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Sensor Fusion for IoT based Intelligent Agriculture System

Muthukumar.T[1], Pranesh Raj.S[2], Raman.A[3], Thirunavukarasu.G[4] and Nishanth.S[5]
[1]Assistant Professor/EEE, Kongunadu College of Engineering and Technology/EEE, Thottiam, India
Email: muthurajanmec@gmail.com
[2-5]UG/Scholar, Kongunadu College of Engineering and Technology/EEE, Thottiam, India
Email: praneshraj1999@gmail.com

***Abstract*—Agriculture is the mainly needed source of human being, 48% of total available land is occupied by the agriculture, and it consumes 80% of fresh water available in earth. This water consumption figure is ever-increasing every year due to globalization and population growth. There is a challenge in front of every country to sustain the fresh food requirement and reducing the farm water consumption. Irrigation is the method of obtaining food materials from the soil. The water requirement to the soil depends on soil properties like soil type, soil quality, soil moisture and soil temperature. It also depends on the crop which grows in the agricultural land. From the last few decades, the few technologies employing for reducing the consumption of water to the agriculture, but these technologies have some limitations. From these systems, soil watering is done without analyzing the properties of the soil. Due to this, the system apply anon-uniform water to the soil results in less cultivates. Also the technology requires more human involvement and time consumption. So we require modern technology to resolve this problem and support better irrigation management.**

***Index Terms*— Yield monitoring, Converter, Communication in Agriculture, Sensor and IOT.**

I. Introduction

In an Increasing business growth is one of the important phenomenon's of a country. Nowadays, the Internet of Things (IoT) and wireless networks are efficiently used in environmental monitoring system, agriculture, and health and disaster management. We usually monitor environmental parameters using IoT devices in our day-to-day business. These small-scale farmers minimise the practice of accepted lines and become the burden of heavy set losses, punk-sized agricultural products, humbleness and so on.

II. Linear Power Supply

A. Yield Monitoring System, Forecasting and Harvesting

Yield monitoring is the mechanism used to analyse the various aspects corresponding to agricultural yields, like grain mass flow, soil moisture content, and harvested grain quantity. It helps us to accurately access by recording the crop yield and moisture content to estimate, how well the growth of crop performed and what to do next.

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B. Green House Farming

Greenhouse farming is considered to be an oldest method of smart farming. Although, the idea of growing crops in controlled environment manner is not new as found since Roman times but it was gained popularity in 19th century where largest greenhouses were built in France, Netherlands and Italy. Further, the practice was accelerated in mid-20th century and it highly promoted in countries that faces harsh weather conditions. Crops grown in indoors are very less affected by environment; most importantly, they are not limited to receiving the light only during the daytime. As a result, the crops are traditionally grown under the suitable conditions or in certain parts of the world are now being growing anytime and anywhere. This was the actual time in which sensors and communication devices can start to support various agriculture applications genuinely.

C.Communication in Agriculture

Communication and reporting the information on a timely basis are considered by the backbone of precision agriculture. The real purpose cannot be achieved unless a reliable, firm, and secure connection among various participating objects are provided. To achieve communication reliability, telecommunication operators can play an important role in the agricultural sector. If we truly want to implement IoT on a large scale in agriculture industry, we have to provide a suitably large architecture for the system. Here, the factors like cost; coverage, energy consumption, and reliability are critical and have to consider before choosing the mean of communication. Low-energy networks able to provide connectivity only on one site and mostly do not offer any services in remote areas where sensed data need to be transmitted to the farm management system (FMS).

D.Wireless Sensors and IOT

The wireless sensors are placed strategically around crop fields are providing farmers with an up-to-date information in real time, allowing them to adapt the care that the crops need which results in higher food production with less waste of water. Wireless networks are also being used to inform that farmers about nearly all aspects of crop growth as well of the helping readiness of the equipment which cultivates a yield. WSNs with GPS capability are helping for tractors in compensating for uneven terrain and optimizing land preparation for growing crops In order to make agriculture sustainable development, the use of the IoT will be at the center and forefront in agricultural operations.

