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CONTINUOUS MONITORING OF CONSERVATORY USING IOT AND CROP RECOMMENDATION USING AI/ML

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***Abstract*: India 's agriculture contributes about 70 percent of the Indian economy. Management of natural resources such as land, energy and resources needed to grow crops. Natural factors such as temperature, soil moisture and natural light cannot be controlled by the farmer, these factors determine the yield of the crop. Today water scarcity is considered to be a major concern for the planting process. Farmers do not get the highest quality and quantity of crop production. As well as major losses during heavy rainfall or drought conditions. Farmers leave the area to do various jobs. And selling properties for commercial purposes. This affects the economy.**

The AI / ML model we are developing will work 24/7 to overcome the problem of climate support in crop production, also to assess soil fertility, and to insist that the same plant continue or crop change or use fertilizer. maintaining soil fertility. If necessary, the farmer can visit the field to check if the setting is working properly. In an emergency or problem an alert message via mobile app is sent by the farmer. To take additional steps to fix the problem.

I. INTRODUCTION:

A conservatory system is usually made of glass, designed to provide a safe and environmentally friendly environment for growing plants in the house. In order to achieve the highest quality and quantity of product, proper management and collection of environmental data for the conservation system is required. Practicing plant monitoring is a laborious and time- consuming process.

The proposed conservatory system is an application that reflects the concept of the Internet of Things and involves the monitoring and control of the universe within the conservatory system, which directly or indirectly controls plant growth as well as its production.

The system, designed specifically, aims to remotely monitor and control the conservatory system using temperature sensor, light sensor, soil moisture, water level sensor and actuators using a custom webpage.

In addition, real-time representation of audible data is clearly planned and stored for further recognition and further analysis, which reflects the concept of cloud instruments.

MOTIVATION:

According to the traditional Agricultural system, the farmer should visit the farm and check that the crop is growing properly or not, and irrigate the crop bed if necessary. They usually do this, but various environmental parameters such as temperature, humidity, light and soil moisture may affect plant growth. Heavy rain, drought zone will contribute to huge losses for the farmer. These problems have prompted us to build automation in the greenhouse (growing area) which is a way for the farmer to automatically monitor and control the environment of the conservatory system anywhere in the world at any time. The automatic
system enhances plant growth rate. And a guaranteed harvest even in the event of heavy rain or drought.

RELATED SURVEY PAPERS:

Author: Shibin David1, *, R.S. Anand2, Martin Sagayam3.
Title: "Enhancing AI based evaluation for smart cultivation and crop testing using agro-datasets". In this paper, the nature of the work to sense various factors such as atmospheric temperature,
soil moisture, rain, and pH value through a GSM module. Using the aforementioned factors, the farmers and landlords can able to predict how much water is required for the land and how much nutrients required for land. The technological advancement in artificial intelligence paves a way to detect the sensed values and predict whether a crop could be

planted on the soil present in a region.

Author: Atia sultana, Md. Abul Hasan, Tajim Md. Niamat Ullah Akhund.
Title: "An approach to Create IOT based Automated Smart Farming System for Paddy Cultivation".
IoT smart farming very useful for farmers .it collects different data from different sensors. As a result, the farmers can easily make any decision. The IoT smart farming receives data through various sensors (water level sensors, moisture sensors, humidity sensors) based on which the automatically is turned on the motor, through which we can prevent power outages and water wastage.

Author: Jayalath Ekanayake, LuckshithaSaputhnthri
Title: "E-AGRO: Intelligent Chat-Bot. IoT and Artificialindustry".
Contribution of this paper is on developing a web based interactive and intelligent chat-bot for farmers to discuss their issues.
Further,this project implements a chat from to interact with peers and share their knowledge and experiences. As the internet infrastructure and mobile technology are rapid by developing these systems at any where, anytime and from any device.

Author: Jash Doshi, Tirthkumar Patel, Santosh kumar Bharti*
Title: "Smart Farming using IoT, a solution for optimally monitoring farming conditions" .
The latest developments made make the farming optimistic, aad also make it cost efficient for the farmers and reduce crop wastage. This paper is more related to our project aim as the product that we are developing assist farmers by getting the real time data like temperature, humidity, soil moisture content.

