

## **2. Literature Review:**

- 2.1 Muhammad et al (2010):** A simple approach to Irrigation control problem using Artificial Neural Network Controller. The proposed system is compared with ON/OFF controller and it is shown that ON/OFF Controller based System fails miserably because of its limitations. On the other hand ANN based approach has resulted in possible implementation of better and more efficient control. These controllers do not require a prior knowledge of system and have inherent ability to adapt to the changing conditions unlike conventional methods. It is noteworthy that ANN based systems can save lot of resources(energy and water)and can provide optimized results to all type of agriculture areas.
- 2.2 Kalyan et al (2011):** The need for systems that make agriculture easier and more sustainable has increased within the past few years. The ability to conserve two of the most important resources of a farmer, water and time, has been the latest challenge. A system that provides this ability - through the use of efficient and reliable methods such as wireless sensor networking, sprinkler irrigation, GSM, SMS technologies and readily available mobile phone devices – is certain to help the farmers get a better yield and on a larger scale, help the agricultural and economic growth of the country.
- 2.3 Prisilla et al (2012) :** Water is one of nature's most important gifts to mankind, because of the increase in population food requirement for human being is also increasing. Over the past few decade usage of water for irrigation has increased hysterically. Water is polluted due to wastage and contaminants in the industries. Saving water is more important. This ultimate aim can be achieved by using the exiting ANN control system. It will provide a way to save flood water in the fields for future irrigation purpose
- 2.4 Cosmin (2012) :** This investigation demonstrates that there is an unquestionable growing tendency in the adoption of artificial intelligence in agriculture. Computerized expert systems cover a broad area of farming but their number and complexity vary considerably from country to country. Underdevelopment of the IT infrastructure in many countries is the first obstruction in using them, only around 30% of the world population currently having access to these new technologies.
- 2.5 YETHIRAJ et al (2012) :** There is a growing number of applications of data mining techniques in agriculture and a growing amount of data that are currently available from many resources. This is relatively a novel research field and it is expected to grow in the future. There is a lot of work to be done on this emerging and interesting research field. The

multidisciplinary approach of integrating computer science with agriculture will help in forecasting/managing agricultural crops effectively.

**2.6 Chetana et al (2012) :** The Automated Wireless Watering System is a user friendly system, which notifies the user about its status. The 2 modes of operations provide the user with the option of automatic and manual process. The system also provides the log file of the events carried out.

**2.7 Prathyusha et al (2012) :** The Microcontroller based drip irrigation system proves to be a real time feedback control system which monitors and controls all the activities of drip irrigation system efficiently. The present system is a model to modernize the agriculture industries at a mass scale with optimum expenditure. They can provide irrigation to larger areas of plants with less water consumption and lower pressure. Using this system, one can save manpower, water to improve production and ultimately profit.

**2.8 Priyanka et al (2012) :** involves some sensors, LCD display, GSM and ARM processor. All the sensors will give analog output but our processor will accept only the digital data. So we have to connect all the sensors to the ADC channel pins which are in-built to the processor. LCD will be on field display purpose. GSM module will contains a Subscriber Identity Module (SIM) user can communicate with this SIM-Number. When the particular command activated or given by the user, immediately the corresponding sensor will activates and reads the present reading and immediately sends results to the same user mobile and displays in the LCD panel in the field. Immediately user will take the necessary action if required. Here we are using total seven sensors to monitor the field condition. Those are Temperature, Humidity, Soil moisture, Leaf sensor, PH sensor, Level sensor, Phase sensor. All these devices are connected to the ARM processor. GSM is used for communication purpose, with the help of AT (attention)-Commands we can communicate with the components. For soil module and level sensing applications we are using motors. One motor is used to store water and another is for releasing the stored water into the soil.

**2.9 Anjum Awasthi et al, (2013):** The proposed system in this paper is designed by considering the requirement of a sugarcane crop for Indian climatic conditions. The WSN in agriculture is new technology for information acquisition and processing in sugarcane field. It is more advantageous than the traditional agriculture techniques. This work structured the precision agriculture monitoring system by wireless sensor nodes and base station to record the data of sensor nodes. This is low cost system where the recorded information is transmitted to remote location using a GSM network via a SMS. The farmer may use the received information to control the parameters. This kind of wireless detection and control improves the effectiveness

and efficiency of resources used, which leads to the improved production. The drawback of system is its dependency on the GSM network.

