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An Effective Smart Agriculture System using Internet of Things

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Abstract: ***Agriculture is the most important sector of economy, contributing major employment in the country and helping to develop the industry development with 16 percent of the national GDP growth and improving the life of people. Agriculture provides food, fiber, fuel, furniture, raw materials, a free fare and fresh environment, and plenteous nourishment for driving out starvation. But in the present scenario, the manual practices being followed by the farmers in our country are posing a huge threat to the sustenance of this sector. There is a need to incorporate automated system for various agricultural activities like irrigation, soil monitoring, harvesting and weather monitoring. Herein, we have created a Smart IoT based agriculture field monitoring and automatic field controlling agricultural storage system. The objective of any IOT system is to develop a smart automation system (smart home, smart IoT agriculture, smart monitor health, smart easy transport, etc.) using IoT technologies such as wireless sensors, embedded control devices and wireless communication protocols. We hereby present an IoT system interconnected with wireless devices which can sense the field and send the data to assigned system and finally the results can be noted with proper arrangements. Wireless sensors are used to sense the field and monitor the field with various aspects controlled manually and could be automated based on the requirement. In this paper we shall see that this IoT system shall not directly connect every device with the Internet but will connect through VPS integrated IoT Gateway. We propose a system that shall monitor and control the moisture level in the field soil and this real time data will be transmitted to the client to provide security for the farmland and avoid animal threats. The proposed smart IoT system will also monitor the growth of the trees.***

Keywords: ***IoT, communication infrastructure, field area network, monitoring and control, wireless sensor network.***

I. INTRODUCTION

Integrating IoT technology with farming practices to develop a smart farming system is the need of the hour to have a better yield and provide more benefit to the farmers in terms of ease of daily work as well as better market value of their higher quality products. IoT technology, in conjunction with wireless sensors can provide for a smart solution.

The Wireless sensor IoT network integrated with smart devices which contain power sources and organized by multi hop prototype network communications has to do with different applications in sensing the data, collecting information and applying the programs from perceived devices in the wireless sensor network area. It tends to be partitioned into earthbound WSN and underground wireless sensor networks (WUSN).

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The farming sensors are typically planted into soil with lower recurrence remote advancements which are increasingly chosen because of low weakening in WUSN. Furthermore, radio wire size and vitality utilization in WUSN is higher than earthbound WSN. With improvement of LPWAN, IoT may not require a work style WSN with power-based steering where one hub advances parcels of different hubs.

II. EXISTING RESEARCH ANALYSIS

Before beginning with our proposed system to incorporate IoT in agriculture, we shall study and analyze the present technique for monitoring and controlling fields, which is hereby presented in four steps.

A. IoT based smart farming system

IoT based smart farming system is developing aggressively since the expenses are very high on the grounds that IoT sensors are equipped on, for providing data about the horticulture fields. The IoT environment creates an innovation of connecting the multiple devices using the IoT platform. Observing ecological variables is the main consideration to improve the yield of the effective harvests. The Main sensor CC3200 chip will sense the temperature and dampness in the rural field. The customary technique for rural checking incorporates the accompanying advances that are represented in the following flowchart:

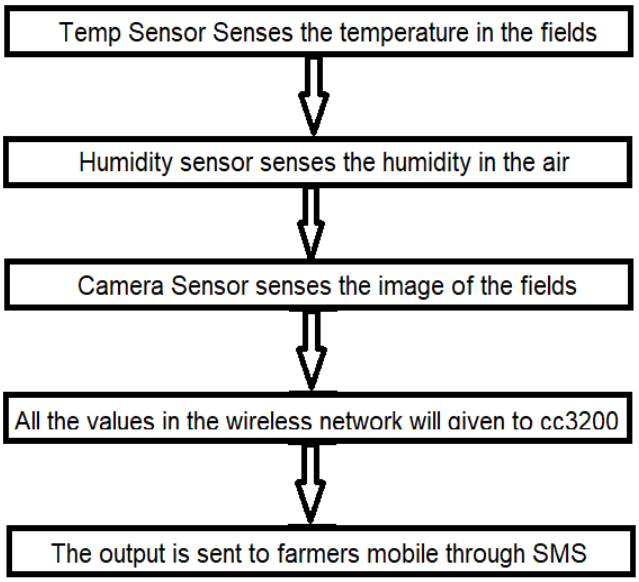

Fig. 1 IoT based sensing system in smart agriculture

In this framework, camera sensors are utilized to screen the field. However we can't detect the accurate moisture content in the soil, therefore water level isn't advanced.