Author: M.W.P Maduranga Ruvan Abeysekera IIC University of Technology IIC University of Technology No 650, NR2, Phnom Penh, Cambodia No 650, NR2, Phnom Penh, Cambodia **Title: "**machine learning applications in iot based agriculture and smart farming: a review".
IoT-ML has become evolution to getting very good crop yields in Smart farming and agriculture.
Allowing ML algorithms to train the datasets and making to allow inputs and generating outputs. They study and analyze existing ML applications in agriculture, from process to results, each with its own strengths and weaknesses. The ml algoritm is trained using the real time datasets.
Usage of sensor data and feeding it as input to the ml algorithms Artificial intelligence system provide suggestions about the crops

EXISTING SYSTEM:

- There is a clever farming method, but it has a few drawbacks such as high investment and these farming methods have individual sensors that work like irrigation management, artificial sunlight etc.
- As usual farmers in the fields will depend on natural temperatures, humidity, rainfall, light for planting crops.
- They should visit the garden and water the beds by hand and should take care of the garden without using technology in the normal way. This task is a bit difficult and takes more time to produce.

IoT Smart technology empowers new digital agriculture. Today technology has become a necessity to meet current challenges and several sectors are using the latest technology to perform their tasks automatically. Intelligent farming, based on Internet of Things (IoT) technology, is thought to have enabled producers and growers to reduce waste and improve productivity by improving the use of fertilizers to increase crop efficiency. IoT-based Smart Farming provides better control over farmers with their livestock, growing crops, cutting costs, and resources.
The world's population reached 6.60 billion in 2000 but is expected to grow to 9.32 billion by 2050. Therefore, it is necessary to increase the yield on limited farms.
IoT smart farming is a high-tech system for growing crops clean and sustainable due to their abundance. Modern Information and Communication Technology is used in agriculture.

SMART FARMING: The impact of IoT on Agriculture:

- Automatic adjustment of farming equipment made possible by linking information like crops/weather and equipment to auto-adjust temperature, humidity, etc.
- In large farmland, IoT equipped drone helps to receive the current state of crops and send the live pictures of farmland.
- Analyzing farmland from the land using IoT based Smart Farming Solutions you will know the current situation of fields and crops in.

ACCORDING TO STUDIES:

- 86% of the studied farmers use some kind of "precision farming".
- 95% acknowledged that "precision farming" is very helpful to use.
- 70% plan to expand their usage of "precision farming technologies & quot;.

BUSINESS CHALLENGES FOR BUILDING THE INTERNET OF THINGS PLATFORM:

- A unified solution which can be integrated with different types of IoT devices.
- The most common challenge for the Internet of Things in agriculture is connectivity. Every area doesn't have

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proper internet connectivity.

- The second most common challenge for IoT based Smart Farming is the lack of awareness among consumers.
- Due to various service providers, it becomes really difficult to maintain interoperability between different IoT systems.
- A scalable solution that can be integrated with thousands of IoT devices for largefarms.

FURTHERMORE:

- **Deteriorated quality of thesoil.**

Excessive use of synthetic fertilizers, pesticides, and pesticides has resulted in a dramatic decline in soil fertility. Soil quality has decreased, leading to a decline in growth rates in all crops. This results in increased demand for synthetic fertilizers, pesticides, and pesticides.
Which is more, when chemical fertilizers are used in agriculture, they seep into the soil and pollute any water sources found nearby.

Climate changes
Demand for increased agricultural production leads to increased demand for agricultural land. Forests are being cleared for land use. Lack of natural cooling materials leads to increased temperatures, which have a negative impact on humans, but to a large extent has an effect on plants and their growth processes.

- **Increased consumption of natural resources**

The agricultural sector consumes a lot of natural resources, and water as well as iron and fuel for agricultural machinery are few.

- **Carbon footprint**

Deforestation for the sake of sourcing farming land has another negative consequence: the carbon in the atmosphere cannot get consumed.