**2.10 Jaichandran et al (2013):** A prototype for automatic controlling and remote accessing of irrigation motor. Prototype includes sensor node, controller node and mobile phone. The sensor node is deployed in irrigation field for sensing soil moisture value and the sensed data is sent to controller node. On receiving sensor value the controller node checks it with required soil moisture value. When soil moisture in irrigation field is not up to the required level then the motor is switched on to irrigate associated agriculture field and alert message is send to registered mobile phone. Mobile phone is used for sending request SMS to get soil moisture value in irrigation field and commands can be sent as SMS to switch on/off the irrigation motor. Prototype is experimented by abstraction three pots containing soil with different moisture level as irrigation fields. The experimental results show that the prototype is capable for automatic controlling and remote accessing of irrigation motor based on the feedback of soil moisture sensor. The prototype can facilitate farmer in monitoring and controlling irrigation activity from remote location.

**2.11 Jyothipriya et al (2013) :**The GSM based Zigbee Controlled Solenoid Valve for drip irrigation system proves to be a real time feedback control system which monitors and controls all the activities of drip irrigation system efficiently Using this system, one can save manpower, water and power consumption is reduced by 20% and 30% when compared to existing.

**2.12 Ganesh et al (2013) :** objective is to detect other white fly stages and other bioagressors or plant diseases, it is simple to introduce new objects to detect or new image processing programs to extract the corresponding information. We propose an original approach for early detection of bioagressors, which It is rather simple to use and exhibits the same performance level as a classical manual approach. Moreover, it detects whiteflies three times faster and it covers three times more leaf surface. The context of our work is to automate operations in greenhouses. Our goal is rather to better spot the starting points of bioagressors attacks and to count these latter so that necessary action can be taken.

**2.13 Galande et al (2013) :**The Microcontroller based automized drip irrigation system using wireless technique proves to be a real time feedback control system which monitors and controls all the activities of drip irrigation system efficiently. The present proposal is a model to modernize the agriculture industries at a mass scale with optimum expenditure. Using this system, one cansave manpower, water to improve production and ultimately profit. The developed irrigation automation system can beproposed to be used in several commercial

agricultural productions since it is obtained in low cost and in reliable operation. This application of sensor-based site- Specific irrigation has some advantages such as preventing moisture stress of trees, diminishing of excessive water usage, ensuring of rapid growing weeds and derogating salification. If different kinds of sensors (that is, temperature, humidity, and etc.) are involved in such irrigation in future works, it can be said that an internet based remote control of irrigation automation will be possible. The developed system can also transfer fertilizer and the other agricultural chemicals (calcium, sodium, ammonium, zinc) to the field with adding new sensors and valves.

**2.14 Sanjukumar et. al. (2013)** : The Soil moisture content based irrigation system was developed and successfully implemented along with flow sensor. Salient features of the system are: Closed loop automatic irrigation system, temperature and water usage monitoring. User can easily preset the levels of the Moisture and is regularly updated about current value of all Parameters on LCD display. In future, other important soil parameters namely soil pH, soil electrical conductivity will also be incorporated in the system

**2.15 Swarup et al (2013)** : Smart sensors based monitoring system for agriculture have been used to increase the yield of plants by monitoring the environmental conditions (parameters) and thus providing the necessary information to the clients (farmers). The proposed system is mainly developed for the betterment of farmers. The use wireless sensor network over the wired one helps for deploying it in any type of environment for monitoring, making it flexible and robust. The use of FPGA element facilitates the system for re-configurability and re-programmability according to different environmental conditions.

**2.16 Manish et al (2013)** : The Automated Intelligent Wireless Drip Irrigation System Using Linear Programming provides to be a real time feedback control system which monitors and controls all the activities of drip irrigation system efficiently as well as it helps us for to do the efficient water management in order to get more profit with less cost. Using this system, one can save manpower, as well as water to improve productivity and ultimately the profit. In future if we modify it properly then this system can also supply agricultural chemicals like calcium, sodium, ammonium, zinc to the field along with Fertilizers with adding new sensors and valves.

