A Study Of Several IOT Enabled Strategies Utilised In Irrigation Systems

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Abstract

India is the second most populated country in the world after China, and agriculture is a significant sector there. Today, a large portion of life in the 21st century, where we currently live, is automated. Thanks to automation, we can control and automate appliances nowadays. It not only provides comfort but also time, energy, and resource savings. The farmer's major responsibility is field irrigation. Irrigation is one of the more labour-intensive traditional practises in the agriculture sector. In this paper, a variety of innovative techniques for Internet of Things-enabled smart irrigation systems in agriculture were covered (IoT). IoT has reduced the need for human involvement by utilising sensors and web services, making the agriculture sector easier for farmers and creating systems that are user-friendly. It is important and necessary to civilization because it produces yields and uses resources efficiently. We have covered many components of the contemporary irrigation system in this study, as well as the issues, challenges, and potential future of the intelligent irrigation system.

Keywords:

Internet of Things (IoT) - Smart Irrigation – Water Management - Agriculture - Sensors – Arduino UNO

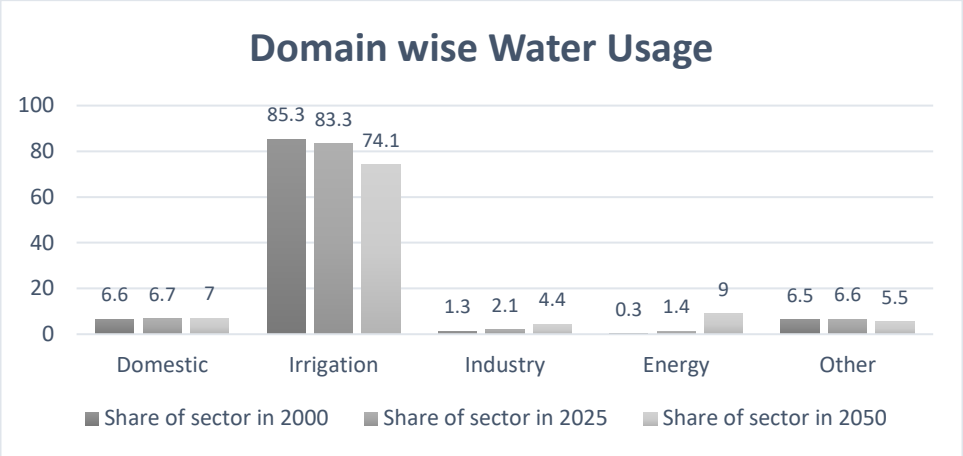
1. Introduction

A worldwide growing technology is the Internet of Things (IoT). The IoT is crucial to the development of the twenty-first century. Any network of online devices that can connect to one another and share data is referred to as the Internet of Things (IoT). The use of IoT in a variety of domains has various benefits. Due to the rising demand for food, the agriculture sector increasingly relies on novel concepts.

The goal of this research is to put into practise and demonstrate the benefits and difficulties of using IoT for irrigation management in agriculture. In all countries, agriculture contributes significantly to the GDP. It has a significant economic impact on India as well. 15% of the world's water resources are supported by India.

Now India is the first-largest populated nation, hence to match the population's pace of food consumption, agricultural production must be increased. A significant portion of the country's GDP comes from agriculture. It has been noted that agriculture provides work for 70% of the population in India. Agriculture depends heavily on irrigation. Only 35% of India's farmland is irrigated, according to World Bank data, leaving the other 65% completely dependent on rainfall.

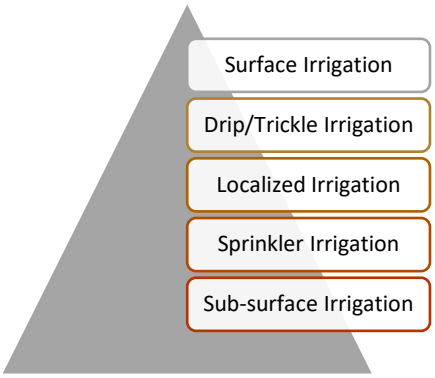
In India, fresh water represents 86% of the total water used for irrigation. The consumption of fresh water will become a severe problem if that percentage keeps increasing. It is important to implement some measures to ensure that just the bare minimum of water is used to meet requirements in order to protect water resources for future generations and for proper water resource usage. To stop the waste of water resources, there should be some techniques that must be put into practise.



[Figure 1: Water Utilization in different sectors in India. (2000 – 2050) [54]]

2. Existing Methods :

Since ancient times, various irrigation techniques have been employed, including:



[Figure 2: Irrigation Methods]

2.1 Surface Irrigation:

The method through which water is applied to the land is surface irrigation. For countless years, this technique has remained the same. It is among the first techniques. Flood irrigation is another name for it since the uncontrolled water flow wastes water.

2.2 Drip/Trickle Irrigation:

The mechanism enables water to trickle gradually to plant roots. Water is distributed by it via a pipe, tubing, etc.

2.3 Localized Irrigation:

To move water through soil, a piped network is used. These plants efficiently obtain water by employing them.

