now you can also operating the system manually and mobile also. The system can be connecting to Wi-Fi & even it could be handled through media. 6 mm depth and 25 C

VIII.RESULT AND DISCUSSION

The irrigation to both type of system was actually compared out from 11th March 2019 to 4th August 2019. Daily water applied was recorded and collected data was analyzed. In the furrow irrigation system averagely 61.13 liter water used per day and in the Smart irrigation system averagely 24.68 liter water used per day for 8nos of plants. So more than 50% of water is waste in furrow irrigation compare to smart irrigation. By using the furrow method water store in root zone is averagely 45.38 liter/day and using the smart micro irrigation system 22.44 liter/day. So averagely 50% water is save by using a smart micro irrigation system. The efficiency of this system is 91.09% it's much better other system.

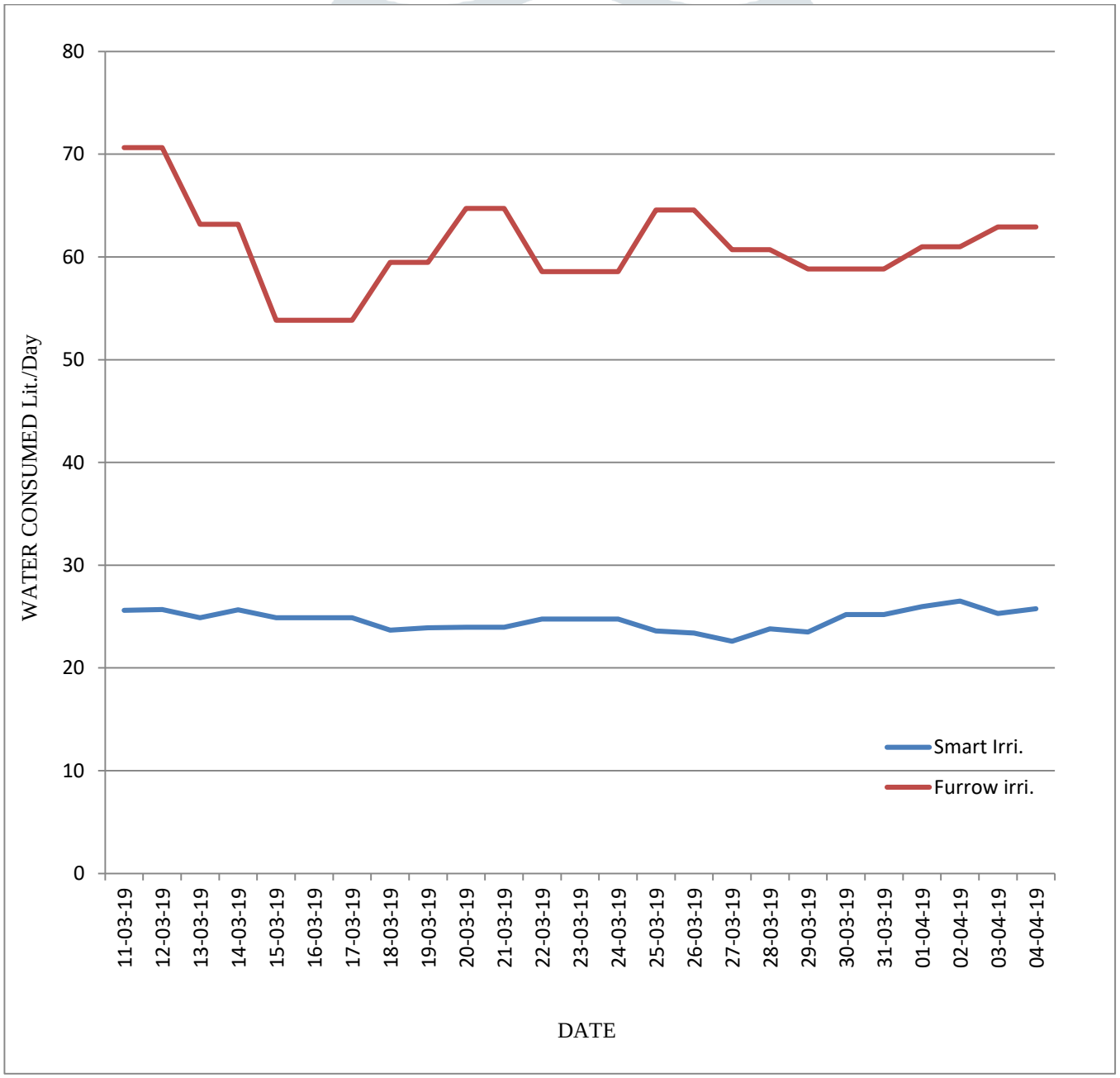

Chart 1
(Water used Comparison Chart)

