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IoT based Smart Irrigation System

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Abstract: ***India is an agriculture based country. Agriculture is something that has been associated with us for long time. Globally India holds second rank for farm produce. The population growth has increased over past few years. This has led to increasing demand of food production leading to shortage of food. In general on an average a farmer spends a lot of time and energy in visiting the farm fields, just to operate the pumps. This task becomes more difficult when the weather conditions are harsh. There is one more problem associated with operating the pump and motors that is the fluctuating power supply and load shedding. Every time travelling to just operate the pump or motor in the field is not feasible. Often there is voltage problem or load shedding. The farm fields are also having the high risk of animals, snakes, etc. Especially when it's the rainy season the efforts get doubled as the water lodging comes into picture. In extreme conditions the existing systems face failure creating problem for farmers. If the farmer has more number of motors, then it becomes difficult to handle all of them at a time when the electricity is accessible. Failure of any electrical instrument is mainly due voltage oscillations. Phase of connection also plays a vital role in mutilation of devices. If this happens often in irrigation kits, this leads to poor crop yield. This is mainly due to improper water supply to the crops. This ON/OFF delay also causes water wastage and increasing the water lodging problem due to uneven quantity of water is pumped into fields. This improper running schedule often leads to wastage of electrical power and sometimes dry running condition in motors.***

Keywords: Agriculture System, IoT, Electricity, Cloud Computing, Android

I. INTRODUCTION

The main aim for establishment of this project is to deliver the technological benefits to the farmers, today using the old methods of farming. The two important factors affecting the farming culture in India are water and electricity. This is our prime focus in project to control these factors in order to help farmers get an advantage of technological innovation. Using this project it will able us to control these factors by implementing a small electrical setup in the centrifugal pump. This circuit will interconnect with the help of GSM/GPRS module and will use the cloud platform to communicate further using Software as a Service (SAAS). A meek console will be designed to access and control purpose with the help of Android or IOS application. This Android application offers a benefit to the end user to control his/her centrifugal pump through the far-off location. The location of the farm may be far-off from farmer home, so just to start a single switch of that pump, he has to travel a distance. As there is shortage of electricity and common problem of load shedding in India, it becomes difficult to water the crops. Henceforth our project will help farmers to operate and control the devices from their homes. And by using artificial intelligence algorithms we can analyse the data of power consumption of the pump verses the water pumped from well. This will ultimately help farmers to analyse the need and also help in managing the water resource. Most of the farmers do the farming in traditional way due to lack of technical knowledge. For that purpose few Government Schemes are included by the Indian Government which is increasing India's GDP and reducing the manpower. Due to traditional ways of farming and ups & downs of the market condition the economic development of the farmer is continuously decreasing. This has led to move the farmers to city area from village side and change their profession from farming to other fields. As the India has second the largest population in the world, so as to provide the food as a daily need for all these people the farming should be done into more technical way and more people should get involved in this field. Now a day youth is more attracted towards city areas as farming is the field where people have to do work with more effort and the process is time consuming. So as to attract these youth, the Indian government has taken some initiative like introducing subsidy for farming related business, online help lines which will help to farmers for their queries related to crop, production, vendors, pesticides etc. The main problem faced by farmers is the environmental circumstances or weather conditions like heavy rain falls, less rainfall, shortage of water, wastage of water etc. For getting over these circumstances, this smart arrangement has to be engaged in agriculture field. The arrangement uses a mobile application developed, which is based on IOT.[7] It is like the connecting various devices with the help of Internet and Electronic Sensor. The main difficulties for water & electricity are controlled in this system. We are proposing a solution which will give farmers real time solutions which will be helpful for end user to take the decisions related to day to day problems for the agriculture need. According to the solution provided we can use the techniques of irrigation like drip and sprinkler is used by the farmers to save the water but they have no control over it. In past few years this system is growing rapidly. Though Drip or

sprinklers are smart way to water the crops there must be intelligence system to have control over them. As continuous flow of water is flowing on the roots crop it can affect the quality of crop. So the easy farming arrangement communicates with centralized unit through internet and sends necessary data to user's android phone to take the decisions. Every time centrifugal pumps are turned ON the constant monitoring of the soil moisture level is done & when it necessity of soil is fulfilled it is turned OFF automatically or the message if send to farmer's android phone to take the decision.