2.4 Sprinkler Irrigation:

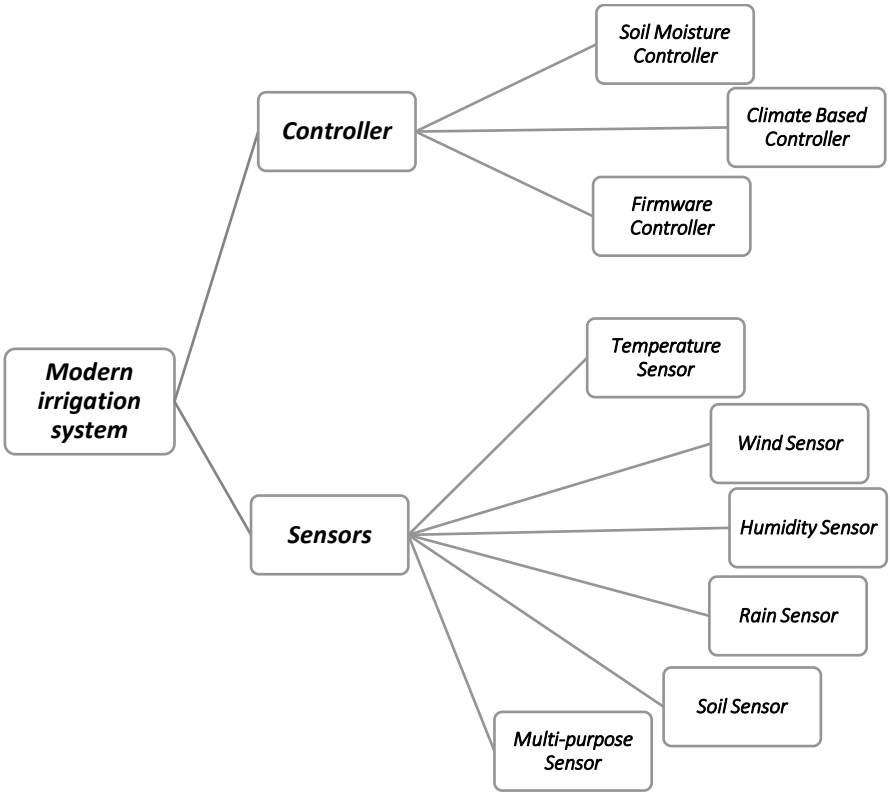
In this system water will spread with the help of sprinklers or guns from moving platform where it sprinkled as it moves.

2.5 Sub-surface Irrigation:

In this arrangement, the water table is raised around the perimeter to disperse water over the land. Pumping stations, canals, gates, and other structures are some of the ways used to raise the water table.

The aforementioned methods are ineffective because they waste water and put the soil at risk for fungal growth, which can spread illness. The integration of information and communication technologies (ICT) and the Internet of Things (IoT) with conventional irrigation techniques can also be advantageous for the irrigation system. In recent years, IoT-based automation systems have grown in popularity and effectiveness [2]. When automation and irrigation are combined, water will be used effectively and efficiently, significantly decreasing waste. Most of the challenges in agriculture are being combated by farmers with the aid of IoT. With the ultimate goal of mechanising the agricultural industry, many models have been developed. We are all aware of how difficult it is to correctly manage plant water without overwatering, not just for farmers but for everyone. Effective water management is essential due to the limited availability of freshwater resources. Also, since farmers cannot spend all of their time in the fields, they may lack the expertise to use various devices to determine the perfect environmental conditions for their crops. IoT offers an automated system that may operate without human supervision and can assist users in making the best decisions possible regarding the many difficulties they face in farming.

The irrigation monitoring and controlling system in the Internet of Things (IoT) is a network of smart devices like sensors (such as soil moisture sensors, temperature sensors, humidity sensors, and others), motors, controllers, and appliances that are connected to one another through the Internet and are capable of operating in perfect unison with one another. Sent to a processing unit that may be located locally or in the cloud, information gathered from sensors and other devices is processed there before being automatically used to carry out the necessary action.



[Figure 3: Several types of Sensors and Controls used in Smart Irrigation System]

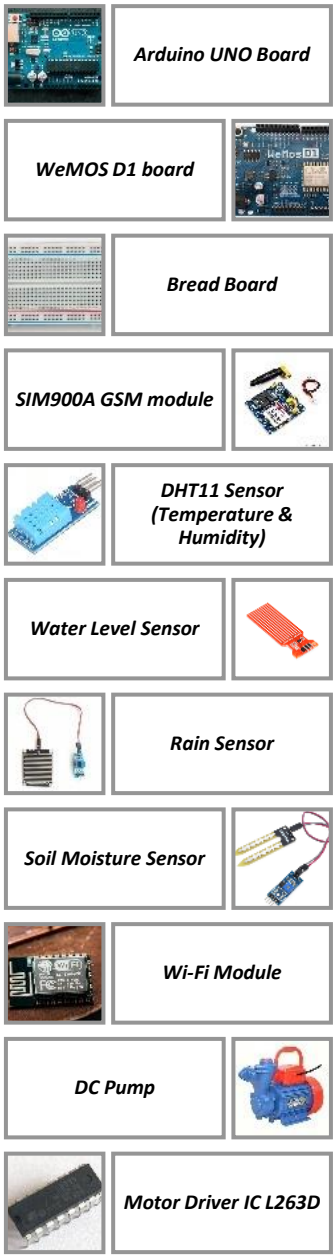
In this study, a sensor-based irrigation system application using wireless sensor networks and renewable energy is made. By using a soil moisture sensor to detect the amount of moisture in an agricultural field without the direct involvement of a human, this smart

irrigation system aims to build a fully automated irrigation mechanism that turns on and off the motor at the appropriate times. [3]

2.1 Advantages of IoT based irrigation

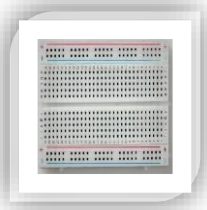
- This method requires less physical labour and human meddling.
- It supplies water with great accuracy and prevents water waste.
- It uses sensors to measure the moisture content of the soil.
- Using sensors to monitor and control temperature, humidity, and sun radiation.
- This method improves soil quality and aids in producing crops of superior quality.