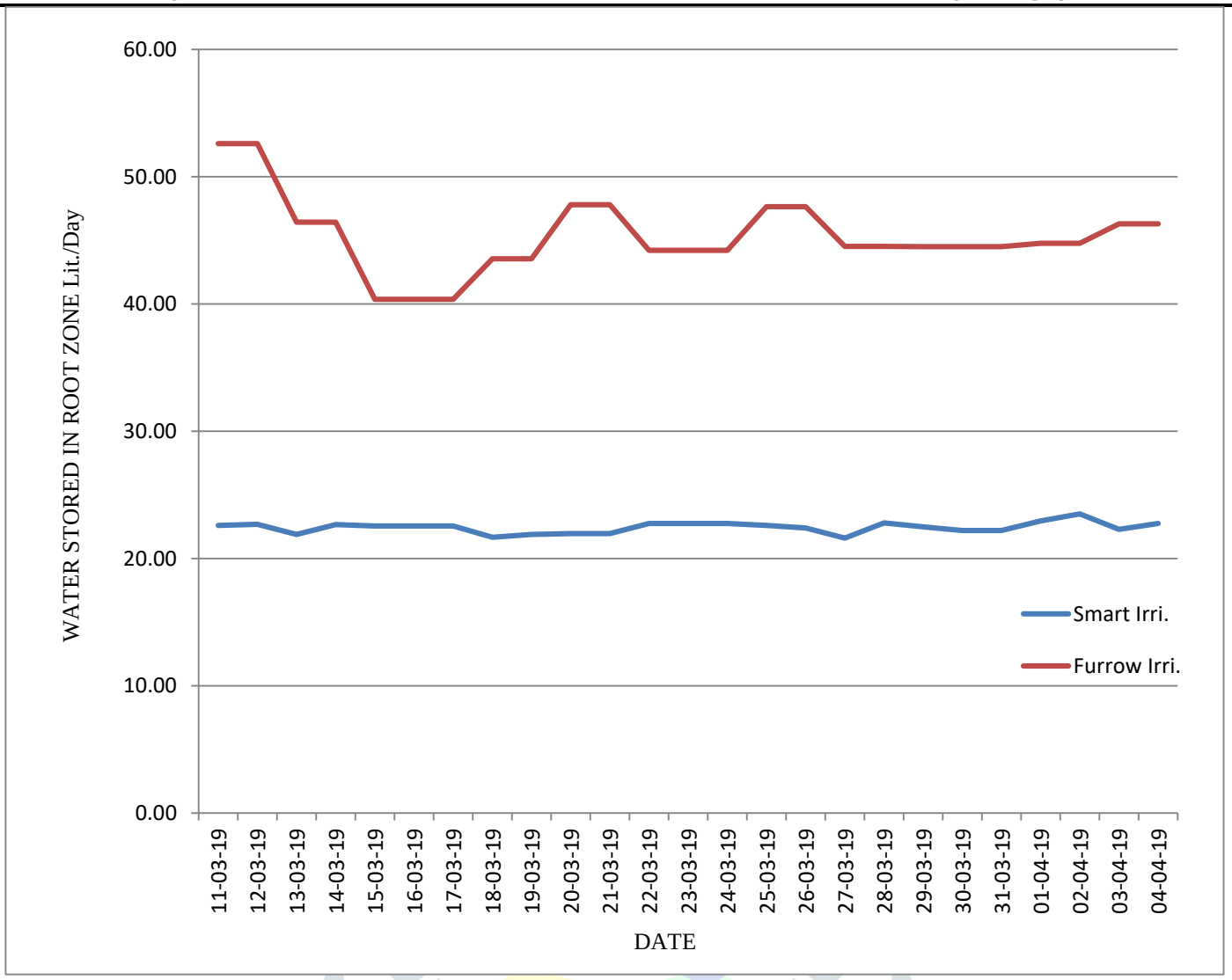

Chart 2
(Water Stored in root zone Comparison Chart)

