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Implementation of Automated Crop Management and Irrigation system using IoT

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Abstract - *The potential need for agriculture is water and good fertile soil for better growth of the plant. In recent years lack of rainfall and soil erosion and man-made disasters reduce the soil quality and area of cultivable land. Automated agriculture helps not only in yield but also reduces the wastage in agriculture. With the help of this system, one can vegetate in a small farm in urban region to overcome the demand in agriculture production. The key feature of our project is to sense the required physical parameters as per the crop requirement depending on soil water flow model which will keep the plant in moist environment and the UV environment make plant grow healthy and pest free. UV helps in developing the plants natural immunity and increase the crops nutrition value. Using IoT, this system can monitor parameters for wide range which can be used for different regions and various crop based on the climatic condition and the nature of the crop to be cultivated as our country has different climatic condition and agriculture methods. So, here we are implementing a project which will give the whole data about the farm cultivation.*

Key Words*: *IoT platform, PIC- microcontroller, Fertilizers, Agriculture Production, Embedded C.

1. INTRODUCTION

Food is an essential necessity of human life and requires its continuous supply and production to cater the needs of the growing population through sustainable agriculture. Appropriate environmental conditions are necessary for plant growth, improved crop yields, efficient use of water and other resources.[1]

Fig 1: IoT Scenario in Smart Agriculture

Automating the data acquisition process of the soil conditions and various climatic conditions that govern the plant growth allows information to be collected at high frequency with less labor's requirements. This can be achieved with the application of emerging technologies in sector to maximize production across vegetation [2].

Technology can aid and improve agriculture in several ways through pre-planning and during harvesting by the use of advanced technology through IoT to determine soil nutrient, pH, soil moisture and water level at the right time amount and right place application [3]. Irrigation is the delivery of water to grow crops. The irrigation system helps the farmers to have less Dependency on rain-water for the purpose of agriculture. In this paper, an automatic irrigation system that works Based on Internet of Things(IoT) in order to reduce the manual work of the humans[5]. IoT is changing the domain and empowering farmers to fight with the huge difficulties they face. PIC microcontroller is used here. To boost the productivity and minimize the barrier in agriculture field there is need to use innovative technology and technique called Internet of things. The technological advances in their areas gather increasing momentum and this means that maintaining as the overview. The most important things of smart farming are environmental and water managements affect the plant growth [6].

To trigger and control sensor devices with help of microcontroller, out of various microcontroller's PIC16F877 series plays major role, it belongs to Harvard architecture microcontrollers registered trademark of microchip technology, which receives programmable command and activates and control the sensor devices depends upon the user requirements, it helps to consolidate the sensed physical parameters and store that data's into its memory locations [7, 8]. Embedded C offer most popular programming language which developing the electronic gadgets, processor used in electronic systems is associated with embedded software and plays a key role in performing specific function by the processor, mainly to implement high level embedded C language gives very high timing accuracy along with code size efficiency are the prime requirements.

Table 1: *Comparison of various irrigation methods in past decades* [9].

Sno.	Work (year)	Sensor used	Conditions	Irrigation Saving (mm)
1.	2001	Soil moisture sensor (SMS)	Landscape	726
2	2007	Evapotranspiration (ET) & Soil moisture sensor (SMS)	Fescue turf grass plots	488
3.	2009	Evapotranspiration (ET) & Soil moisture sensor (SMS)	St. Augustine grass turf plots	840
4.	2010	self-designed wireless sensor	Virtual	685.5
5.	2010	Temperature Sensor (RS) & Soil moisture sensor (SMS)	Bermuda grass turf plots	602
6.	2014	Soil moisture sensor (SMS)	Landscape	603
7.	2016	Temperature Sensor (RS) Humidity sensor Solid pH Sensor	virtual	673
8.	2017	Soil moisture sensor (SMS)	Landscape	No Result
9.	2018	Soil moisture sensor (SMS)	Landscape	No Result

2. EXPERIMENTATIONS AND METHODOLOGY

2.1Tools Utilization

New and modern tools has been utilized in agriculture sector can improve the agricultural production and sustainability. For instance, best management practices and technological tools are widely applied for improvement of agriculture nowadays. Our model (IoT) and sensing devices such as water sensing, soil sensing, and pH sensing etc., can provides information to farmers for realizing precision agriculture, which is done by matching inputs based on actual yields of different portions on the field. These tools play a vital role and also allow agriculture to manage land for our wildlife.