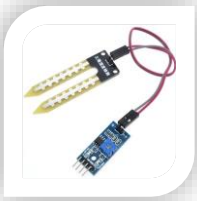
In IoT-based irrigation, a few of the key components are:



[Figure 4: Major components are used in IoT based irrigation]

[Table – 1 Major IOT Key Components Used in Irrigation System]

Sr No	Product Name	Product View	Description
1	**Arduino UNO Board**		A crucial part of the irrigation system is played by Arduino. It transforms inputs from algorithms into digital outputs. The GSM Module received that output. Many operating systems employ affordable Arduino devices. It is simple and adaptable for beginners.
2	**Bread Board**		Individual bob wires are connected by inserting their "end connectors" into the opening provided in a breadboard, the header connector of a circuit board, or a small portion of test equipment. The Thingspeak cloud was used to showcase the suggested technology.
3	**Raspberry PI 3**		The Arm processor is the heart of the Raspberry PI 3 desktop computer. With Bluetooth and Wi-Fi as an added feature, the Raspberry PI 3 will cost the same as its predecessor.
4	**DHT11 Sensor (Temperature & Humidity)**		The DTH-11 sensor is a well-liked sensor for gauging temperature and humidity. The DTH-11 sensor has an IC on the back, a temperature sensor, and a moisture sensing sensor.
5	**Water Level Sensor**		The height of liquid or water is determined using a water level sensor. The sensor turns the observed data into an electric signal after detecting the liquid level.

6	**Rain Sensor**		A specific kind of gadget called a rain sensor is used to track down rain and sound an alarm. The major function of this sensor, which operates similarly to a switch, is to automatically close the switch whenever it rains.
7	**Soil Moisture Sensor**		A soil moisture sensor is used to calculate the soil's moisture content. This moisture level sensor's response depends on the resistance. A low resistance value denotes a high moisture content in the soil. The dryness of the soil will be obvious when resistance is considerable.
8	**Wi-Fi Module**		The 32-bit microcontroller and full TCP/IP stack of the ESP8266 enable microcontrollers to connect to Wi-Fi networks at a low cost and with the least amount of power possible.
9	**Motor Driver IC L293D**		Two DC motors can be operated simultaneously in both directions by a 6-pin motor driver IC. DC motors cannot operate directly without a Motor driver IC. L293D is therefore essential in helping the motor run.

3. Literature Reviews:

Sukanya Desikan, Sheena Mohan, T. Sangavi, S. Darshna, and A. Soundharya (2015) In Smart Irrigation, they offered for both the moisture and temperature sensors, Arduino specifies a predetermined range of resistance values in digital format (from 0 to 1023). Any deviation from the predetermined range triggers the pump's on/off and watering of the plants. system demonstrates to be efficient and effective in saving water and minimising its waste [4].

Pramitee Behera and Chandan Kumar Sahu (2015) They provided a prototype for a fully automated irrigation motor access in their study. The prototype contains many sensor nodes dispersed over the farmland. Data from each sensor is sent to the "ATMEGA-328" microcontroller, which is on an "ARDUINO-UNO" development board, utilising an internal wireless networking device. Through the internet, a microcontroller may be reached using the RASPBERRY-Pi. They were given a selection of soil moisture sensors that are used in different agricultural field applications for testing. Sensor nodes measure the soil moisture in each field direction, and the measured information is sent wirelessly to microcontroller nodes. After comparing the sensor data to the required soil moisture value, the controller node receiving it. When the soil moisture in a particular field drops below the predetermined level, the Raspberry Pi analyses all the data and activates the motor to irrigate the associated field

by sending a notice SMS to the registered mobile phone. The RASPBERRY-Pi employs a screen to display the current state of the irrigation system and to change any userneeded settings [5].

Irrigation System using Wireless Sensor Network and Embedded Linux Board was proposed by Pandurang H. Tarange, Rajan G. Mevekari, and Prashant A. Shinde in a paper published in 2015; it uses the ZigBee protocol to communicate with all of the scattered sensor nodes installed in the farm and serves as a coordinated node in the wireless sensor network. The coordinator node's primary goal is to wirelessly gather data such soil temperature and moisture. Each sensor node has a soil moisture and temperature sensor as well as a ZigBee RF antenna for communication with the coordination node. Once it has been collected, Raspberry Pi assesses the data that has been stored in the database. How the system functions will be determined by the algorithm developed for watering the crop. Run the board basic data web server and includes an Ethernet port. [6]

G. Merlin Suba, Y M Jagadeesh, S Karthik and E Raj Sampath (2015) proposed a paper in This device automatically adjusts irrigation and water flow based on the climate and soil moisture level. This technology is more suited for the complexity of large crops growth and lowers maintenance costs. The system is made up of a number of smaller components, including a microprocessor, moisture sensor, soil sensor, and energy collecting device [7].

Mr. Deepak Kumar Roy and Mr. Murtaza Hassan Ansari (2014) proposed a paper in which Smart Irrigation Control System are present in this method, irrigation happens when a plant needs water. It just provides the plant with the water that it requires. The cost of a smart irrigation controller is reasonable for all types of farmers, municipalities, and commercial green area authorities when compared to its features and lifespan [8].

Mohd Kassim, Ibrahim Mat, and Ahmad Nizar Harun(2014) offered a paper titled "Wireless Sensor Network in Precision Agriculture Application" in response to a theory proposed by Mohamed Rawidean. The IGMS makes use of temperature, humidity, and moisture sensors. But the IGMS can also work with additional sensors, such as pH, salinity, and NPK. The sensor data will be sent to a distant server, which will track and examine it. When the threshold value of a certain data (such as moisture) is reached, pumps, valves, and related equipment will be triggered to begin the automatic watering operation [9].

The Xiaojuan Duan (2014) proposed IOT-Based Smart Garden Project involves installing sensor nodes throughout the garden crops; each node is in charge of keeping track of local soil temperature and humidity levels. Each electromagnetic valve is connected to an irrigation controller, and each road's drip irrigation and spray time is managed by a controller at the same time by a reliable power delivery and distribution pipe network of branch pipes. Practice has shown that a garden size of 1000 square metres and a node distance of 220 metres are the ideal choices. Additionally, the system's electromagnetic valve control precision and stability are improved [10].