III. COMPARISON OF EXISTING AND PROPOSED SYSTEM

A. Existing System

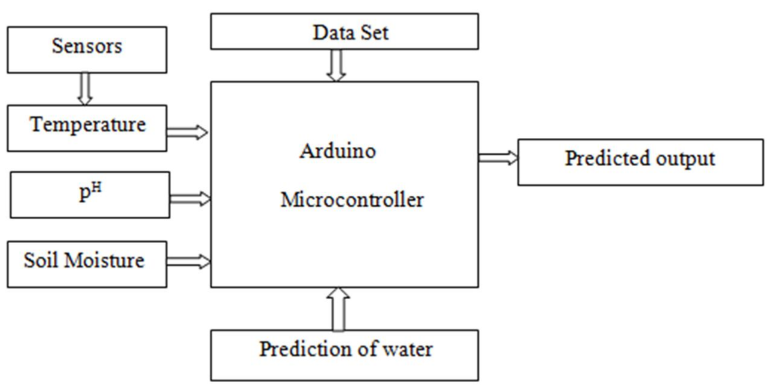

Fig. 1. Block diagram of Existing system

In last few years, remotely monitored embedded system was used for irrigation purposes have become a new necessity for farmer to save his energy, time and money. This agricultural solution for the farmer based on Wireless Networks and GSM technology. The data acquired about the environmental conditions of the field is transmitted to the farmer enabling him to monitor the actuators in the field. Zigbee based low power devices are employed to enable the cost saving and the sprinklers are employed to save the water usage for irrigation. The micro-controller is the heart of the idea which controls all the devices and activates it and runs them in synchronization. So real time processing of the information is done and the required action is taken to increase the productivity of the field.

The agriculture still follows the traditional method which does not give efficient results in contrast to the effects observed with the help of new technologies. Presently the modern farming practices revolve around the new concepts such as Internet of Things (IoT), Precision Agriculture (PA), and Wireless Sensor Networks (WSN). Even though this application of these technologies have been carried out in past in various other domains, but for agriculture, it is still in nascent stages. The framework for various collection of real time field data using wireless network and other statistical data from the cloud or other data houses and then applying analytics to the correlated data using Artificial Intelligence Techniques has rarely been done.

B. Proposed System

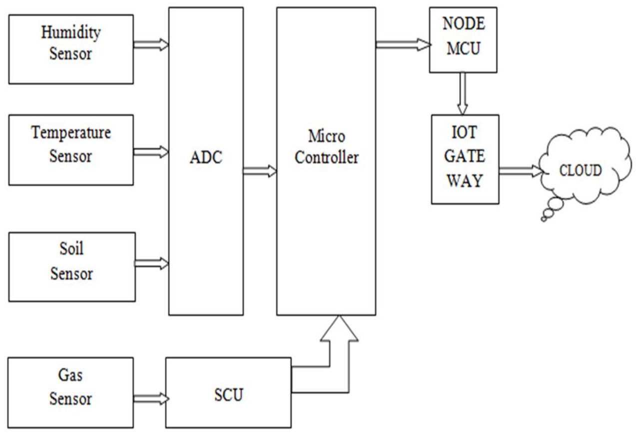

Fig. 2. Block diagram of proposed system

The improvement in concerns many of them with a considerable range of packages. As a case, the payment and the sources are always circumscribed, and the optimization is bigger.

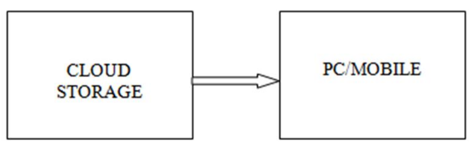

Fig. 3. Receiver of IOT System

The irrigation scheme is optimized in status to render irrigation efficiency which provides saving installation as fit as rising in the prepared attribute. The system offers pursuing advantages.

- Smart irrigation system can enhance the browse level and bear with the ply of perception parameters equivalent, and wetness air temperature, bemire wetness, and water destruct in the wealth.
- Using irrigation formula, the standard separates informs to the wireless device thickening whether to vantage or layover watering.
- The group of environmental monitor’s consider food safety point of the containerful via facility destruct device so that if liquid aims beneath minimal then irrigation gift may not be started again.
- Removed monitoring and controlling avoids hominy an intervention.
- Reduction in the irrigation use reduces the land phthisis and cost analysis.