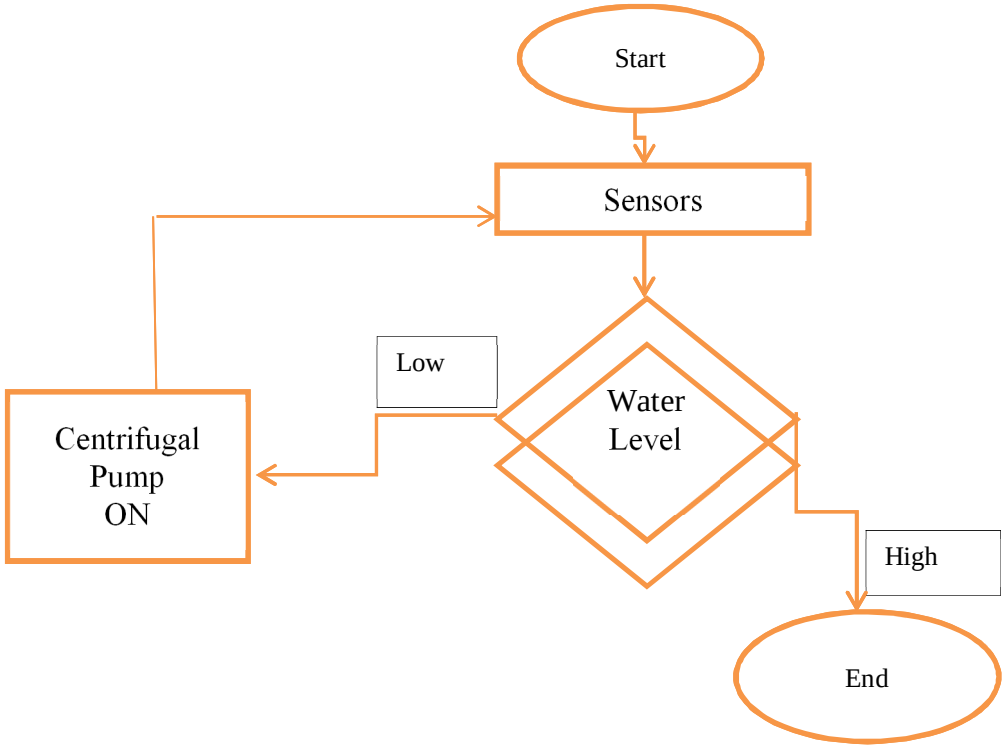

Fig 1.1 Basic Flow of Centrifugal Pump Working

II. AIMS AND OBJECTIVE

A. AIMS

To study the difficulties occurred in Indian traditional agriculture system with respect to water and electricity. And develop the system for managing the same. The solution is based on Android Application which will have control over the system to reduce the efforts taken by farmers.

B. Objectives

To develop the smart irrigation system which will automatically perform the function of ON and OFF for centrifugal pump by sensing the soil moisture level with the IOT techniques.
To reduce the efforts taken by farmers and increase in the crop production.
To regulate required quantity of water to avoid the wastage.
To control the electricity supply to save time and manpower.
Monitoring the performance of centrifugal pump.
To develop an android application of these services for smart irrigation.

III.SUMMARY OF THESIS CONTRIBUTIONS

Based on case studies, agriculture utilizes more than 80% accessible freshwater resources, and this percentage will increase in water consumption because of population growth and increased in need of food. This gives birth to the need of managing water utilization, inclusive of methodological, agronomical, and economical enhancements. Wastage of water can be organized by taking assistance of the internet and sensor technology available. This will ensure that the water which is available on the earth can be utilized in a better way eventually contributing in addition of productivity. The IOT technology which uses the portable phones and transportable

instruments are used for monitoring and controlling the working of the arrangement. The IOT has the ability to interrelate and converse with the instruments that are mounted in various areas of meadow. IOT set-up has the ability to intellect the data which is available of the various sensors mounted in the arrangement and can transmit this data using internet.
There will be a processing unit which will receive the data from sensor and after processing, it will display on user's device.
Android application is uninterruptedly gathering the data from an allocated IP address by enticing that data into the set-up or arrangement so as to have enhanced outputs. The mud dampness levels are constantly monitored with the help of the sensors mounted which is further connected to relays and then to arduino microcontroller which will predict the further plan of action.

IV. IOT

Few days back Internet of things was the newest technique and still unknown to the ordinary people but now it has emerged in almost every field to make life easier. From Home appliances to public infrastructure, in every field it has become popular. It includes Health Sector, Agriculture, Smart Home, Smart TV, Smart Phone, Transport, Defence etc. IOT system is assembled with the wireless sensor networks, physical devices, Micro controller, GSM, arduino etc. IOT system consists of different sensors, controllers, physical connections, input and output devices which can fetch the valuable information from the source then process it and give the meaningful results to the user. This result can be used to make the smart choice for user of the device. IOT can keep track of business data. It will help for customer satisfaction. It can give the desired reports of the business which will make the evaluation of business easy. Most importantly it saves the time and energy. By saving more any it can increase the profit of company.