Ai XIAO-YAN, Xu DONG-SHENG, Zhang FENG, and Dong JIAN-GANG (2013) proposed the pump frequency regulator PID control algorithm and examined the information systems and networking fundamental framework of the automatic control system in order to achieve integrated application and demonstration of the agricultural Things agricultural park system[11].

IOT-Based Remote Control System was proposed by Qian Zhang, Yubin Zhang, and Huomei Zhu with this approach, labour costs may be significantly decreased. In the meanwhile, it allows the monitoring and management of the irrigation process accessible anytime, anywhere, especially in rural China. Additionally, this approach makes it possible to administer the farm in a dynamic manner. This system offers a higher level of stability than the Arm embedded control system and is less prone to interference from adjacent electromagnetic waves. Furthermore, it can sustain the operation throughout the entire year and has sufficient data storage space [12].

Sandip Delwadkar, Kaushal Jani, Shreyans Shah, Vishal Zaveri, and Karan Kansara presented a sensor-based automated irrigation system utilising the Internet of Things. The wireless communication interface between a programmable logic controller from a control station and the computer at a base station, as well as sensors from in-field sensor stations, were both thoroughly described in this study. By utilising commercially available sensors and controllers with serial communication ports, the Bluetooth wireless technology employed in this research provided a plug-and-play communication module and saved considerable time and money. By placing antennas 1 m above the plant canopies and using a power management circuit design, stable wireless signal communication was made possible. The creation of WISC software enabled continuous mission planning decision-making, real-time remote monitoring, and management of variable rate irrigation [13].

Nazma Tara, Khondakar Shahid Hyder and Selina Sharmin (2016) proposed a paper in which WSN (Wireless Sensor Network) is station where all sensors in the field are connected which grant the data through communication gateway. The gateway approaches the internet which used to send data to support web services on the cloud. On IOT platform data access by cloud. Soil moisture sensor will verify the volumetric content of water within the soil. Base on that it will assemble data. As per data it will mechanically turn on and off the sprinkler as per required. The main objective of this system is to provide water directly into the root zone and help to overcome water wastage. That essential Wi-Fi model to operate the system. [14]

Ammar Ahmed Khan, Aamir Zeb Shaikh2, Shabbar Naqvi and Talat Alta [2017] proposed a paper in which tiny humidity sensor is placed to check the moisture in soil. The principle to placed sensor in the middle of crop row to ensure that the crops in each row get as per 50% volume of water. And other sensor is placed at end of field to check that all crops get 100% water. There are three sensors to check water accessibility at 0%,50% and 100% of the crops in the farm. The water flow from channel toward crops and when water reached middle of crop row the sensor will detects the moisture and send data to user. The method is old which use in small farm. [15]

Shweta B. Saraf and Dhanashri H. Gawali [2017] proposed a paper in which it use WSN with Cloud Computing, ZigBee, 6LoWPAN, Arduino to make IOT base irrigation system. Data can be accessed from anywhere and anytime as per user required. By using soil moisture, air temperature, humidity and water level of tank it will help to know when start or stop watering and it will help to make crops more productive . Here the user has to run computer with wi-fi model connective for a long duration to access the data. Android application is developed for user to receive recent field information. [16]

Pratiksha Devkar , Annu Kumari , Snehal Choudhari and Hrishikesh Dhanawate [2017] proposed a paper in which technology are introduce to make optimum usage of water in this project. In this GSM technology is use to know the status of sensors in soil which detect the soil moisture and other sensor will detecting water level . It reduce human interference by using this system in which motor control by ON /OFF controller. The wed page access all the information about sensors and directly send message by sending SMS or mail to user . It is approachable from remote area by using GPRS technology. [17]

Rashmi R. Agale and D. P. Gaikwad [2017] proposed a paper in that raspberry pi board is used and ADC installed in the system. The sensors mainly use in project are moisture , humidity , Temperature , Float , PIR which detect different perimeter . All sensor work parallelly work to collect reading from land. In this system moisture sensor detect soil moisture in soil it start water supply until level of moisture satisfies as per required and are well it check level of water in tank. PIR sensor detects object and to prevent crops buzzer is use to make sound to scare crow and other object. This system provide security by monitoring the buzzer . Less manpower and reduces soil erosion but this system mainly used on small agricultural field. [18]

Dr. M. Newlin Rajkumar , S. Abinaya and Dr. V. Venkatesa Kumar[2017] proposed a paper in which Arduino board is used in system. It reduce energy, efficiency ,less time consuming and also reduce water logging and water shortage. This system is globally access .It reduce work for farmer by using wireless switching on-off of pumps for watering. The sensor which connected to Arduino are soil temperature sensor , soil pH sensor, soil moisture . The system provides water only when the humidity in the soil goes below the reference. Due to the direct transfer of water to the roots water management takes place and also helps to maintain the moisture to soil. [19]

Amogh Jayaraj Rau, Jairam Sankar, Ashok R Mohan, Deepti Das Krishna and Jimson Mathew[2017] proposed a paper in which solenoid vavle control the watering by opening or closing of vavle by reading rasp pi input. The main feature of this system is server which do processing part. When the humidity and temperature reading cross the line a single sent back to raspi which open the solenoid vavle for 10 second. It will calculate the amount of water required per plant and as per that the amount of time for valve to be open had decided. And for further web application named AutoGate access the reading from anywhere with an internet connection. The prototype considering the reading of temperature and humidity, as it was relatively easier and practical . The irrigation becomes smarter and more optimised reducing the amounts of overheads and allows efficient use of water helping in water conservation. **[20]**

R.Nandhini ,S.Poovizhi, Priyanka Jose, R.Ranjitha and Dr.S.Anila [2017] proposed a paper in which soil parameters such as pH, humidity ,moisture and temperature are measured from soil and with use of PIC microcontroller is used to made automated motor pump ON/OFF as per level of moisture in the soil. The system formed power from sunlight through photo-voltaic. This system does not required electricity and weather forecasting is not included in this system. This system collect data and store it and sends message to farmer by using GSM about soil parameters. It has gardening flexibility and completely automatic. It controls water requirements in the field. **[21]**