2.2 Internet of Things

The Internet of things (IoT) is the network of everyday objects and physical things embedded with electronics, software, sensors, and connectivity enabling data exchange. Basically, a little networked computer is attached to a thing, allowing information exchange to and from that thing. Be it light bulbs, toasters, refrigerators, flower pots, watches, fans, planes, trains, automobiles, or anything else around you, a little networked computer can be combined with it to accept input (especially object control) or to gather and generate informational output (typically object status or other sensory data). This means computers will be permeating everything around us ubiquitous embedded computing devices, uniquely identifiable, interconnected across the Internet. The IoT act as a receiving section which receives the sensor values where we can monitor the parameters in the IoT website.

Fig 2: Photo copy of IoT System

2.2 PIC16F877- Microcontroller:

The term PIC, or Peripheral Interface Controller, is the name given by Microchip Technologies to its single – chip microcontrollers. PIC micros have grown to become the most widely used microcontrollers in the 8- bit microcontroller segment. The PIC16F877A CMOS FLASH-based 8-bit microcontroller is upward compatible with the PIC16C5x, PIC12Cxxx and PIC16C7x devices. The microcontroller sends the sensed physical parameter values to the IoT where it can be monitored by the people.

2.3 Soil Moisture:

The soil moisture sensor consists of two probes which are used to measure the volumetric content of water. The two probes allow the current to pass through the soil and then it gets the resistance value to measure the moisture value. Measuring soil moisture is important for agricultural applications to help farmers manage their irrigation systems more efficiently. Knowing the exact soil moisture conditions

on their fields, not only are farmers able to generally use less water to grow a crop, they are also able to increase yields and the quality of the crop by improved management of soil moisture during critical plant growth stages.

2.4 Water Level Sensor:

The water level sensor connected with microcontroller, made up of floating type of plastic, which floats in water to sense the level of water. When the water is full in the land the floating type sensor will float in water and reaches the top edge which used to indicate the water is full. Likewise when water is low in the land it reached the bottom and indicate the microcontroller that water is low. All the data will be send to the particular person through IoT by the microcontroller

2.4 Process Flow:

Soil moisture is directly connected to the microcontroller which will measure the moisture of soil present. If the moisture of soil is less than threshold level, then microcontroller will command the driver circuit to turn ON the pump motors. Water level sensor detects the level of water present in the farm cultivation.

An IOT is connected to the microcontroller to display the data and control the water pump according to that. pH sensor is used to monitor ph level and nutrition sensor is used to find out the nutrition in the field and crop according to that. To improve crop immunity UV LED is placed. Real time data monitoring and logging in cloud storage with easy access. Use of UV LED increases the crops immunity and nutrition value.

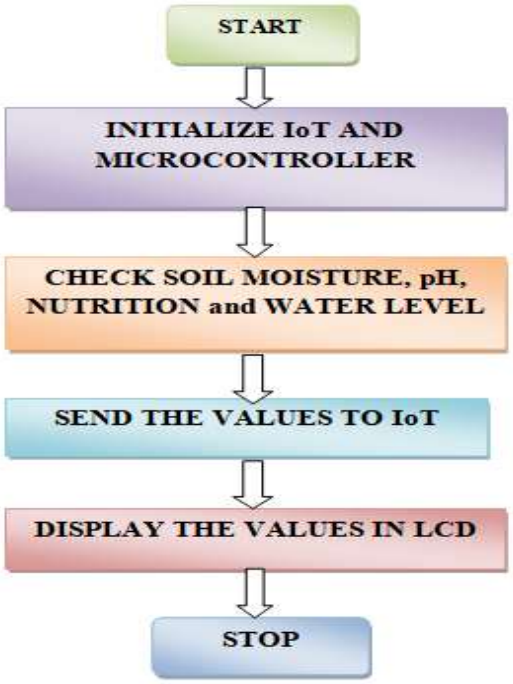

Fig 3: Work Flow Model.