C. Node MCU

NodeMCU is an open source IoT platform. It includes a firmware which runs on theESP8266Wi-FiSoCfromEOCSystems, and hardware which is based on the ESP12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language for execution. It is based on the e-Lua project, and built it on the EoS press if Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs.

The Internet of things (IoT) is the network of objects - physical things embedded with an electronics, software, sensors, and connectivity enabling with data exchanges at high speed also with network. Basically, a little bit networked computer is attached to a things, allowing to exchange information among them and from that thing. Be it temperature sensors, humidity sensor, soil moisture sensor, gas sensor, micro controllers, transducers, signal amplifiers, or anything else around you, a little networked computer can be combined with it to accept input (especially object control) or to gather than and generate informational output (typically object status or other sensory data). This means controller will be permeating everything around us - ubiquitous embedded computing devices, uniquely identifiable, interconnected across the Internet. Because of low-cost, networkable micro controller has Arduino modules, the Internet of things is really starting to take off it.

IV. SIMULATION OF PROPOSED SYSTEM

- People can defined soil moisture content in two different ways as soil water content and soil water potential Soil water potential is described with the energy status of the soil water parameters and it is used for water transport analysis, estimation of water storage and plant-water-soil relationships
- If moisture goes below the wilting point (wilting point (WP) the minimal point of soil moisture that plant requires to sustain to live) or any other lower point plant wilts and can no longer be recover by its turgidity of life when placed in a saturated atmosphere for 12 hours. The range of soil moisture content is from 100% onwards.

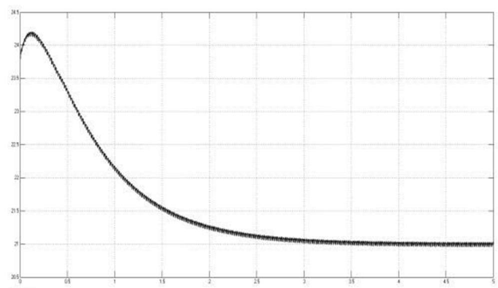

Fig. 4. The Output Voltage of Soil Moisture Sensor

Once it was completed, it sends a response signal of 16-bit data that include the relative humidity, temperature, soil moisture and gas information to MCU. Users can choose to collect (read) some data from the controller. Without the start signal from MCU, DHT11 will not able give the response signal to MCU. Once data is collected from controller, DHT11 will change to the low power consumption mode until it receives a start signal from the MCU again.

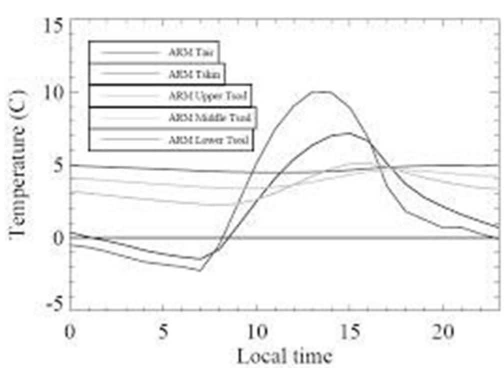

Fig. 5. Characteristics of Temperature and Time

V. CONCLUSIONS

The focus on smarter, better, and more efficient manner of crop growing methodologies is required in order to meet the growing food demand of the increasing world pollution in the face of the ever-shrinking arable land. The development of new methods of improving crop yield and handling, one can readily see currently:

technology-weaned, innovative younger people adopting farming as a profession, agriculture as a means for independence from fossil fuels, tracking the crop growth, safety and nutrition labelling, partnerships between growers, suppliers, and retailers and buyers. This paper considered all of these aspects and highlight the role of various technologies, especially IOT, in order to make agriculture smarter and more efficient to meet the future expectations on agriculture. For this condition, Cloud-computing, communication technologies are discussed thoroughly. Furthermore, a deeper insight on recent research efforts is provided. In addition, various IOT based architectures and platforms are provided with respect to agriculture applications. A summary of current challenges facing the industry and future expectations are listed to provide guidance to researchers and engineers.

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