A. IOT in Agriculture Field

As most of the nation's GDP is depends on agriculture field, it is more important to develop this field to improve the economic condition of the nation.
If IOT will be part of the agriculture industry there will be

1) Production of crop will be increased to great extent.
2) Quality of crop improved, this can give the cost benefits to the farmer.
3) Farmers have to do many physical activities throughout the phase of crop production, this can be reduced.
4) Reducing the Manpower.
5) Increase in Nation's GDP
6) IOT in agriculture field leads to the smart and intelligent farms.

This technology can analyse many things for farmers like type of crops, fertilizers, soil type, water storage, required water, harvesting, temperature, humidity and any more. IOT can suggest farmers that which crop can be taken with respect to weather conditions, water storage, soil type and the location. The farmer can get many updates about the field as well as the market conditions using IOT. IOT can be a combination of hardware and software to analyse the data stored and processed by the sensors and micro controllers.[8]
Examples of IOT Applications in Agriculture field:

a) *Green House Management:* Mostly green house is used for small quantity of vegetables, plants or crops. As the maintenance cost goes too high for green house. After investing such large amount, if this system fails due to any mistakes like excess or less water or unusual weather conditions, it will be a huge loss it farmers. IOT acts as a smart way to deal with. Using this technique we can control and manage the things and automated the system for avoiding the future loss.
b) *Crop Management:* Crops management consists of the database containing the information related to crop and techniques used for it. There will be a training set which will store the previous experiences of the farm and gives result accordingly. They can also suggest crop according to market condition with the help of internet.
c) *Cattle Monitoring & Management:* Cattle are the most important part for agriculture field. Cattle management with IOT can keep the records of cattle right from their birth to their sell or death. It can track their daily activities, production, work, feeding times, cleaning times. Their vaccination and dues can also be notified by IOT.
d) *Water Management:* Water management is most time consuming part of the agriculture. Many things are depend on water management. Wrong water management can lead loss of the things like soil nutrients, quality of crop, and energy losses. In existing irrigation system wireless sensor set-ups help to determine the soil condition. Advancement in this field has been done at very small level. They just capture the things and give manual data results. There is no use of Artificial Intelligence, Algorithms, machine learning. Machine-Learning Algorithms have been implemented in order to get the result from previous

data set. But there are only predicted data results, they are not fully reliable. So these drawbacks can surely overcome through Internet of Things. It will be more automated system for faster and reliable service. Along with these Arduino, Micro controller, Arduino hardware measures the physical conditions. Real time data is fetched by the sensors which will be processed with the previous training sets and get desired output for making the system more intelligent. In the smart irrigation system using IOT the algorithms are developed which will help to make the make training set of results, analyse the real time data to get the control over system. More advancement in future can be done by producing the data analysis graph and report for further study of farming.

e) *Android:* Android is the operating system developed for mobiles. It is open source, Linux based software used on smart phone and tablets. Android is now interlinked with TV and Cars also. The latest version of android is Android 10 launched on 3 September 2019. Android is associated with Google play store where the applications, which are open source, are available and can be downloaded by the people for free and some are paid also. Now a day these applications are really helpful for expanding the business. For Example online shopping applications like Amazon is useful for business expansion as well as for people it can give the things with fewer efforts. The key features of android are Near Field Communication, Alternate Keyboard, Wireless Application Download, Widgets etc. Android is increasing by uploading more third party application which can be downloaded by the users. Developers of the application can upload their application to Google play store with APK file and licence. Mostly Android devices are battery powered and designed so as to consume the less power and less memory. Android devices are incorporated with hardware platform ARM. There are any other optional hardware used like camera, GPS, Gaming Sensors, pressure sensors and touch screen.

i) IOT with Android: IOT with android simply means interlinking between smart devices with internet. Those devices are with sensors and internet that can process the data gives appropriate result which will be useful for people.

ii) This has been used as a software as a service which is growing rapidly. It gives opportunity to the developers to design the newest technology which will be user friendly and smart. They work hard to give the smart solution with IOT, in almost every gadget that is used by the people. The have almost controlled every small thing like Toaster, fan, AC, Switches, TV to big machineries which are used in industry.

iii) As it is open source, everyone can customize it and use the source code.

iv) As of now many versions of androids are introduced in market which is the updated version of previous one. Though the embedded system developments have dome with android, they are not applicable to IOT.