2.5 Automated agriculture irrigation system:

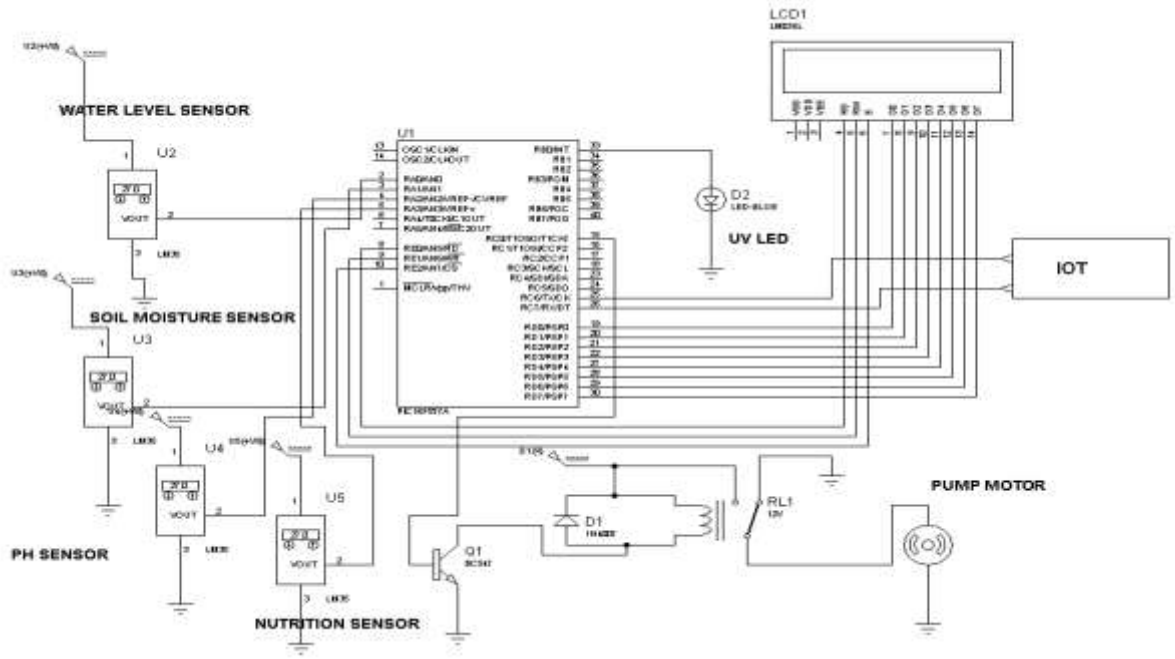

Fig 4: Circuit layout for automated agriculture irrigation system.

In Fig 4 shows the circuit for our system which senses the moisture content of the soil and automatically switches the pump when the power is ON state. A proper usage of irrigation system is very important because the main reason is the shortage of land reserved water due to lack of rain, unplanned use of water as a result large amounts of water goes waste. So we implement this system, which will very useful in all climate conditions.