Yuthika Shekhar, Ekta Dagur, Sourabh Mishra , Rijo Jackson Tom and Veeramanikandan M , Suresh Sankaranarayanan [2017] proposed a paper in which system involves Arduino and Raspberry Pi3 are main board for sensor to control soil moisture and temperature sensor and sensor sent information to this microcontroller for action. The data detect moisture and temperature for different soil condition like dry, little dry ,wet , little wet and send message to Arduino for actuating the pump for watering the field accordingly. It store the data in webpage of cloud for farmer to access the system by using it. It control units holds the machine learning data and send SMS to farmer to know the condition of agriculture field. This irrigation system was found to be feasible and cost effective for optimizing water resources for agricultural production. The irrigation system requires little maintenance and may be modified to meet the needs of various different crops. [22]

Srishti Rawal [2017] proposed a paper in which it use automatic microcontroller based on rain gun irrigation system in which it provide when water is required intensely it help to save large quantity of water . Android SDK is used to operating system and access data -information . This system covered lower range agriculture land . With use of AT command this system send and receive SMS automatic on based of environmental parameters. When a sensor for soil moisture reads data from the soil and detects moisture levels, it automatically turns on sprinklers and turns them off as needed. Reduce manual labour by remotely monitoring the irrigation operation. The system helped create a smart farm. When necessary, it will turn the sprinklers on and off. [23]

V.Ramachandran and R. Ramalakshmi [2018] proposed a paper in which a smart irrigation system that uses IoT and store the information for the optimal irrigation parameters, and implement with the using solenoid valves. The irrigation system is initiated based on the soil moisture. [24]

Ban Alomar and Azmi Alazzam (2018) proposed a paper in which the design of the irrigation system and the sensors and communication media. Agriculture remains the world's biggest water consumer, with farming and food production accounting up to 70% of it. The design of the irrigation system and the sensors and communication media. The logic was used in based on the knowledge on the moisture and the temperature. [25]

Kshirod Kumar Rout and Sivkumar Mishra (2018) proposed a paper in which the prototype for the automated solar powered smart irrigation system (SSIS), comprises of ESP8266 as its master controller. In which the process starts with the moisture sensors sensing the soil, where they help to regulating the water usage of an agricultural land by periodically monitoring the soil moisture, humidity and temperature the via sensors. [26]

Sinitambirivoutin Emrick and Rekha Prabha (2018) proposed a paper in which the Irrigation was considered to be a solution to compensate the lack of a water when the rainfalls were rare and water. Irrigation and fertilization are the two major factors that play a key role in farming. This research work aims to devise an IoT based framework that helps farmers to affect the various activities such as like an irrigation or a fertilization based on the current environmental conditions in the world. [27]

J. John Paul and Namrata Sharon (2018) proposed a paper in which the system receives three parameters from the sensors and activates the actuators if the actual values are more than the threshold values and it is also stores these values in the cloud database enabling them to be accessed from anywhere or an anytime. This paper also sheds light on the automatic control over for the climatic conditions is an inside the greenhouse the prototype was using compromises so the moisture sensors and the humidity sensors. [28]

JS Sandeep Kiran and AVS Kasturi Karthik (2019) proposed a paper in which to the Renewable Energy Based Smart Irrigation system. The proposed system cannot predict the time to the harvest or implement and maintain the irrigation system. Agriculture is the major backbone of India. An automated smart irrigation system was successfully developed various sensors like soil moisture, Sensor to analyse the conditions of the soil and decide whether it should be irrigating the farm or not. [29]

Hajar M. Yasin and Subhi R. M. Zeebaree (2019) proposed a paper in which the all hardware components are connected to Arduino Mega via wires, and the Arduino platform supplied by the 5V DC adapter. The traditional automatic irrigation machine is to be modernizing the agriculture technology it means of all programming components and built to the essential issue for the irrigation system. An efficient system is proposed the designed and implement that the remotely controls and monitoring the irrigation process or a level of water in a tank. [30]

Bobby Singla and Abhishek Singh (2019) proposed a paper in which the Automatic Irrigation System on Sensing Soil Moisture Content where they only include measuring the moisture of the soil. This Automated Smart Irrigation System using IoT for found the techniques to preserve the water resources. [31]

Abu Shufian and Riadul Islam (2019) proposed a paper in which were a model is designed which switches the motor pump ON/OFF to automate the irrigation system by sensing the moisture content of the soil. Irrigation plays a very important roles in agricultural field. Irrigation scheduling has become an important issue in the agriculture as it is provided better yield and reduce water loss. Limitation of this irrigation system is that the moisture sensor cannot detect the dampness level for all the day as a long in a handy water system field. [32]

Rodrigo Togneri and Carlos Kamienski (2019) proposed a paper in which is the success of next generation systems for precision irrigation based on IoT technologies. The precision irrigation problem can be modelled as the soil water balance system at the root zone, and where the soil water content is the result of the balance between water content level and a series of mechanisms that make this level increase or decrease. The platform allows easy solution deployment involving IoT components working in an application. [33]

J. Karpagam, I. Infranta Merlin, P. Bavithra and, J. Kousalya (2020) proposed a paper in which Smart Irrigation system is developed by using the Microcontroller i.e., Arduino UNO and it plays a main role in this automated system. In this project the motor can be turned ON and OFF automatically by using relay which controls this operation. The plants get the required amount of water from the water tank or water storage that is connected to the motor. The irrigation depends upon the type of soil, crops and the atmospheric conditions. [34]

