# IoT: Smart Agriculture System Using Thing Speak

**Bhagyashree Anil Tapakire.[1], Dr. Manasi M. Patil[2]**
[1] Dept of Electronics department
[2]Professor, Dept of Electronics department
[1, 2] Walchand College of engineering, Sangli, India

***Abstract-*** *As we have known, irrigation in the agriculture field can be used to assist in the growth of crops, maintenance of landscapes, re-vegetation of distributed soils in dry areas and during periods of inadequate rainfall, etc. Traditional irrigation approaches may supply a controlled amount of water to the plants at regular intervals. Irrigation and other plant watering system are typically push-based systems, which based on one or more factors that push the water towards the plants to be irrigated. These systems are not always effective or efficient and can lead to insufficient water or surplus water in the soil around the plants which may lead to plant damage and/or water wastage. Wasting of water whether by a manual or automatic watering approach can lead to flooding of a region of soil and damage to the soil as well as to the plants. To avoid this scenario we proposed our IoT :Smart Agriculture System Using ThingSpeak to provide the controlled amount of water to plants by not only controlling the ON/OFF action of a motor but also OPEN/CLOSE action of a solenoid valve.*

***Keywords***- Agricultural system, Internet of Things, Telegram, ThingSpeak,

## I. INTRODUCTION

Water is an essential element for survival. About seventy percent of the human body consists of water; plant contains almost 90 percent of water. Still, we have to depend on some outside source to fulfill the water requirements of our body. Similarly, also crops require water for their growth, synthesis of food through photosynthesis only in the presence of water in their system and development. Water helps to maintain the turgidity of cell walls. Irrigation is one type of application in agriculture that allows controlled amounts of water to plants at needed intervals. Irrigation helps to grow crops in farms, maintain landscapes in the field, and revegetate disturbed soils in dry areas and during periods of less than average rainfall.

Farmers in India usually work on large portions of farmland to grow different types of crops. It is not always possible for one person to be able to keep track of the entire farmland all the time. Sometimes a given patch of land can receive more water leading to water logging or it might receive for less or no water at all leading to dry soil. In either of these cases, the crops can get damaged due to over/under irrigation, and a farmer may suffer losses. So to solve this scenario, we propose an "IoT: Smart Agriculture System using ThingSpeak". This is a very useful system wherein, the user can monitor and control the supply of water to the plant from a remote location.

## II. LITERATURE REVIEW

The era of cognitive IoT and its application in real scenarios are trending technologies. It is powered by several smart, wireless, and sensing technologies. The design of combining the internet of things, cloud computing, big data analytics, and modern agriculture is proposed in paper [12]. In addition to that, a hybrid data storage scheme based on NoSQL database DynamoDB, relational database oracle, and file object storage Amazon S3 is designed for monitoring the agriculture scenario.

The paper[1][11] present a survey on recent studies related to crucial water management issues in agriculture. They address a diversity of topics regarding water usage in agriculture including water pollution, irrigation reuse, and leaks in pipelines and livestock drinking water. They build all these challenges using the WSN network, IoT technology, and cloud computing. Innovative younger people adapting farming as a profession, agriculture as a means for independence from fossil fuels, tracking the crop growth, safety and nutrition labeling, partnerships between growers, suppliers and retailers, and buyers. The paper [2] considered all these aspects and highlighted the role of various technologies especially IoT to make the agriculture smarter and more efficient to meet.

The paper[3] investigated an optimal T-s fuzzy model of an irrigation station by using an intelligent Takagi-sugena model (itaSuM). They developed an optimal control law by using fuzzy logic control (FLC) based on dynamic models of the irrigation station. Process obtained by itaSuM. The FLC control technique was compared with the classical PI control strategy to prove the robustness and the effectiveness of the proposed control technique.

The paper [4] demonstrates real-time control of the irrigation. The double drip line system developed for this study. In a location where soil and management zones can be defined by clustering the irrigation control cell to reflect the new management zone. The management zones can be changed dynamically during the growing season by just logically clustering irrigation control cells differently without changing physical infrastructure. This proof of concept experiment carried out in a vineyard demonstrates the advantage of automated and customized irrigation for control zones of as little as 40 vines that can result in a 26% improvement in yield and an average 16% increase in water use efficiency.

Moisture content in soil is a key environmental variable important to e.g. farmers, metrologists, and disaster management units. A paper [5] present a one method to retrieve surface soil moisture value from the sentinel-1 satellites. The sentinel-1 satellites carry C-band Synthetic Aperture Radar(CSAR) sensor that provides the richest freely available SAR data source. The paper [6] developed a technology-assisted outlier detection and decision support system (DSS) to facilitate irrigation.