**2.17 Patel et al (2013)** : The advancement in engineering and technology over the last few decades has encouraged researchers to develop automatic monitoring and controlling system in agricultural field. Survey of some of the systems have been summarised. Use of WSN provides the mobilised controlled over the field. The earlier discussed systems can be

modified to obtain higher yield and use of WSN, ZigBee, etc. will help to achieve better performance, optimised and economical system.

**2.18 Rashid et al (2013)** : The fertility meter and ph. meter to determine the percentage of potassium, phosphorus, nitrogen which are the most important ingredients of soil. Now after measuring fertility of soil, we have implanted the automatic plant irrigator for DRIP irrigation through wireless. Both techniques will help to judge fertility and moisture content of soil. This application of sensor-based irrigation has some advantages such as preventing moisture stress of trees, diminishing of excessive water usage, ensuring of rapid growing weeds, measuring fertility of soil.

**2.19 Rakesh et al (2013)**: The model bridges information gap within and outside the nation. In Indian agricultural sector, the suggested model can be considered as a pilot project. An effective implementation of this model will encourage other sectors also, which will lead to optimal benefit of shifting towards cloud. This will definitely have a positive impact in the overall economic development of the nation. Above all, cloud computing is a newly introduced concept and most of the developing nations are not readily willing to accept and implement it. Therefore, it needs a mass awareness and promotion among the prime stakeholders to acquire the full potential of it and have a well established information base for the nation. This will in return lead to a well-connected world.

**2.20 Saleemmaleekh et el (2013)** : With the advancement in technology, the world around us in every part of our life getting automated. The manual procedures are being replaced by these automated systems, since they are with energy efficient and consume less labor work. This paper proposes the advantages of having Wireless Sensor Network technology in Indian agricultural sector, which shows the path to the rural farmers to replace some of their traditional techniques. Here, multiple environmental data such as Humidity, Soil moisture, Soil pH etc. are collected by a set of wireless sensor nodes and applied as input to the Peripheral Interface Controller (PIC). The data is checked continuously by PIC controller and a set of control actions like Irrigation, Soil fertility check etc. are made if they exceed threshold level. After every activity, an evidence message is sent through SMS via GSM modem to the farmer. The module by module design and implementation of the system are given. The system overcomes the limitations of traditional agricultural procedures by utilizing water resource efficiently and also reducing labor cost.

**2.21 Divya et al (2013)**: The project aimed at developing “SEEDING AND FERTILIZATION USING AUTOMATED ROBOT” is completed successfully. A machine assembled using the above-mentioned idea successfully seeds and fertilizes large areas of land without human

intervention. The technology deployed in this work is an interface between aspects of robotics and artificial intelligence. India, being a nation with an agriculturist economy, would be greatly helped by such an invention that takes off an extra burden from the shoulders of small and large-scale farmers.

**2.22 Drishti et al (2014)** : It has incorporated automation into various aspects of the farm. A new design for animal enclosures is put forward to improve the living conditions of livestock, as well as reduce manual labor. It includes an automated light, temperature, humidity and sprinkler system. The humidity and moisture control mechanisms make sure the animals are comfortable in the enclosures they are kept in, by adjusting the settings as per requirement. The system is made secure through a password protected digital lock which ensures the safety of animals in their enclosures. The auto lock and release doors can be used to facilitate the incoming and outgoing livestock. Smoke detectors are included to prevent fire hazards which if not detected on time could lead to loss of livestock and valuable resources. The feeder control system times the meals of the animals and reduces the human labor in the process. The system is energy efficient as it helps conserve resources like energy, water and reduces manual labor to a great extent. A GSM module is interfaced to connect all aspects of the modern automated farm. The farm owner has easy access to the system and can control it remotely through his mobile phone. This paper demonstrates that with the integration of information technology to the farm environment, systems and appliances will be able to communicate in an integrated manner. This will result in convenience, energy efficiency, and quality and safety benefits.