Dr. S. Velmurugan, V. Balaji, T. Manoj Bharathi and K. Saravanan (2020) proposed a paper in which they described The major objective of an automated irrigation system combining GPRS and WSN technology is to increase the utilization of water for agricultural crops. A crucial consideration when creating a smart irrigation system is the soil moisture. Many environmental factors have an impact on the soil moisture. Environmental changes are not taken into account while reading sensor data in this system. [35]

Bharath Ravi Prakash and Sanket S Kulkarni (2020) proposed a paper in which a
WeMOS D1 which has ESP8266 module built-in adds an advantage It has ESP8266EX as the microcontroller. The operating voltage is 3.3V. which consists of 12 pins with 11 digital I/O pins and 1 analog pin. It has a flash memory of 1Mbyte. Either Arduino IDE or NodeMCU can be used to program and dump the code onto the controller. The fact that it has 11 I/O pins helps to connect more hardware devices. the system was connected to two 12V DC motors. The system was able to monitor and control two fields at a time. [36]

A. Anitha, Nithya Sampath and M. Asha Jerlin (2020) proposed a paper in which an IoT based smart irrigation system utilizing ARDUINO Uno, Connecter wire, Bread Board, Laptop, sensors (DHTll Temperature and Humidity Sensor, Water level Sensor, Soil Moisture Sensor) to record the data and store it in the cloud storage. which to use a proposed algorithm with several nodes in order to examine water savings while also lowering system costs. The water level and the sand content are crucial factors in the creation of an intelligent irrigation system. [37]

Mr. Harshit Meena, Mr. Himanshu Nandanwar, Mr. Dushyant Pahl, Mrs. Anamika Chauhan (2020) proposed a paper in which the system presents an effective photovoltaic pumping system which can be used under various climatic conditions. This system is designed in such a way that it costs beneficial for poor farmers, helps in reducing the water resource, reduce manpower, saves time & efficiency will increase. The proposed model has the limitations: data in large quantities, the computation can become complex. increasing the number of sensors, the complexity of system increases, the need for the more powerful microprocessor is required. in the system. [38]

Angelin Blessy J and Anveesh kumar (2021) proposed a paper in which the recent smart irrigation techniques are based on IoT, Artificial Intelligence, Deep Learning, and machine learning. So, water optimization, reducing energy, saving money and increase the yields can be better with the help of smart irrigation system. The integration of sensors is very challenging task because the different sensors are used for different purpose. [39]

Prakash Kanade and Jai Prakash Prasad (2021) proposed a paper in which the framework offers a component for computerizing the way toward getting wild animals far from farmland and furthermore gives checking to recognize approved and approved animals and Non-approved individual. In this venture, they are basically utilizing AI related to IoT to achieve the undertaking including the exchange and appropriate correspondence of information focuses. Plant upgrade at different stages and environment conditions, might be considered to choose

the water prerequisite for the yield. This will upgrade planting, setting off the monetary progression of about our nation. [40]

R. Santhana Krishnan, E. Golden Julie, Y. Harold Robinson, S. Raja, Raghvendra Kumar, Pham Huy Thong and Le Hoang Soni (2020) proposed a paper in which the smart agriculture irrigation controlling and plant disease monitoring system has four major units: end device node, coordinator node, web server node and mobile (controlling unit). The agriculture irrigation control is one of the most significant interests in agriculture. This study mainly focused on fuzzy logic control to obtain higher level of accuracy to expertly use water for irrigation. This may embed smart farming technologies using IoT, which will facilitate both growers and farmers to minimize waste and to enrich the productivity ranging from quality of fertilizers used to the amount of harvest made. [41]

Pankaj Kumar Kashyap, Sushil Kumar, Ankita Jaiswal, Mukesh Prasad and Amir H. Gandomi (2021) proposed a paper in which an irrigation model and sensing network model are presented to elaborate the architectural view of DLiSA and basic structural design of the IoT network for irrigation. 1. Smart Irrigation Model 2. Sensing Network Model. a recurrent neural network-based intelligent irrigation system for precision agriculture has been presented for the prediction of soil moisture content. It focuses on the crucial requirements of agriculture such as the amount of water saved and irrigation period by controlling the functionality of the irrigation scheduler. The water volume estimation and irrigation timing have been validated in the test farming area as suggested by state-of-the-art models. [42]

Rafi Ullah, Arbab Waseem Abbas, Mohib Ullah, Rafi Ullah Khan, Irfan Ullah Khan, Nida Aslam and Sumayh S. Aljameel (2021) proposed a paper in which they developed for intelligent irrigation, efficient freshwater utilization in agriculture primary aim of SWAMP is to auto manage water reserves, distribution, and consumption of various levels, avoid over-irrigation and underirrigation problems, and auto manage time to maximize production. Proposed EEWMP system's performance is compared with the SWAMP model using simulation conducted in a MATLAB environment. models' performance is evaluated in energy consumption, network stability period, packet sent to destination, and packet delivery ratio. [43]

Agriculture is an important job in India. In this research, the irrigation system is automated using the Internet of Things technology. Therefore, it reduces the need for human intervention. This study will find the best crops suitable for the particular soil. From this, physical exertion is reduced and the field is watered effectively. [44]

Iraq was affected by drought as a result of the lack of rain, which led to a decrease in agricultural production. With the emergence and expansion of IoT, studies have taken a new approach to treat drought through smart agriculture. This study aims at identifying scientific research on technologies related to smart irrigation using the Internet of Things. [45]

In this research, we present a low-cost intelligent irrigation system for struggling farmers. Our developed prototype can measure water level, temperature, and humidity. We use different sensors to take different readings and decide to turn on or off the motor. We provide essential algorithm and a flowchart to explain the system. [46]

The use of modern farming inputs is somewhat underdeveloped in Sri Lanka's agriculture industry. Inputs for agriculture that are effective for farmers are urgently needed. This project will develop a prototype of a low-cost IoT based smart irrigation system. It will offer a quick, easy, and effective way to supply water to farmers' crops. [47]