The research[7] presented a novel WSN computer system model named SOUL, which was proved that the designed SOUL sensor node is robust enough for field employees and mainly it could increase the network lifetime by using real developed hardware.

The paper [8][9] discusses cybersecurity challenges in smart farming and elaborates open research questions. They outline multi-layer smart farming agriculture illustrating different entities pertinent to real use-cases supported by edge and cloud environment.

The paper [10] present flexible IoT- ML platform and highlight its scientific contribution over related work. They used SWAMP project pilots. It is operating properly and data is being collected on this platform. The platform allows easy solution deployment involving IoT and ML components working in an application.

The paper[13] proposes agritalk, an inexpensive IoT platform for precision farming of soil cultivation. They conduct an experiment on turmeric cultivation which indicates that the turmeric quality was significantly enhanced through agritalk.

By referring all above papers it is found that no such systems are existed with all integrated features but proposed system includes these all features such as displaying temperature, humidity, and soil moisture values on thingspeak channel as well as on telegram application and also automatic switching on and off of motor as well as valve movement by considering soil moisture values.

## III. EXISTING SYSTEM

Nowadays, water storage is one of the biggest problems in the world. Many different methods are developed for the conservation of water. We need water in each field. Water was considered to be a basic need of all living creatures. Agriculture is one of the fields where water was required in a massive quantity. The major problem in agriculture is every time the excess of water is given to the field. Many techniques were used to save or to control wastage of water from agriculture like ditch irrigation, terraced irrigation, sprinkler system, rotary system. The existing system does not make the efficient use of water is not fed to the plant whenever there is a need it leads to water scarcity.

## IV. PROBLEM STATEMENT

On the farm, there are some places where land surfaces are uniform due to natural effects and/or manmade effects. Due to this irrigation was not performed well properly. There was the possibility of mis-storage of water in some places on the farm which will degrade the crop productivity. In such cases, we see some plant growth was good in some places and some plant growth was degrading in some places due to the long storage of water at the plant's root. So to reduce this possibility, we propose the system which not only controls the motor but also controls the valve of the pipe. So that we can achieve a uniform supply of water to non-uniform land of the farm.

## V. PROPOSED SYSTEM

We proposed a smart irrigation monitoring and controlling system using raspberry as the main controlling system. The main focus area will be parameters such as temperature, humidity in the environment, and soil moisture. This system will be a substitute for the classical farming method. We will develop such a system that will help a farmer to know his field status in his home or he may be residing in any part of the world using ThingViewFree application as well as on Telegram application which is already available in the app store. It proposes an automatic irrigation system for the agricultural lands. Currently, automation is one of the important roles in human life. It not only provides comfort but also reduces energy, efficiency, and time-saving. Now the industries are using automation and control mechanism which is high in cost and not suitable for use in a farm field. So here

it also designs a smart irrigation technology at a low cost which is usable by Indian farmers. a raspberry pi is the main heart of the whole system. An automated irrigation system was developed to optimize water use for crops. Automation allows us to control appliances automatically. The objectives of this paper were to control not only water motor automatically but also control valve movement and we can also watch live streaming of farm on android mobiles in THingViewFree application as well as on Telegram application.

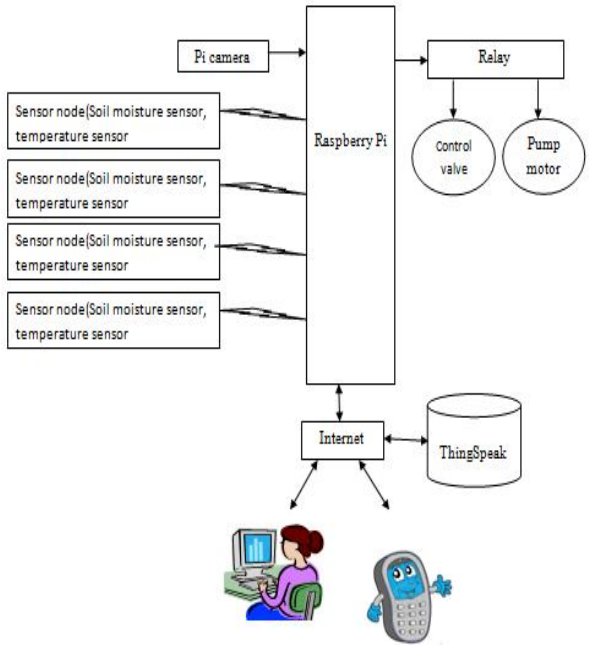
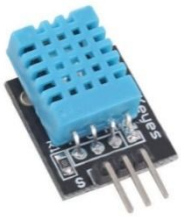


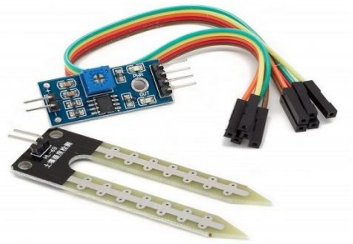

Fig.5. Block diagram of proposed system.

