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A Sensor-Based IOT For Precision Agriculture

Muthukumarasamy.S
Associate Professor
S.A.Engineering College

Balakrishnan.C
Associate Professor
S.A.Engineering College Chennai

Anusha.P
B.E.(CSE) Student
S.A.Engineering College Chennai

Neena.S
B.E.(CSE) Student
S.A.Engineering College Chennai

Abstract-Internet is experiencing a completely explosive boom these days with the quantity of the gadgets connecting to it. Earlier we had the simplest non-public computers (PCs) and Mobile handsets linked to the internet however now with the Internet of Things i.e. IoT concept of connecting matters with the internet; hundreds of thousands of devices are connecting with it. This improvement of IoT results in the concept of device-to-device communication this means that machines can talk to every different and additionally all of the statistics which changed formerly with personal servers can now be had on the net so the person can get right of entry to it remotely. Application of IoT is possible in nearly all industries especially wherein the velocity of communication isn't always an issue. Precision agriculture is essentially an idea that insists to offer a proper quantity of assets at and for a specific period. These assets may be any matters which include water, light, and insecticides. To put into effect precision agriculture the advantages of IoT have been applied inside the proposed paper. The essential concept is to feel all of the required parameters from the agriculture area and take the required choice to govern the actuator. These agriculture parameters are Soil Moisture, Temperature & Relative Humidity around the plant, and rain sensor. Based on the analysis sensed through the sensor appropriate motion is taken irrigation valve is actuated primarily based totally on soil moisture readings, the valve for fog is actuated primarily based totally on the Relative humidity(RH) readings, etc. At the pinnacle of that sensor nodes also can send these statistics to the cloud.

Keywords - Precision Agriculture, IOT

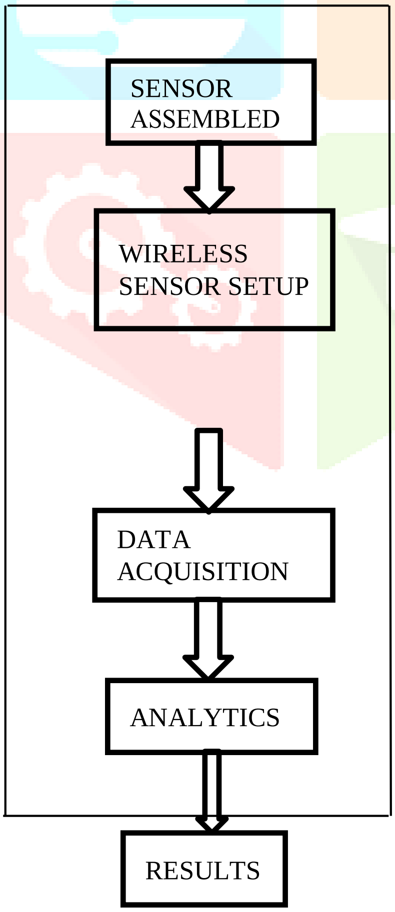
I. INTRODUCTION

The agriculture sector is the primary pillar of the economy of many countries and it deserves technological amelioration within a shoestring budget. Internet of Things (IoT) offers a new dimension in the major health monitoring of soil leading toward smart agriculture and farming. The amalgamation of traditional farming methodology with advanced sustainable agriculture. With this rationale, we have designed and developed an IoT enhanced device – FarmFox, which can

Analyze the sensed information and transmit it to the user via the internet. In comparison to the existing IoT drove agricultural solutions, FarmFox thrives in real-time data collection, soil health monitoring via in situ analysis, and controlling the whole architecture from a remote location. The production or cultivation of useful crops in the ecosystem produced by the people is known as agriculture. From another point of view, the farmers are the ecosystem engineers who find new ways of cultivating crops. The water management practices are also adopted by many villages which provided water for drinking and other purposes in the dry season. At present time, Indian agriculture still faces the challenges: Dependence on monsoon, fragmented land farming, and holding, traditional farming practices, poor infrastructure in rural areas, and less usage of technology applications. The advancement in technology will help farmers increase crop gain. IoT will be applied in different areas, e.g. smart cities, agriculture, energy, environment protection, health, and home automation. The applications of IoT-based smart farming not only target conventional, large farming operations but could also be new to uplift other growing or common trends in agriculture like organic farming, family farming (complex or small spaces, particular cattle and/or cultures, preservation of particular or high-quality The new concepts in the technologies nowadays are (i)Internet of Things (IoT) (ii) Wireless Sensor Network (WSN) (iii)Precision Agriculture (PA).In precision agriculture, a key component is the use of IoT and various items like sensors, control systems, robotics, autonomous vehicles, automated hardware, and variable rate technology. More recently, the advent of aerial imagery systems, such as drones, has enabled farmers to get richer sensor data from the farms. Drones can help farmers map their fields, monitor crop canopy remotely, and check for anomalies. Over time, all this data can indicate useful practices in farms and make suggestions based on previous crop cycles; resulting in higher yields, lower inputs, and less environmental impact. Considering the limitations of Wireless Sensor Networks (WSN) and drone use in precision agriculture the design and operation of a telemonitoring system for precision farming is mainly based on the use of IoT platforms.