IX.EFFICIENCY

1. CONVENTIONAL IRRIGATION SYSTEM

The averagely **61.13 liter/day** water give to plants and out of this **45.38 liter** water stored in plant root zoon so averagely **15.75 liter** water waste per day. Average conveyance efficiency of this system is **80.92%** and average value of application efficiency is **91.59%** so the Scheme irrigation efficiency of this system is

- η = (80.92 x 91.59)/100 = **74.11%**
- ηc = 80.92%
- ηa = 91.59%

2. SMART MICRO IRRIGATION SYSTEM

In the smart irrigation system averagely **29.53 liter/day** water gives to plants it's half than the furrow irrigation system. Average conveyance efficiency of this system is **91.09%** and average value of application efficiency is **100%** so the Scheme irrigation efficiency of this system is

- η = (91.09 x 100)/100 = **91.09%**
- ηc = 91.09%
- ηa = 100%

X.COST ANALYSIS

Initial cost of a smart micro irrigation system is more but it's cheaper in longer run. Farmer's presence on the field is not required so they can give time to other occupation. In the arid or semiarid region where the hardly water are available. This system is more suitable in this area and farmer can save the amount of water and they can used it in different season, so the wealth of the farmer is increased.

COMPONENT	COST Rs.	QUANTITY	TOTAL COST
SOIL MOISTURE SENSOR	250.00	1	250.00
MICROCONTROLLER	750.00	1	750.00
RELAY BOARD 8 CHANNEL	500.00	1	500.00
WIRELESS NETWORK DEVICE	1300.00	1	1300.00
SOLENOID VALVS BRASS	950.00	1	950.00
ADAPTOR AND POWER SUPPLYER	500.00	1	500.00

Table 1 (Cost analysis)

This table is give idea about the approximation value of the hardware which is used in smart irrigation system, so the total initial cost is about Rs.25000 to 30000. By reducing the valves and sensors cost will be decrease.

XI.FUTURE SCOPE

- The developed system can also transfer fertilizer and the other agricultural chemicals (calcium, sodium, ammonium, zinc).
- Webcam can also installed with devise for photo capture which can you field related information.
- Speech base opinion system can also install for those who are unable to read.

XII.LIMITATION

- The software code is programmed; hence it must be changed for every crop with requirement.
- The solar energy is available only in the morning so, the kit must also have an alternative battery for operation

XIII.AKNOWLAGEMENT

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XIV.CONCLUSION

In this paper a model for programmed controlling a water system framework is presented. Here models incorporates sensor hub and control hub. The sensor hub is conveyed in water system field for detecting soil dampness esteem and the detected information is sent to controller hub. On accepting sensor esteem the controller hub checks it with required soil dampness esteem. At the point when soil dampness in water system field isn't up to the required dimension then the engine is changed on to inundate related agribusiness field and ready message is send to enlisted cell phone. The test results demonstrate that the model is able for programmed controlling the exploratory outcomes demonstrate that the model is able for programmed controlling of water system engine dependent on the criticism of soil dampness sensor. This framework is utilized in a remote zone and there are different advantages for the ranchers. By utilizing the programmed water system framework it upgrades the utilization of water by decreasing wastage and lessens the human intercession for ranchers. It spares vitality likewise as it programmed controlling the framework. So there are the framework is OFF when the field is wet and consequently begin when the field id dry. It is executed in all kind of water system framework (channel, sprinkler, and trickle). What's more, we present additionally less number of sensor hubs to use in an extensive zone of field so the expense of the framework likewise decline. Furthermore, control utilization of the remote system gadgets are likewise less and the framework play out quite a while work. Following are the point to be concluded out of this study.

- This system reduces farmer's workload and increases the crop productivity.
- This system is save the water, energy and manpower.
- Uniform distribution of water into the field.
- Authorization is done so that only valid person can operate on this system.
- The time consumed is less there by giving more throughputs.

- Saving the fertilizer and controls the growth of weeds.
- By using this type of a system erosion of soil could be stopped totally.
- It does reduce the significant amount due to consumption of water and electricity.

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