1. Sensor Information–

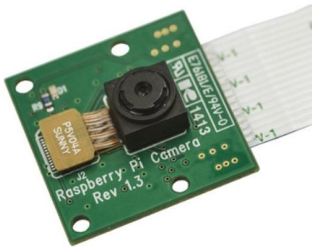
(a) DHT11 –DHT11is basic ultra-low cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin. You can get new data from DHT11 once every 2 seconds.



(b) Soil Moisture Sensor –This is an electrical resistance sensor. The sensor is made up of two electrodes. This soil moisture sensor reads the moisture content in the soil around it. A current was passed across the electrical through the soil and the resistance to the current in the soil determining the soil moisture. This module includes a potentiometer that will fix the threshold value, & the value can be evaluated by the comparator-LM393. The LED on the module will turn on/off based on the threshold value.



(c) Raspberrypi Camera Module V1.3 –The Raspberry Pi Camera Board plugs directly into the CSI connector which is already available on the Raspberry Pi board. It can deliver a crystal clear 5MP resolution image or 1080p HD video recording at 30fps.




2. Module information

(a) Raspberrypi3B –The Raspberry Pi is a small pocket-size computer used to do small computing and networking operations. It is the main element in the field of the internet of things.

This module provides access to the internet and hence the connection of an automation system with a remote location controlling device becomes possible. Raspberry Pi is available in various versions. Here, model Pi 3 model B is used and it has Broadcom BCM2837 64Bit ARMv7 Quad Core Processor powered Single Board Computer running at 1250MHz and RAM of 1GB. it also has 40 GPIO pins, Full

HDMI port, 4 USB ports, Ethernet port, 3.5mm audio jack, video Camera interface (CSI), the Display interface (DSI), and Micro SD card slot.

3. Controlling Component

(a) Relay Module: A relay is an electrically operated switch. This relay module works on the principle of an electromagnetic attraction. It energies the electromagnetic field which produces the temporary magnetic field. This magnetic field moves the relay armature for opening and closing the connections. Relays are used in the field where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal.

(b) Water pump motor – This component lifts the water from the water tank which is DC 3v to 6v submersible pump. This DC 5V water pump can take up to 120 liters per hour with a very low current consumption of 220mA

(c) Solenoid valve –A solenoid valve is an electromechanically operated valve that is controlled by an electric current through a solenoid present in the valve. It is commonly used to control the flow of liquid or gas. There are various types of solenoid valves present in the market, but the main variants are either pilot operated or direct-acting. Here we used direct operated solenoid valves directly open or close the main valve orifice which is the only flow path in the valve. They are used to replace the manual valve or for remote control. Solenoid valve consists of a coil, plunger, and sleeve assembly. In normally closed valves, plunger returns spring holds a plunger against an orifice and prevent flow.

4. User Interface

(a) ThingSpeak - thingSpeak is an open IoT platform for monitoring your data online. In ThingSpeak channel, you can get the data as private or public according to your choice. ThingSpeak takes minimum of 15 sec to update your reading. It's a great and very easy to use platform for building IoT project.

(b) Telegram - Telegram is massaging app like whatsapp, but telegram can create the bots. It has an API bot that not only allows the human to talk to it, but also machine. Telegram has a botfather that will help us create a bot. bot is nothing but one small chat box through which telegram allows the communication the communication between user and raspberryPi.

## VI. SYSTEM ARCHITECTURE

A smart microcontroller which is raspberry Pilies at the heart of the automated irrigation infrastructure.