II. FRAMEWORK

The main aim of this study was to predict the apple scab which is the most common disease in apple crop. In this problem, we used the real- time data of wireless sensor/IoT nodes as input for the linear regression model. In this, an application is developed for farmers which is simple and user-friendly to inform them about the status of their apple orchards on a real-time basis. The framework consists of some WSN/IoT nodes scattered in the orchards of the apple with the nearby gateway for collection of the data from the mesh of the nodes while performing the research on the said problem various steps have come in the way that forms the basis of our study. The nodes are in the apple orchard for data collection. A network is established between the nodes, data acquisition is done by the nearby gateway or a fog node from a prefixed number of nodes in the network. The data analysis is done on a real-time basis for each location/orchard for quick action if needed.



III. SENSOR / IOT NETWORK SETUP

A. ARDUINO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Can read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low-cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, and musicians and artists use them for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone - children, hobbyists, artists, programmers - can start tinkering just by following the step-by-step instructions of a kit, or sharing ideas online with other members of the Arduino community.

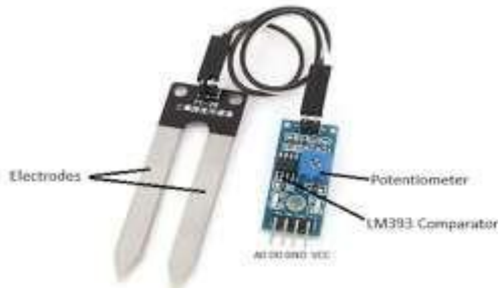
There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX- 24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap them up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantages for teachers, students, and interested amateurs over other systems.

B. DHT11 SENSOR

DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability, and cost-effectiveness. Each DHT11 element is strictly calibrated in the laboratory which is extremely accurate in humidity calibration. The single-wire serial interface makes system integration quick and easy.

C. SOIL MOISTURE SENSOR

The sensor can be used to test the moisture of soil, when the soil is having a water shortage, the module output is at a high level, and else the output is at a low level. By using this sensor one can automatically water the flowering plant, or any other plants requiring an automatic watering technique. Soil moisture sensors measure the volumetric water content in the soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. Module triple output mode, the digital output is simple, analog output more accurate, serial output with an exact reading



D. RAIN DETECTION SENSOR

A YL-83 Rain Detector OR RAIN SENSOR is one kind of switching device which is used to detect rainfall. It works like a switch and the working principle of this sensor is whenever there is rain, the switch will be normally closed. Nowadays, conserving water as well as its proper usage is essential in everyone's life. Here is a sensor namely a rain sensor which is used to detect the rain and generate an alarm. So, we can conserve water to use it later for different purposes. There are several methods available for conserving water like harvesting, using this method we can increase the level of underground water. These sensors are mainly used in the field like automation, irrigation, automobiles, and communication. This article discusses a simple as well as reliable sensor module which can be available at a low cost in the market

E. MOTOR DRIVER IC:

Common DC gear head motors need a current above 250mA. There are many integrated circuits like ATmega16 Microcontroller, and 555 timers IC. But, IC 74 series cannot supply this amount of current. When the motor is directly connected to the o/p of the above ICs then, they might damage. To overcome this problem, a motor control circuit is required, which can act as a bridge between the above motors and ICs (integrated circuits). There are various ways of making an H-bridge motor control circuit such as using transistors, relays, and using L293D/L298.

F. WATER PUMP MOTOR

GENERAL DESCRIPTION

As the name implies, water pumps pump water. Whether that is in a vehicle, at a business, in the home, or a well, shoppers can probably find a water pump to fit their vehicle or to help them draw water from the ground in a self-dug well to be used in pressure tanks within the location. Vehicle water pumps help regulate the flow of water through a vehicle's cooling system; when the seal on these goes bad, the whole pump must be replaced. Located within the home or business, pressure water pumps regulate the water pressure year- round, controlling water flow to different areas of the location.