**2.23 Chavan et al , (2014)**: Zigbee-based agriculture monitoring system serves as a reliable and efficient system for monitoring agricultural parameters. The corrective action can be taken. Wireless monitoring of field not only allows user to reduce the human power, but it also allows user to see accurate changes in it. It is cheaper in cost and consumes less power. The GDP per capita in agro sector can be increased. This project can be extended for cattle monitoring.

**2.24 Heldi et al (2014)** :The objective of the study is to develop a system for monitoring the temperature in the greenhouse by placing multiple temperature sensors at several observation positions. The proposed system allows more representative and comprehensive observations for conducting an analysis of the temperature changes using wireless communication. In addition the temperature in greenhouse can be monitored optimally .

- 2.25 **Snehal et al (2014)** : By considering various situations of climatologically phenomena affecting local weather conditions in various parts of the world. These weather conditions have a direct effect on crop yield. Various researches have been done exploring the connections between large-scale climatologically phenomena and crop yield. Artificial neural networks have been demonstrated to be powerful tools for modeling and prediction, to increase their effectiveness. Crop prediction methodology is used to predict the suitable crop by sensing various parameter of soil and also parameter related to atmosphere. Parameters like type of soil, PH, nitrogen, phosphate, potassium, organic carbon, calcium, magnesium, sulphur, manganese, copper, iron, depth, temperature, rainfall, humidity. For that purpose we are used artificial neural network (ANN)
- 2.26 **Shaik et al (2014)** : The water level monitoring in agricultural field and motor controlling system based on GSM technology using PIC16F877A microcontroller. An advantage of this system is very simple, more competent and low cost. Future work can be done by designing a system based on 3G camera for visual identification of water level from remote level.
- 2.27 **Sakthipriya et al (2014)** :The real-deployment of WSN based crop monitoring which is designed and implemented to realize modern precision agriculture. End Users can tailor the mote operation to a variety of experimental setups, which will allow farmers to reliably collect data from locations previously inaccessible on a micro-measurement scale. Such a system can be easily installed and maintained. This paper successfully applies the wireless sensor networks on agro-ecology fields by investigating environmental situations. The complete real-time and historical environment information is expected to help the agro-ecological specialists achieve efficient management and utilization of agro-ecological resources.
- 2.28 **Mahesh et al, (2014)**: The use of WSN and Cloud services in agricultural field provides high potential benefits which are economically worth in the field of agriculture. In this paper we have proposed and outline an agricultural WSN Cloud for providing assistance to farmers during crop cultivation. Farmers can receive at an affordable price the information about soil condition, crop cultivation environment, crop diseases, and pricing solutions during cultivation through the expertise available in a cloud computing system. As a part of future work, a prototype model of the system is planned.
- 2.29 **Sami et al (2014)** :The Indian farmer and those who are working for their welfare need to be - powered to face the emerging scenario of complete or partial deregulation and reduction in government protection, opening up of agricultural markets, fluctuations in agricultural environment and to exploit possible opportunities for exports. The quality of rural life can

also be improved by quality information inputs which provide better decision making abilities. IT can play a major role in facilitating the process of transformation of rural India to meet these challenges and to remove the fast growing digital divides. By this study, the authors conclude that the Indian Govt is being made a remarkable achievement especially in the area of agriculture by giving various facilities to the farmers in which the ICT services is one among which is helping the farmers to understand the modern cultivation methods, availability of agriculture inputs, irrigational sources, availability of pesticide and fertilizers for increasing the production and productivity of crops.

**2.30 Chaitali et al (2014) :** The Microcontroller and soil moisture sensor based irrigation system proves to be a real time response control system which monitors and wheels all the activities of irrigation system. The present system is a model to modernize the agriculture industries at a mass scale with optimum expenditure. An automated irrigation model is proposed using different circuits as demonstrated in different figures. We designed and implemented this model considering low cost, reliability, alternate source of electric power and automatic control. As the proposed model is automatically controlled it will help the farmers to properly irrigate their fields. The model always ensures the sufficient level of water in the paddy field avoiding the under-irrigation and over-irrigation they can provide irrigation to larger areas of plants with less water spending and inferior pressure. Using this system, one can save manpower, water to get better manufacture and eventually income. Advanced soil moisture level sensor will use in these we can measure different parameter that is pressure, temperature and humidity, of soil. Different amount of water requirements for different types of soil in this according to the type of crop, and water resistance capacity in different seasons, system provide definite amount of water to the plant hence, we can save large amount of water.