Arduino is kind of a design board which consists of microprocessors and microcontrollers. This board is open source for the community to design and develop the single board which can be a set of input & output pins. They are assembled in kits that are easy to design which makes interfacing to boards and circuit. Arduino have the feature of USB (Universal Serial Bus). Microcontroller used in the kit can be programmed by C or C++ language. This provides an easy and low cost method to make the environment for smart devices.

f) *Sensors*

i) *Soil Moisture Sensors:* Sensors are the devices that convert physical content into the electric signal, like temperature, blood pressure, water level, weather etc. In soil moisture sensor, the content of soil is converted from analog to digital signal which is then sent to processor. The physical factor used here is copper electrode, which can sense the moisture of soil. There will be two probes which will allow the current to pass through soil which will give the resistance value. This value can measure the moisture level. When the quantity of water is more, electricity will be more, resistance will be less and moisture level will be more. For the less water, electricity flow will be less means resistance will be more so moisture level sensed will be low. The outputs from sensors will be in Analog mode then it will be converted to digital mode so it will be easy to give result to user. The phenomenon behind this is dielectric permittivity of water. The moisture value changes according to the evaporation, species of crop, and type of soil.

ii) *Temperature Sensor:* It is a device with thermocouple which provides an electric signal to measure the temperature. Two different metals are used in thermocouple for generating the electric voltage which will be directly proportional to temperature value. Temperature sensors can be made of semiconductors, RTDs, Thermocouples, Thermistors, and Infrared etc. Thermocouple consisting two different metals are referred as HOT JUNCTION OR HOT END & COLD JUCTION OR COLD END. There will be voltage created between these two factors which will be indicating the temperature value.

iii) *Centrifugal Pump:* Centrifugal Pumps are designed to transfer the fluid like water, petrol etc. They convert rotational kinetic energy to hydrodynamic energy. The water goes into the pump which then flows towards the diffusor with the help of rotating

axis. The revolving impeller creates the energy which is directly proportional to the liquid flowing. The working of the centrifugal pump is defined by converting the electric energy into kinetic energy. The main working of the centrifugal pump is to manage the speed of the impeller. The efficiency of the centrifugal pump is maintained by the speed of the impeller because it is proportional to the velocity of the edge. As it defines the efficiency it directly affects the farmer because the electricity is the major consent in the rural areas and affects the day to day activity of the farmer hence how efficient the pump, the better productivity the farmer can achieve in his field. Several sensors can be used to monitor the efficiency of the centrifugal pump. In traditional irrigation system also these pumps are highly used as these are very easy to use. But some difficulties faced by the farmers related to pump are solved in Easy Farming system. Automation of centrifugal pump to ON and OFF the pump from different location can be done in this system. This can be done with help of micro controllers and sensors and android application from farmers mobile phone.

iv) *LCD:* Liquid crystal Display are the display panels which used liquid crystals. These are flat panels unlike CRTs and they are compact in size. They are used in almost every display devices, from calculators to laptops TV etc. In smart irrigation system LCD will display the processed data to farmer. It is like user interface for them.

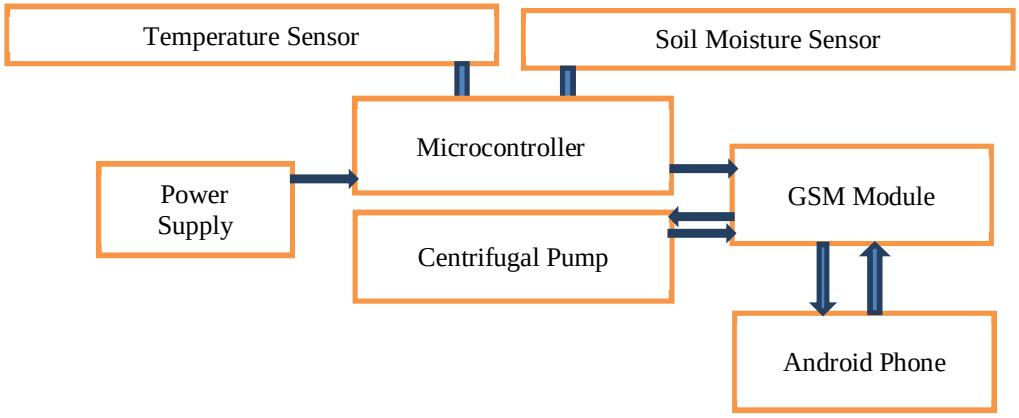

Fig2. Design of system

V. CONCLUSIONS

Main concern about water wastage and uniform distribution of water is solved by using this system. As the system will be software based the effort of the farmers will be reduced and younger generation will be attracted towards farming. This will be really helpful for the farmers, new generations, and for the nation too. The system is android based so it is cost effective as well as user friendly also. By using IOT, the system will become more efficient, smarter and precise. In the next few years this system can definitely be improved and it will be more accurate, cost effective and with the advance technology.