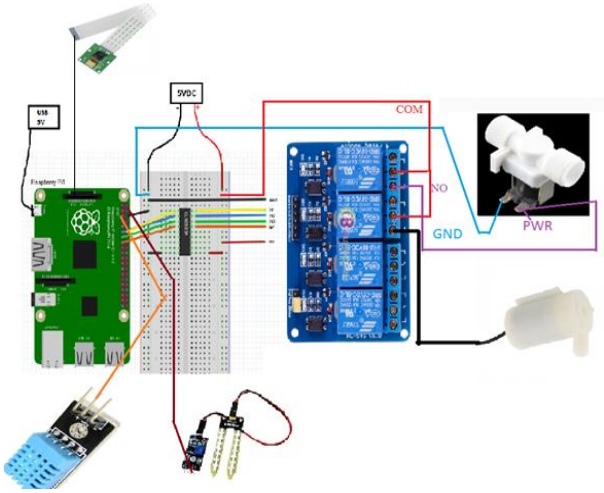



Fig.6. – system architecture of proposed system

Sensor node comprises soil moisture sensor and temperature sensor, which are placed on the field, send real-time data to the microcontroller. Generally, a moisture/temperature range which is already specified in datasheet of module, and whenever the actual values are out of this range, the microcontroller automatically turnON the water pump, which is mounted on at output pins. The microcontroller also has solenoid valve attached to it to make sure that the pipes are actually watering the fields uniformly so that no area gets clogged or is left too dry. The entire system can be monitored by the end-user through a ThingSpeak and Telegram application. Smart irrigation system makes it possible for farmers to monitor and irrigate their fields remotely, without any hassles.

## VII. FLOWCHART

Iot based smart agriculture system using ThingSpeak which is capable of automating the irrigation process by analyzing the moisture of soil and the climate condition that is temperature and humidity. Also the data of sensors will be displayed in graphical form on Thingspeak cloud page as well as in text format in telegram application.When power supply is on then microcontroller checks the soil moisture content, temperature and humidity. If the moisture content is not up to the threshold level then it makes the motor to get on automatically and turns off automatically if reaches the threshold level and according valve movement on the pipe When the weather condition is such that it is raining then the microcontroller puts off the motor till then raining. After the raining it checks for threshold value set in system and makes

the necessary action. All the data from the sensors and water is graphically shown in the thingspeakiot cloudpage which is used for monitoring. We can see the sensor data on telegram application in text form on the android mobile phone. Advantages of these system, it is a cost effective irrigation controller, increase efficiency and decrease wastage, easy to monitor, reduces man cost, reduced runoff water and nutrients.

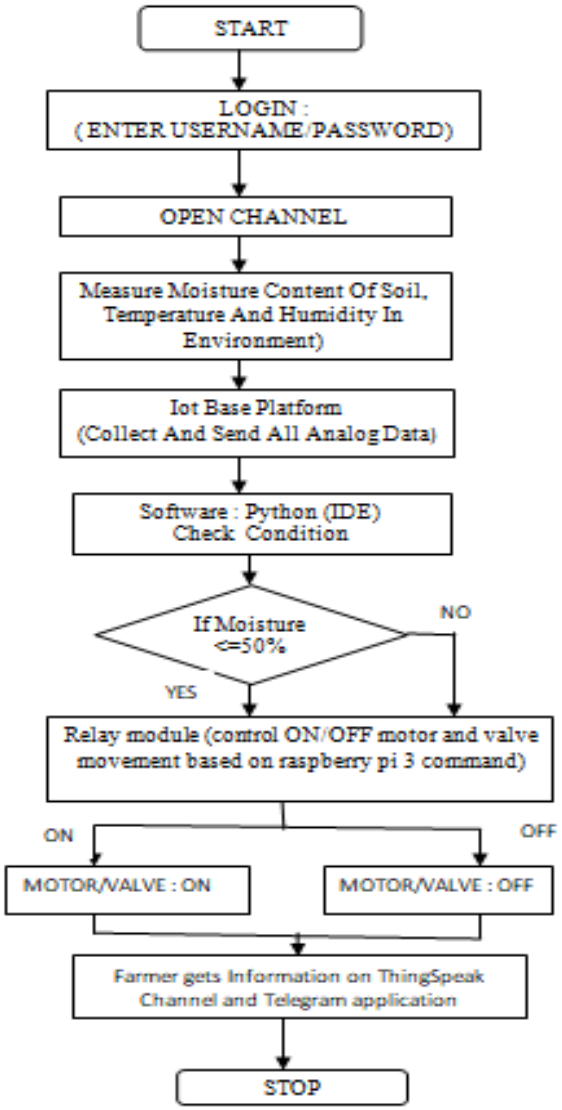



Fig.7. Flowchart of proposed system.