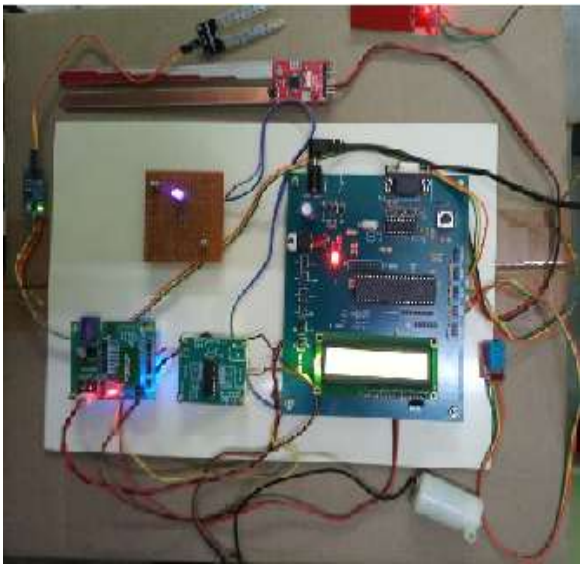

Fig 5: Photo copy of Hardware System

3. RESULTS AND DISCUSSIONS

We tried and implemented, digitalize farming and crop management activities so that the farmers can check on the requirements of the crops and accurately predict their growth. Our concept will surely accelerate their business to reach new heights and also more profitable with help of IoT based technology into the agriculture business and better crop production and system automatically convey the status of crops such as water level, temperature, pH level, nutrition and etc., all these are executed by sending status as SMS notification by collecting the valuable information by proper detailed data analysis.

Table: 2 *Sensed Physical parameters and their values*

Sno.	Time	Soil moisture	Water level	Nutrition
1.	1pm	232	0	254
2.	2pm	235	75	253
3.	3pm	243	125	257
4.	4pm	248	132	245
5.	5pm	252	146	260
6.	6pm	256	161	255

The above mentioned parameters are made by observing the fields at various conditions and the value of pH depends on nature of the soil (alkalinity or acidity).

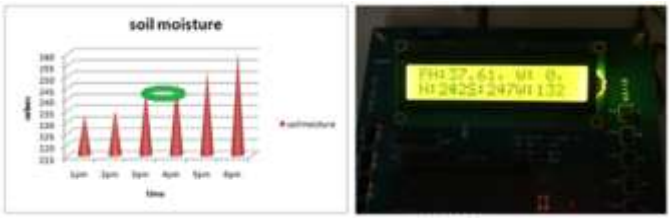

Fig 6: Moisture vs Time

In Fig 6 we developed web interface for soil moisture monitoring and time generator by system. It was seen that it succeeded in detecting a fall in moisture and correcting soil moisture, thus maintaining a constant environment

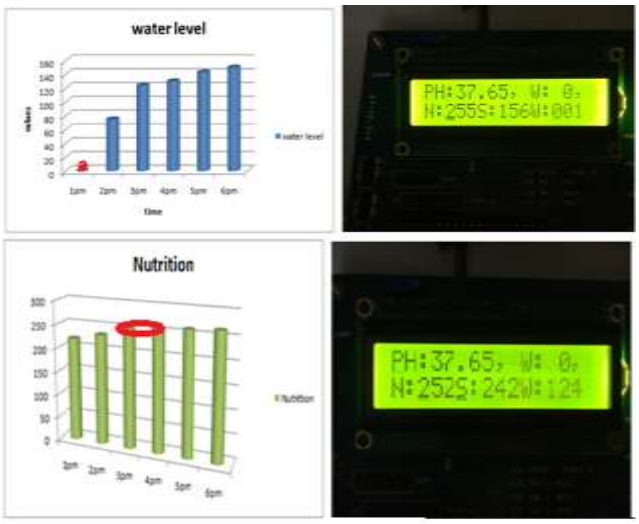

Fig 7: Nutrition and Water level vs. Time

In Fig 7 water level is analysed and maintained automatically with the help of our project. Water level is present only if we supply it efficiently. Since water quality in any source of water and at the point of use can change with time and other factors continuously monitoring of water is essential. The nutrition level represents the good quality of the crops and the sustainability of the crops on the fields.

4. CONCLUSION

The farming and the agriculture industry overall can really benefit from implementation of such IoT solution platform. Monitoring and collecting data of soil moisture, pH water level and nutrient across multiple fields improve efficiency of water usage and crop yield of large and local forms. As the world population increases farming and food production will have to increase with IoT platforms will enable this efficiency and production. In future some additional features that can be added are motion sensor for

monitoring behavior of the animals, robotics sprayers to sprinkle fertilizers and pesticides and much more.

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