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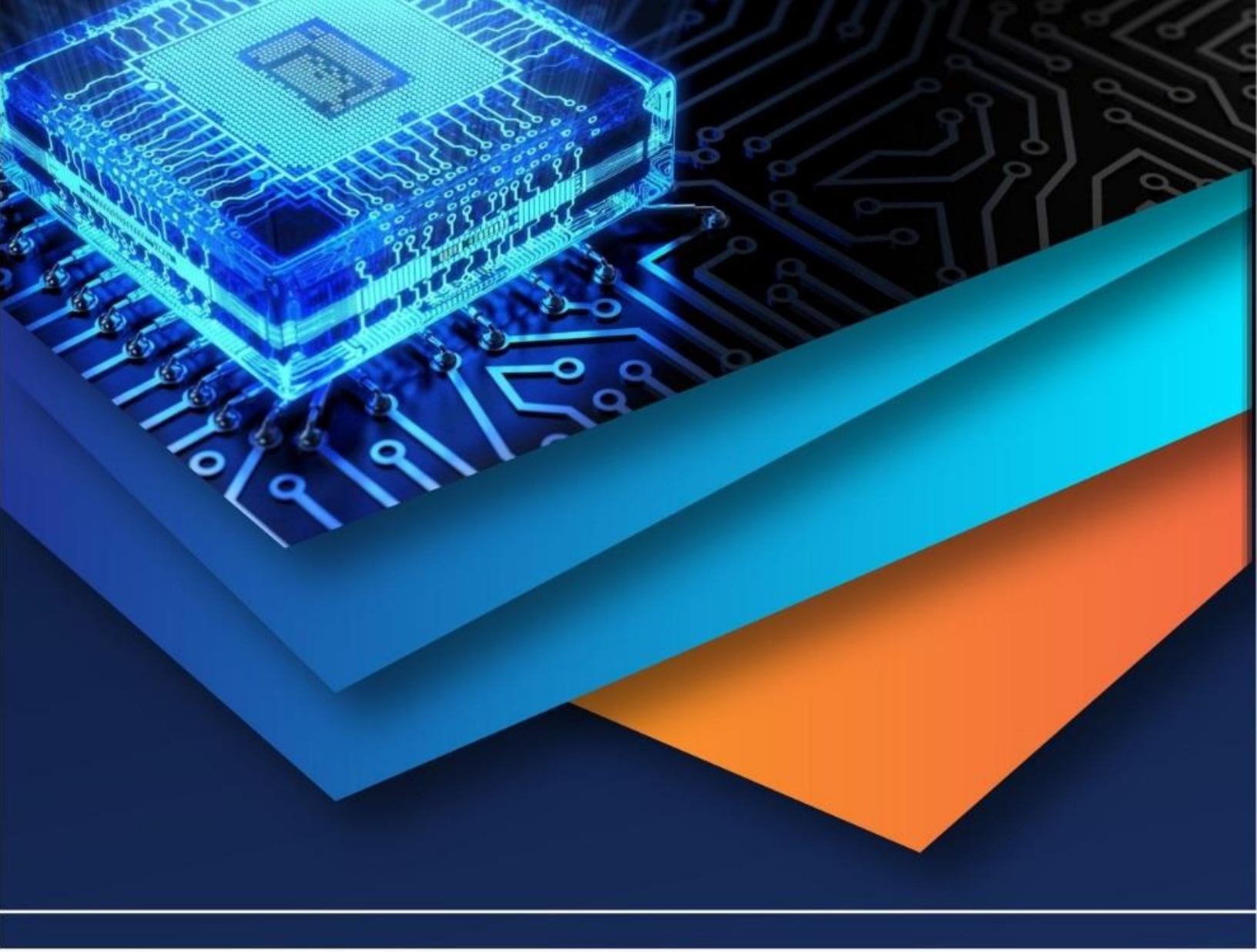

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