Climate change and global warming have had a drastic effect on agricultural food production. This research proposes an intelligent solution to the agricultural problem by providing environmental monitoring and irrigation facilities with the help of IoT. The system offers monitoring of a greenhouse's temperature, soil moisture, and light intensity onsite and remotely. [48]

The objective of our project is to control the water supply to each plant automatically. The system has a soil-moisture sensor. Mechanism is done such that soil moisture sensor electrodes are inserted in soil. Thus, this paper describes detailed information of "Automatic Irrigation System using IoT". [49]

Agriculture is a major user of ground and surface water in the United States. Improving the efficiency of agricultural irrigation is critical for sustainable agriculture. We propose an IoT-based irrigation system, which

includes two major components: an IoT wireless network of sensing and actuation nodes, and a DRLbased control algorithm. [50]

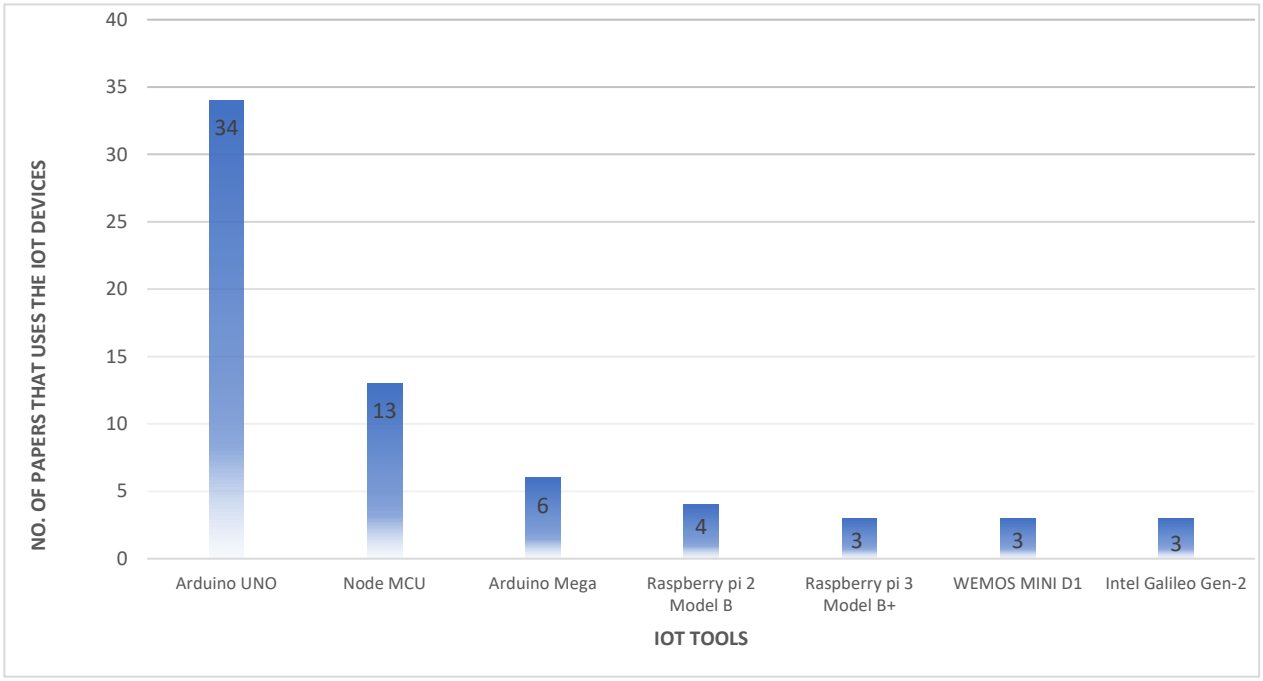
A centre pivot is a mechanized irrigation system type that irrigates crops in a circular pattern around a central pivot. Using Innovative IoT applications alongside centre pivot irrigation systems allow for increasing labour automation, better water management, and cost rationalization. It could aid farmers in making more informed decisions by giving accurate real-time data. [51]

Nigerian researchers have simulated a solar powered smart irrigation system using Blynk Mobile App. The pump is activated as long as the water reservoir is having enough water and will switch OFF when the required level of moisture in the soil is reached. It consists of two main units that is transmitter and receiver. [52]

Water is the main limiting factor of our life and any human activity, including agriculture and industry. Smart irrigation is considered one of the most common applications in smart or precision agriculture. The main components of a smart irrigation system may include soil, weather and plant sensors such as soil moisture and evapotranspiration controllers. [53]