## VIII. RESULTS AND DISCUSSION

We can develope the proposed system according to system architecture diagram. Soil moisture sensor connected with raspberryPi wasdipped in soil and we get resultant valve on ThingSpeak channel as you in fig. we can also see temperature data and humidity data on ThingSpeak channel using DHT11 attached to raspberrypi as you can see in fig

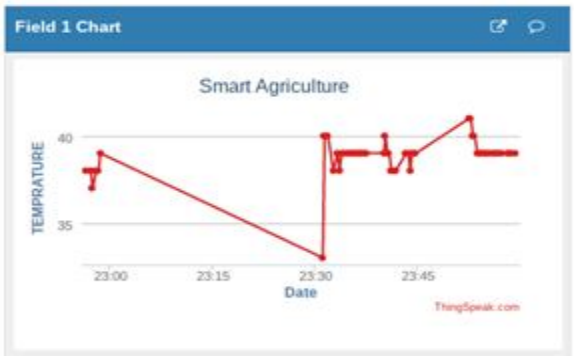



Fig.8.1Temperature data on ThingSpeak channel


Fig.8.2. Humidity data on ThingSpeak channel

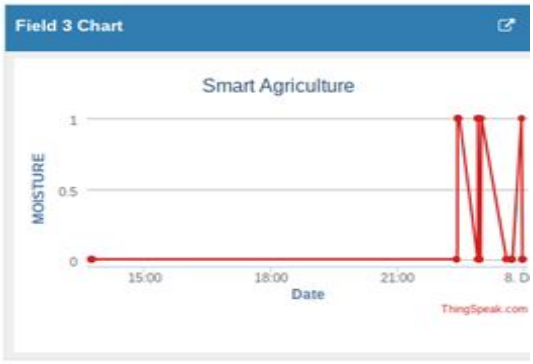



Fig.8.3Soil Moisture data on ThingSpeak Channel

Telegram is one type of massaging app which is used here in this proposed project so that farmer get sensor data in text format. We get temperature, humidity, soil moisture and real scene in farm on telegram application which is shown in fig.

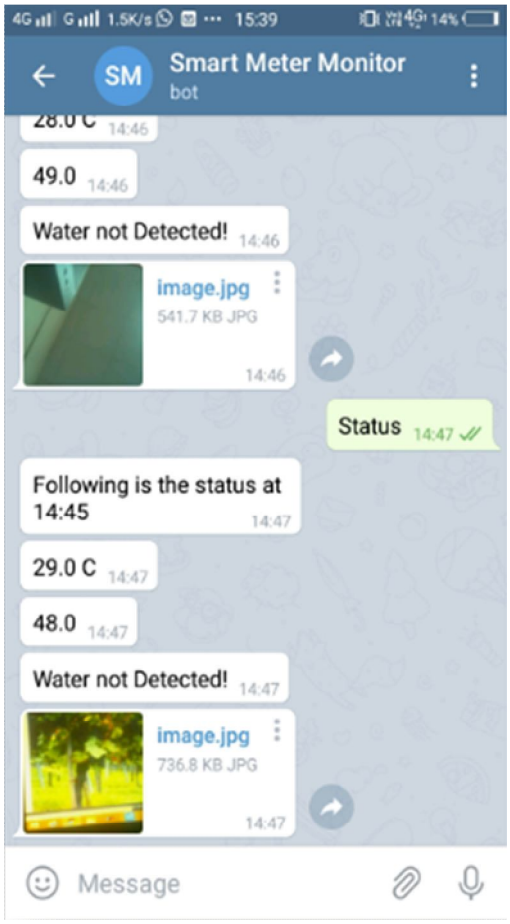



Fig.8.4. sensor results on Telegram Application

Farmer gets all this real time data on their mobile phone and monitor their field data from remote location. According to the sensor data, microcontroller turn ON/OFF of the motor and accordingly valve movement. So that plant gets uniform and controlled amount of water in farm.

## IX. CONCLUSION

Plant growth becomes increased using this proposed system. Farmer and remote owner of the farm get the real time field data from remote location in their mobile phone using ThingViewFree app and telegram application. As we can also control the valve placed between pipe so that plant gets uniform amount of water and which also make nutrient level soil in appropriate level. So with this proposed system, crop productivity increased which increases the yearly farmer earning. This system helps in farmer work.

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**AUTHORS PROFILE**

Miss. Bhagyashree Anil Tapkire is student of walchand college of engineering, sangli.she did her graduation from PVPIT, Budhgoan in electronics department. Her area of specializationis embedded system and VLSI system.

Dr. Manasi M. Patil is Professor in electronics department of walchand college of engineering, sangli. She did her graduation in industrial electronics. Post-graduation and Doctorate in electronics from WCE, sangli. Her area of specialization is image processing and embedded system. She has published around 30 papers in international journals and conference. She has guided numerous students for graduation and Post-graduation. She is member of IEEE. She is life member of ISTE.