PRODUCT DESCRIPTION

A pump motor is a DC motor device that moves fluids. A DC motor converts direct current electrical power into mechanical power. DC or direct current motor works on the principle when a current-carrying conductor is placed in a magnetic field; it experiences a torque and tends to move. This is known as motoring action. Pumps operate by some mechanism (typically reciprocating or rotary) and consume energy to perform mechanical work by moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps.

IV. INTERNET OF THINGS

The internet of things (IoT) is the network of physical devices, vehicles, buildings, and other items embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on the Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society. The IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems and resulting in improved efficiency, accuracy, and economic benefit. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation, and smart cities. Each thing is uniquely identifiable through its embedded computing system but can interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of almost 50 billion objects by 2020.

V. WORKFLOW

Arduino MEGA microcontroller is used to interface with the sensors and the communication devices. The temperature sensor and humidity sensor are used to monitor the weather condition in the agriculture field area. The soil moisture sensor and rain sensor are used to monitor the soil moisture and rainfall. The LCD is used to display the updated value from the sensors. The IoT module ESP8266 is used to update the information of sensors to the cloud. The result can be monitored on a webpage. The water pump motor is activated based on the soil moisture level by automated or manually controlled from the webpage.

VI. SUSTAINABILITY OF FARMFOX SYSTEM

Sustainable and precision agriculture conforming to Agriculture 5.0. It is important to delve into the sustainability aspects of the developed FarmFox system. We are presenting a qualitative sustainability analysis of FarmFox, following the footsteps of contemporary literature which discusses technical models in securely saving the energy resources in smart villages and smart cities using sustainable IoT devices.

A. Environmental Sustainability

The utilization of solar power is certainly a greener approach. This will reduce the carbon footprint of Farmfox during utilization, compared to others. Since FarmFox measures the turbidity of the water above the soil, it also helps control water usage for the field. This reduces the usage of excess water in the field, compared to other devices, and this will result in a positive water footprint.

B. Economic Sustainability

FarmFox uses Arduino-based hardware instead of Raspberry Pi. Hence, the device is inherently cheap. As a result, the initial investment for installing the system is less compared to other

Contemporary precision agriculture systems. There is always a 'Cost of Quality. FarmFox is built using quality components, but everything has a lifespan. So far, a FarmFox device can operate flawlessly for 3 years, which reduces any maintenance cost. FarmFox will enhance the yield of the crop. More yield means more business. Hence, the farmer will be economically benefitted as well, together with an accelerated Return on Investment (RoI).

C. Social Sustainability

FarmFox can be well implemented and expanded among urban farmers and hydroponic farmers. Hence, the device serves its intended purpose for different layers of people in society, irrespective of their social background. Rooftop farming or gardens, organic farming urban farming, etc. will get a boost which will ultimately benefit society.

VII. FUTURE ENHANCEMENTS

In the future, we would add the camera technology to interface with the controller to get live stream updates through IoT. And we also introduce different machine learning and deep learning technique to predict crop fields.

VIII. CONCLUSION

Developed an IoT-based automated soil health monitoring system, equipped to deal with agricultural parameters. Farmers will be able to integrate different field parameters to take smart decisions according to the situation. FarmFox can be directly connected to the cloud and is capable of remote data storage/retrieval facilities. This work can further be extended to incorporate AI /machine learning algorithms to help the agro-scientists and farmers taking smarter decisions and strategy formations toward Agriculture.

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MUTHUKUMARASAMY.S is a Ph.D. scholar in the Department of Computer Science and Engineering at Anna University. He is currently an Associate Professor at S.A.Engineering College, Chennai, India. He received his M.E degree in 2011 at Sri Krishna Engineering college and B.E. degree in 2005 at E.G.S Pillay Engineering College. His area of interest includes Mobile Computing, Wireless sensor Networks Information Security.

Mr.C.BALAKRISHNAN received his M..E Degree from Anna University, Chennai, Tamil Nadu, India. He is currently an Associate Professor at S.A.Engineering College, Chennai, India. He is pursuing his Ph.D degree in Information and Communication Engineering from MIT, Anna University.

ANUSHA.P is a B.E. scholar in the department of Computer Science and Engineering at S.A.Engineering College. She received is DCE diploma in 2015 at Murugappa Polytechnic College. Her area of interest includes artificial intelligence and Robotics. Subject knowledge in Digital Principles and Systems Design, Microprocessor, and Microcontroller.

NEENA.S is a B.E. scholar in the department of Computer Science and Engineering at S.A.Engineering College. She received is DCE diploma in 2015 at Murugappa Polytechnic College. Her area of interest includes artificial intelligence and Robotics. Subject knowledge in Digital Principles and Systems Design, Microprocessor, and Microcontroller.