**2.31 Pranita et al (2014) :** Agriculture is one of the important occupations of India on which whole economic conditions are dependent. So, the paper is just focusing on the new automation technology which will make it more efficient all the way. Detailed survey of agriculture industry is done with the conclusion that it is lagging with new innovative, efficient and cost effective techniques. The problem is going to overcome by the use of proposed automated system for the Monitoring and Controlling Operations of Greenhouse Environment and other agricultural sectors also. This will lead to decrease in the cost and increase in the production of agricultural goods



**2.32 Gholap et al (2014):** A system with high speed of operation for an advanced agriculture process which includes cultivation based on robotic platform. The robotic system is an electromechanical (conveys a sense that it has agency of its own) and artificial agent which is steered by DC motor which has four wheels. The farm is cultivated by the machine, depending on the crop considering particular rows & specific columns. The infrared sensor detects the obstacles in the path and it also senses turning position of vehicle at end of land. The seed block can be detected and solved using water pressure. The machine can be controlled remotely and solar panel is used to charge DC battery. Assembly language is used in programming the microcontrollers. The microcontroller is used to control and monitor the process of system motion of vehicle with the help of DC motor.

**2.33 Udupa et al (2015) :** The Arduino board and soil moisture sensor based irrigation system proves to be a real time response control system which monitors and wheel all the activities of irrigation system. The present system is a model to modernize the agriculture industries at a mass scale with optimum expenditure. An automated irrigation model is designed and implemented this model considering low cost, reliability, and automatic control. As the proposed model is automatically controlled it will help the farmers to properly irrigate their fields. The model always ensures the sufficient level of water in different fields avoiding the under-irrigation and over-irrigation

**3.34 Raj et al (2015) :** To provide an overview of some previous research and studies done in the direction of applying pattern recognition techniques in the agricultural domain. A unique and proper combination of pre-processing, feature extraction, feature selection and classification process is required for each domain or problem in order to optimize accuracy, speed and reduce cost by minimizing feature set used for training and classification. The theories behind pattern recognition are presented at the beginning and a review of different techniques applied in grading, remote sensing, diseases detection etc. is provided as part of the evolution.

**2.35 Kirankumar et al (2015) :** The project would be considering an area where any of the crops that are grown, and finds a solution for a an agricultural system by different deployment techniques, the device will successfully help in growth of a plant by monitoring temperature, pesticides, humidity without human interference, these device can be implemented an in a half acre of land as a prototype model, the device if implemented in a large scale the overall cost can be brought down that is demonstrated using qualnet simulator. This device will go over the years, as sensors usually has large durability with frequent replace in batteries.

- 2.36 **Mamta et al (2015)** : These system was found to be feasible and cost effective for optimizing water resource for agriculture production. These system can adjusted to variety of crop and improve the maintenance .this system is feasible for all type of crop. we can used these system for large scale up green house and open field.
- 2.37 **Nilesh et al (2015)**: Different types of irrigation systems based on GSM. these systems were all remotely controlled systems which proposed a low cost information exchange via SMS and GSM. The result of the survey conducted has lead to a very positive approach on the impact of GSM technology in farm irrigation methods & techniques. Everyday new techniques have been implemented for minimizing the irrigation process like mobile phone and other software application for conduction of irrigation process. This leads to a better and more efficient agricultural development for the future generations to come.
- 2.38 **Istikoma et al (2015)** :Plantation agriculture is a backbone for the Malaysian economy since the turn of the 20th century. It is very clear that, from agricultural sectors might contribute high income for the country and help for people to improve their life. The plantation from rubber and palm oil is a big majority contribution in order to achieve the target by the year 2020 which the aim to enhance the industry's GNI from RM 52.7 billion to RM 178.0 billion and The effort from Government which emphasize to New Economic Model (NEM) as represented to approach on the Tenth Malaysia Plan based on the performance of palm oil and rubber productivity to support Malaysia to achieve the target by the year 2020.
- 2.39 **Suraj et al (2015)**: This system is reduces the water use because it provide irrigation as per the requirement of the crop. 2. This system is automated irrigation system so it reduces the human resources.3. This irrigation system was found to be feasible and cost effective for optimizing water resources for agricultural production. 4. The irrigation system can be adjusted to a variety of specific crop needs and requires minimum maintenance. Using this system we can monitor the status of all the sensors (Soil-moisture, Temperature, Water level) and also the ON/OFF status of the motor and Fan.
- 2.40 **Rayala et al ,(2015)**: System was found to be feasible and cost effective for optimizing water resource for agriculture production. These system can adjusted to variety of crop and improve the maintenance .this system is feasible for all type of crop. We can used these system for large scale up green house and open field.
- 2.41 **Jaymala et al, (2015)** : Zigbee based agriculture monitoring system as a reliable and efficient system for efficiently monitor the environmental Conditions. Wireless monitoring of field not only reduce the human power, but it also allows user to see accurate changes in it. It