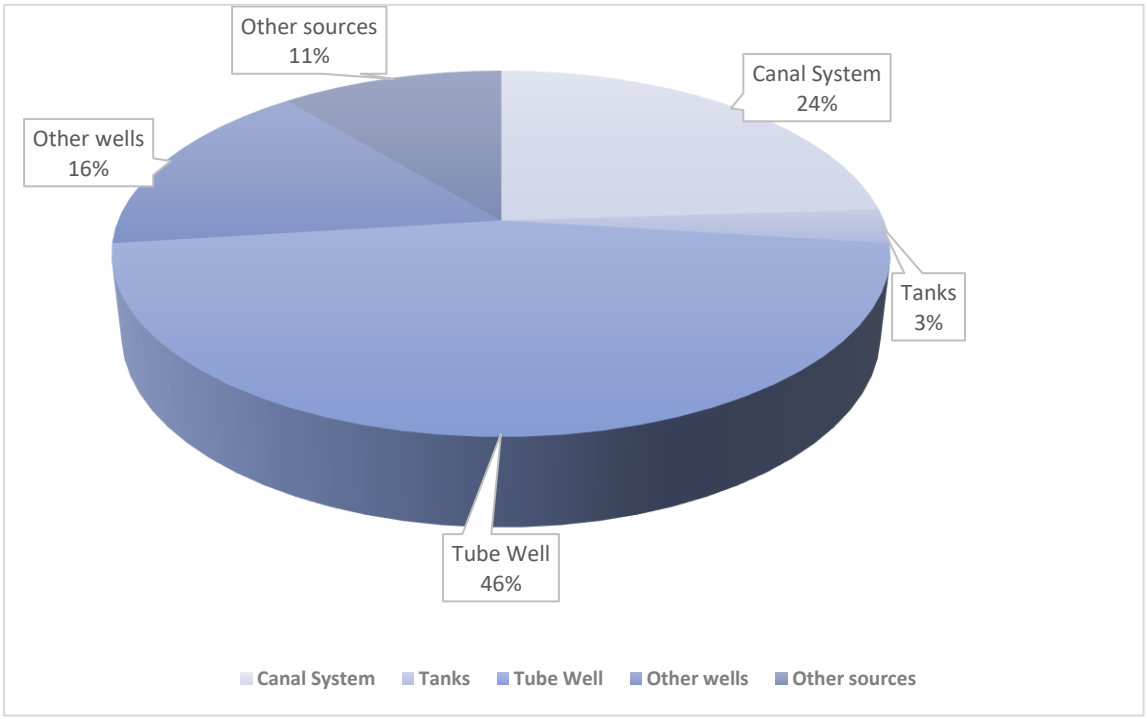
4. Data Analysis:

This graph presents the most used IoT Tools for the implementation of Smart irrigation systems. As it can be seen that Arduino boards are the most used tool for the implementation of IoT irrigation systems.



[Figure 5: Numbers of Researchers that Uses the IoT Devices in their Research. [55]]

This pie chart represents the irrigation methods are used in India.



[Figure 6: Agriculture Water Demand and Management in India. [56]]

This graph presents the number of papers per year of publication it can be seen that the interest in this topic has been increasing over the years.

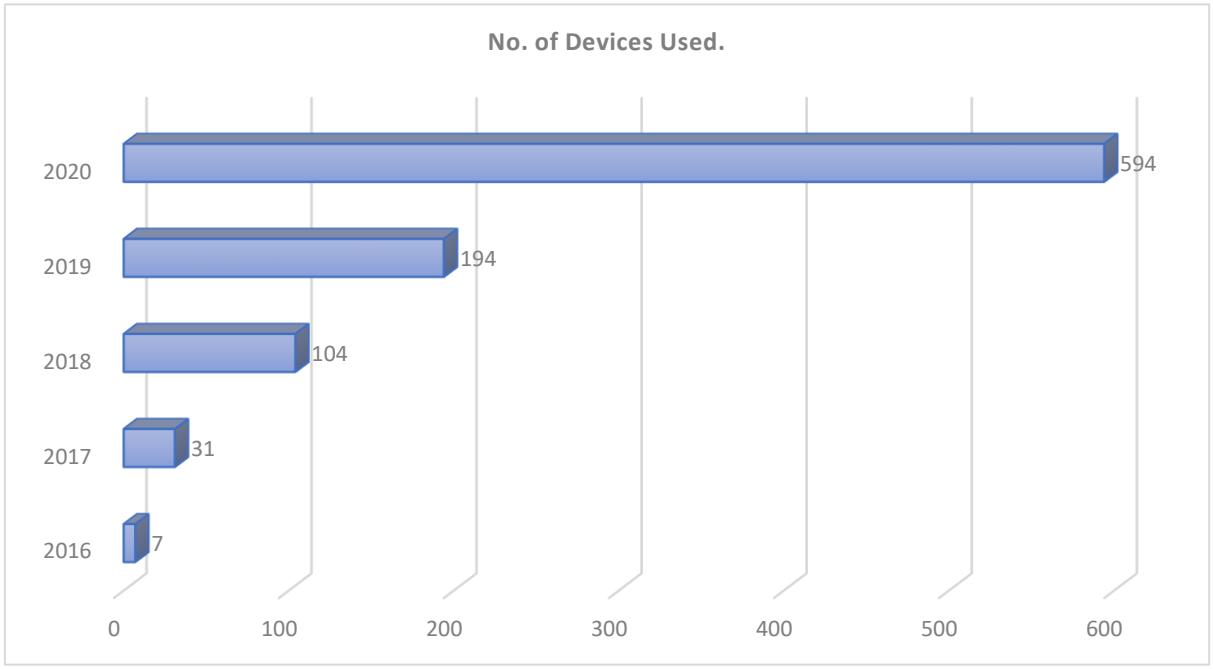


Figure 7: Year by Year the Popularity of IoT Devices for Agriculture. [57]

5. Limitation & Future Scope

- The main issue in every IoT based Automated system is security. Finally, the security and integrity of agricultural data may be secured during transmission for analysis for prediction.

- IoT based Automated Irrigation system which will help to spraying appropriate chemicals for proper growth of crop.
- In future, the system will detect water level in tank before irrigating the field.
- A light sensor can be added to detect the light present in the greenhouse and as a result give light to the crops.
- pH sensor can be added to detect soil alkalinity and, as a result, warn farmers to monitor the use of pests chemicicides.

6. Conclusion:

In this modern period where the IT industry is booming, farmers still use ancient methods of crop monitoring. When this task is automated, it will reduce the burden on farmers with a huge margin. Around the world, 86% of freshwater is used for agricultural purposes. As we know, oversupply or lack of water supply will damage the crops. and natural resources need to be supplied in a limit to the crops. the future of the world is facing different short coming in water and energy. Thus, water optimisation, energy reduction, saving money and increasing yields is an important task in the smart irrigation system. In this paper, section 3 describes various components, advantages of IoT based irrigation. The section 2 presents various types of techniques are used in smart irrigation system. The main purpose of this smart irrigation system is to make it more innovative, user-friendly, faster and more efficient than the existing system.

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