B. Smart Farming System using sensors for rural errand mechanization.

The fundamental thought of this framework is to robotize the exercises of cultivating by utilizing the standard of mechanics; correspondence and hardware. Such a model gives the farming methodology a benefit to let go of manual practices and rely more on automation, thereby leading to a more efficient and easy to handle framework for smooth working. For this purpose, there are two modules - a brilliant homestead detecting framework and portable keen irrigator that proceeds over mechanical extension slider game plan. The Smart farm contains the optocouplers, dampness and spectroscopy sensors which calculate the power and estimated energy content which simulate the additional content in the yields. A crane contains the two basic identification sensors and the Smart irrigator is mounted on the top of the crane through which harvest development can be broke down. Sensors trigger the optocoupler associated with green fertilizer, seeds, manure and water compartment.

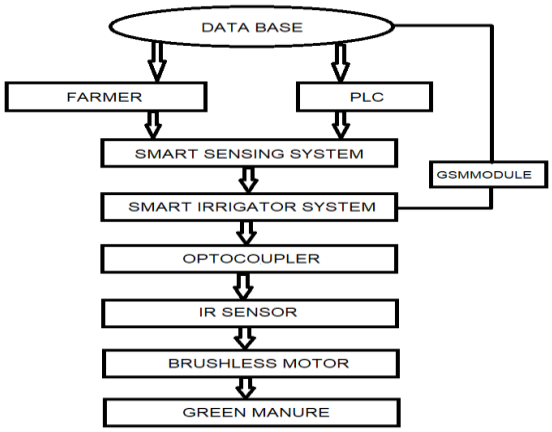

Fig. 2 Smart farming system using sensors

C. Automated control

The vegetable yield utilization in the sensor gathering information is sent to mobile phones and remote sensor systems for the interested farm. The infrastructure will give long benefit to the farmers to utilize the computerized automation. The construction of the framework has built up a system which contains the soil dampness sensor, air mugginess sensor and air temperature sensor. The water flow will be controlled through the sensors and the data is gathered and passed to the mobile phones. The system is controlled with a microcontroller and any changes on the system will immediately reflect the communication to all network devices. Finally, the naturally sent data to MCU will ready the Xbee system through sequential data.

D. Remote agribusiness robotization utilizing remote connection and IoT passage foundation.

The framework engineering for remote agribusiness process computerization, including sensors and actuators is associated with IoT door running OPC UA server. This methodology includes the benefit of advantageous conceivable outcomes to change control rules from cloud administration (introducing or designing procedure controller without refreshing mode of remote sensor/actuators). This examination spotlight is on the remote neighborhood organize reasonableness to server remote robotization task. The framework construct with conveying structure in between remote sensor and necessities of wireless configuration, partition of detecting/incitation gadgets from application control gadgets using OPC UA server based IoT door foundation .

III. PROPOSED FRAMEWORK

In the proposed framework, observing and controlling are done through sensors, for example, soil dampness sensor, PIR sensor, pH sensor, water stream sensor. To anticipate tress, a mouthpiece is utilized to record the sound of hatchet or different apparatuses utilized for cutting of trees. Here the data is transmitted through the Internet which is prepared by PIC16877 Microcontroller.

The final structure of the Internet method is a versatile technique for correspondence and sends the data through this method.

The working of this proposed system is as follows:

1. The system consists of soil moisture detecting sensor which senses and measures the moisture level in the soil.
2. The PIR sensor determines the structures with high recurrence formation.
3. The ph sensor and water stream sensor is utilized to streamline the manure utilization.
4. The information of the water level will be updated through the water siphon which is turned on at the field.

5G network has been defined with slicing IoT network technology with quality, speed and storage in developing service. Not only that but at radio/access level carriers must work to reduce device cost, energy consumption and increased reliability, coverage and spectrum efficiency. This is the key point that can implement the system in entire field. Since costing will be low we can easily implement the system in entire field and the system can update the details on the go in the field. This intelligent system tells about a field whether it is ready to harvest or not since the system is equipped with sensors which will monitor the field every day and update the status. The system has been integrated with a modem which can also be integrated with the output device.

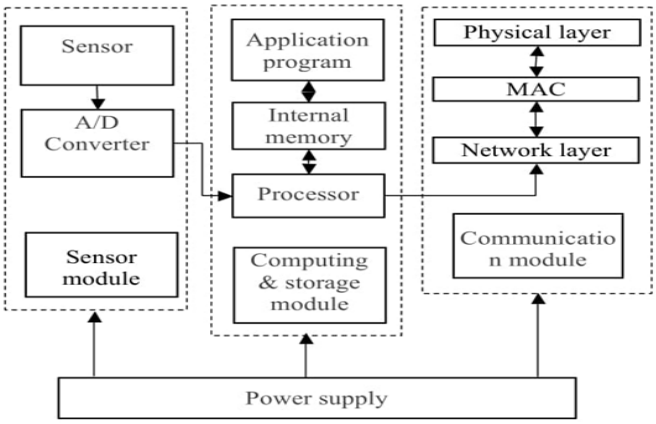

Fig. 3 Structure of sensor nodes

IV. WORKING METHODOLOGY

We hereby present the methodology of the working of our Smart IoT Agriculture system:

1. The Solar Panel is interfaced with the stepper water electrical motor when the smart system processor detects the solar energy in the Solar Panel in LDR.
2. Solar panel arm moves both sides around 180 degrees, which could help us use the sun intensity in battery.
3. The Humidity sensor senses the soil humidity in between 300 degree to 900 degree Celsius. When the soil moisture less than the 300 degree Celsius the Water Motor pump will electrically pump water in the field.
4. Temperature sensor will sense the temperature of the Smart IoT farm.
5. Rain sensor will be activated by rainfall. While the sensor is activated the irrigation system will be shut down in the event of rainfall.
6. All the data has been passed through the Internet forwarding strategy .When it's raining in the farm the water motor will stop pumping to the farm and inform the user through forwarding strategy technique.

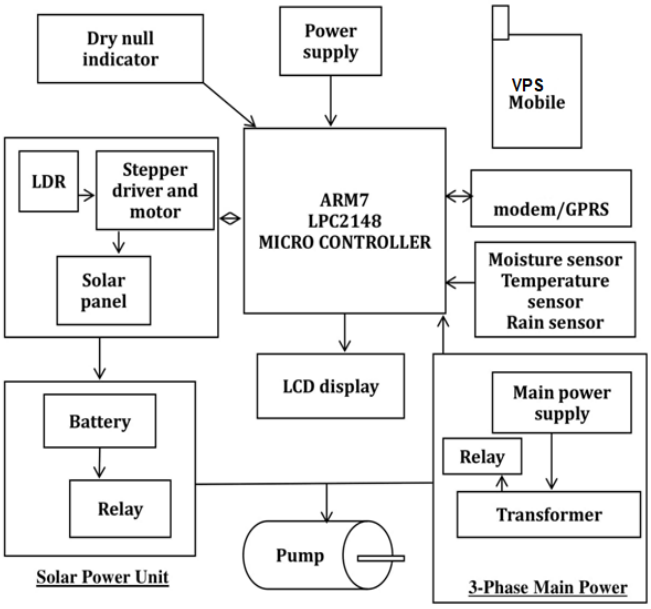

Fig. 4 Microcontroller block diagram

The created model is expected for the remote checking and control of a keen micro grid framework arranged in a field territory organization. The HTML website page was intended for the observing and controlling of different vitality sources.

V. ALGORITHM

The model uses IEEE 802.11 and IEEE 802.3 measures for observing and control. An Ethernet shield is utilized for correspondence among Router and the UI. A graphical GUI is contained with full power framework and area of the plane is effectively functioning with remote mode with communicating with all the devices and shared the data with neighborhood nodes and utilized with various resources. Consecutive needs were relegated to sources.

At first the framework takes a shot at a matrix. The heap will at that point be moved to sun powered and battery power dependent on the estimation of the limit current. The model speaks to an immediate current (DC) micro grid. It can work in both framework associated and island mode.

A limit of 254 gadgets can be associated and controlled in the system. Further expansion can be accomplished by utilizing distinctive system gadgets, for example, switches. A sequential terminal program has been utilized to catch constant information. Different cultivating apparatuses can be worked on any of the three vitality sources dependent on their heap serving capabilities. When the model is working on the nearby arrangement, the port can be sent for a WAN application. The planned model was tried on the created site. Smart Agriculture Enhancement System using IoT has the following flow of control:

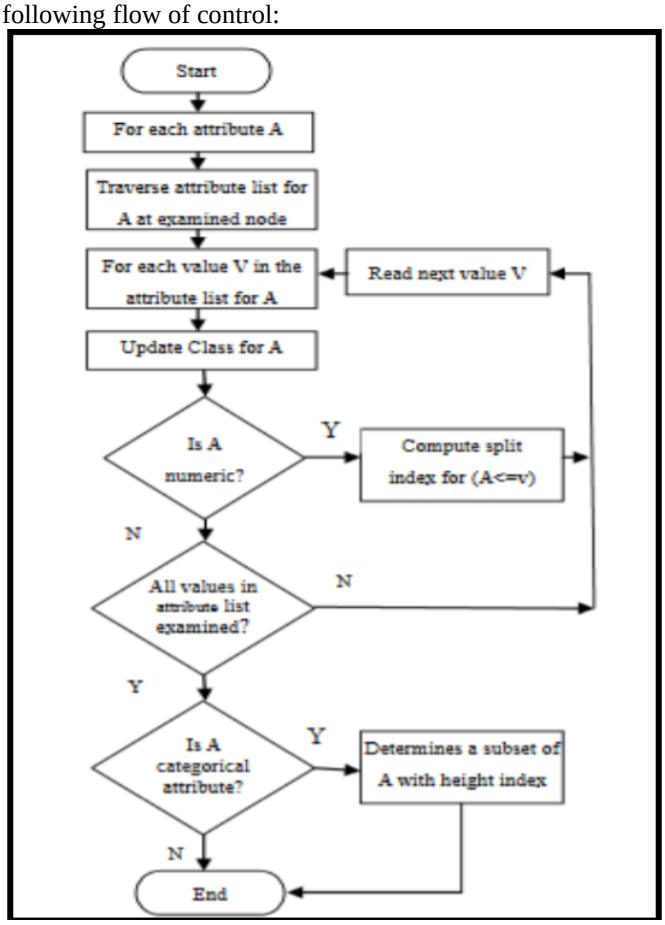

Fig. 5 Smart farming system algorithm flow

1. Check the nodes which are used in devices.
2. For each attribute, get the normal values as mentioned in the farm which have to be compared with movements of the farm.
3. Let there be an attribute 'a' with its information.
4. Start the decision node with the set of parameters of attribute 'a'.
5. The attribute 'a' and with its children's node attributes a obtaining the nodes as such.

VI. RESULT AND DISCUSSION

Machine Learning (ML) is a brilliant route for PCs to reproduce individuals' learning exercises, get new information, ceaselessly improve execution and actualize their very own flawlessness. As of late, machine learning has made incredible progress in calculation, hypothesis and applications and has been joined with other horticultural advances to expand harvest yield while limiting the information costs.

Machine learning innovation is assuming a significant job in harvest rearing, malady ID, irritation and ailment forecast, canny water system arranging and rural master frameworks. For instance, ML innovation can break down past farmland information, including the presentation of harvests under various climatic conditions and the legacy of a specific phenotype. Also, ML innovation can investigate the affiliation principles and after that fabricate a likelihood model to foresee which qualities are destined to take and in the process the character of the plant is reproducing the concept and interest rearing test. A strategy is made for distinguishing the development of a solitary flawless tomato-based ML which comprised of three stages: pixel-based division, mass based division and individual organic product location. In the initial two stages, choice trees were created dependent on highlights, for example, shading, shape, surface and size and picture divisions were directed utilizing the produced trees. The Smart IoT system will track the planet and measures the growth step by step and the data transferred to IoT control system .The microcontroller will identify entire the farm and tracking the planet with individual natural product in numerous details and the recognition image optimizing the crop rotation in the entire system of the planet. The pictures from the planet will notify the neural system and identifying the growth ness of the crop. The sensors are monitoring the seeds and sense the color, which clearly notify the stage of the seed. The color management states the seed stages which are classified green, yellow and red. These are the three colors that will specify the different stages of seeds.

VII. CONCLUSION AND FUTURE WORK

In this paper we have proposed an IoT based smart agricultural system using Internet of Things (IoT). After examining the ongoing research on smart farming, such as Internet of Things based monitoring system in agriculture, we have seen that a smart farming system using identified growth and vegetable crop (which uses VPS based smart phone), a wireless sensor network for smart farm and remote agriculture automation(using wireless network system with integrated IoT gateway) and named data networking forwarding strategy infrastructure, shall be an effective and well designed smart farming solution. Our proposed system is useful in monitoring and controlling the moisture level in the soil and this data can be transmitted to the client webpage through VPS IP address given the microcontroller which is connected to a live scenario of the fields. This is real time data and it provides security for the farmland and avoids the animal threats. The proposed smart IoT system will also monitor the growth of the trees.

Further, we can also see that there can be some future developments possible in this proposed system. These future developments are as given below:

- Irrigation system can also be monitored in the field.
- Vegetable damage caused by predators can be reduced.
- Wireless system can be integrated with Named Data Networking.
- Data forwarding strategy can be incorporated in the smart farming solution.

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Ms. Akanksha Gupta is working as an assistant professor in the department of Computer Science, University of Delhi and currently pursuing Ph.D in the area of Internet of Things, from Shri Venkateshwara University. She completed B.Sc honors in Computer science from University of Delhi in 2009 and MCA from Bharatiya Vidyapeeth college, Indraprastha University, Delhi in 2012. She has also qualified UGC NET in computer science in 2013. She has a teaching experience of over 6 years and has earlier published 2 research papers in reputed international journals and 2 chapters in edited books.

Dr. Priyank Nahar pursued his UG degree in Computer Applications(BCA). He followed it with MCA, M.Phil(CS), Ph.D(CS). He has over 14 years of teaching experience. He worked as a corporate trainer in companies like Hewlett Packard and Integer software, Bangalore. He has attended more than 5 FDPs/seminars and conferences. He has written 5 research papers in international and national journals. He has also authored 13 books on paper solution series along with a book on VB.Net for BCA students. Currently, he is associated with MCA department as an Associate Professor.