is application of low cost, Energy consumes means less power and can control 254 devices at a time, which in turn leads to the development of lots of new technologies like Home Automation, Health Care Automation using zigbee.

2.42 **Fan TongKe, (2015)**: IOT is closely related to cloud computing in a way that IOT obtains powerful computing tools through cloud computing and cloud computing finds the best practicing channel based on Smart Agriculture Based on Cloud Computing and IOT Fan TongKe IOT. Agricultural information cloud is constructed based on cloud computing and smart agriculture is constructed with combination of IOT and RFID. Hardware resources in agricultural information network are integrated into resource pool by using vitalization technology, achieving dynamic distribution of resource and balance of load, significantly improve efficiency of resource using. Large amount of data obtained by using radio frequency identification, wireless communication, automatic control, information sensing techniques of IOT are handled with agricultural information cloud, truly realizing smart agriculture.

2.43 **Katariya et al,(2015)**: the four major work in agriculture field which is done by a robot without giving any human support. For designing automatic system we provide proper tracking through the white line following robot concept in which the robot distinguishes white and black or dark surface and follows only white track. With reference to this concept we are going to implement a white line on a farm where actually we need to work & remaining surface is treated as a black surface due to the brownish color of soil. We also provide delay to robot at equal distance to do the agriculture work like pesticide spraying, water supplying, plugging, dropping of seed, accurately and automatically & the solar plant provides the supply source to whole robot which makes it eco-friendly.

2.44 **Jayade et al,(2015)**: Many initiatives in the recent past portrayed the significant role that the Information Communication Technology (ICT) plays in the realm of rural development. Several projects have reduced the costs, and it also has increased transparency. It is noted many scientists are using these ICT for information retrieval or data updating, data analysis, for finding references, for searching details related to their research for farming communities.. In developing countries ICT has played very important role in the development of education, health, rural development as well as in agriculture development. This technology has brought a significant change in agriculture development in Maharashtra and India in particular where farmers directly connected with research centres, universities, government, market, buyers, customers and meteorological department to get information regarding inputs, practices, weather forecast and prices. ICT has also increased the income of

farmers in Maharashtra. Now, there is need to provide facilities to farmers and introduce technology in rural areas where farmers are unaware and they do not have knowledge and skills regarding this technology. It was also indicated by different research that this technology has increased the product of agriculture by adopting ICT tools in agriculture and farming. However, farmers are facing major problems and challenges including poor agricultural practices, inadequacies in information delivery, reconciliation of records among farmers, government and traders. Similarly, lack of information on best practices to farmers.

**2.45 Vidadala et al, (2015)** The implementation of agricultural automation system using WEB and GSM technologies. This Embedded project is to design and develop a low cost system which is based on embedded platform for agricultural automation. Optimum usage of water is main objective of this system. This project uses soil moisture sensor and temperature sensor to detect the water quantity present in agriculture and water level sensor is used for detecting water level in tank. In this system we monitor status of the sensors through WEB and GSM technologies. Here temperature, soil moisture and water level can be monitored on web page through micro controller and information will be send by SMS. This page contains all the information about the status of the sensors. This information will be viewed at remote location by using GPRS technology. Key words: WEB and GSM technologies, Embedded platform, Soil moisture sensor, Temperature