- **Decrease in biological diversity**

The deforestation also means killing a wide range of plants and decrease in the biological diversity. This, in turn, seriously impacts the flora and fauna in the deforested region.

WAYS OF FARMING:
What is natural farming?
Organic farming is an agricultural practice that mimics the natural system. It can be interpreted in many ways, and the word "nature" is inadvertently used in many places, so the concept of organic farming can be misinterpreted. Also known as Organic Farming, do nothing Farming or No till Farming.
The most important aspect of organic farming is to take the environment into account as much as possible. No till, farm biodiversity, integration, symbiotic farm parts, and land cover protection are all included in this management process.
The emphasis on land ownership has created problems with organic farming, such as no- till farming. The phrase "do nothing in agriculture" was coined because the farmers were considered mediators and the actual work was done on their own. Therefore, while much to think about the performance of organic farming, the actual work and performance seems to be up to 80% less than other farming programs.
Organic farming is commonly known as "doing nothing & quot; farming by farmers. Organic farming is a cultivation method with no side effects.

Is natural farming realistic?
In the production process, there is no way to always need additional resources from Earth to replace. Our advanced science and agricultural sector clearly show that industrial agriculture is irrational and totally ridiculous.
There is no system around it, and technology and innovation cannot be achieved through biological reality. No farm can sustain the planet based on pollution or pollution. Remove instead of activating Earth's habitat and resources. Now let's learn more about the practices and principles of natural farming.

Difference between natural farming & organic farming
The important differences between natural farming & organic farming:
Cost: Organic farming is more expensive than natural farming because it requires the use of large amounts of organic fertilizer and fertilizer on land purchased from vendors.

Effort: Organic farming requires activities such as mixing fertilizers and compost, cultivating, and overturning, while natural farming does not require cultivating, overturning, or fertilizer. "In natural farming, the decomposition of organic matter by microorganisms and earthworms is promoted on the soil surface itself, and nutrients are gradually released to the soil."
Environmental impact: Organic farming affects the environment, but natural farming does not. It is consistent with the biodiversity of the region.

II. PROPOSED SYSTEM:

The AI/ML Model that we are developing will be working 24/7 to overcome the problem of climatic support for growing crops, also considers the soil fertility, and insist whether to continue with same crop or to change the crop or to use the fertilizer to maintain the fertility of the soil. If needed farmer can visit the field to check if the setup is working fine. In case of any emergency or problem alert message via mobile app is sent to the farmer. So that further

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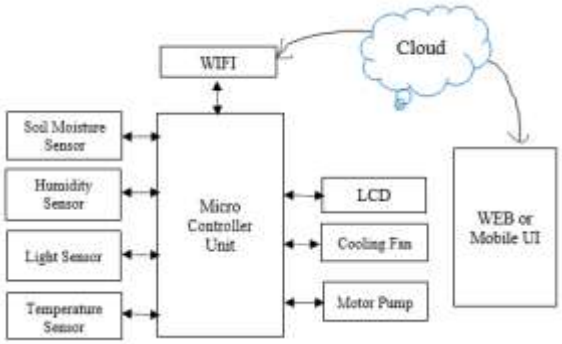
actions can be taken to fix the problem.
We have divided the project into four modules.
Module 1: IoT module.
Module 2: Mobile app development module.
Module 3: AI/ML module.
Module 4: Web development module.

Module 1: IoT Module.
Used sensors like LDR sensors, soil moisture sensor, DHT Leve; ESP 01 WIFI module, ESP 8266 microcontroller, LCD, and LED displays.

Working:



- AllthedatafromthesensorsarepassedtotheMicroController,andArduinocodethatwe have developed is stored in Micro Controller, which takes input from sensors andperform appropriate actions. Actions can be, if the temperature is high in conservatory setupmade, micro controller turn on Cooling Fan. or if temperature is low turn on artificialsunlight.
- Thedataisstoredincloud,thedatafromthemicrocontrolleri sstoredincloudusingWIFI module.

Module 2: Mobile App Module.
- Mobile App is developed using Kodular Creator.
- The Temperature, Humidity values will be displayed, real time changes of them will be updated.
- Also shows the current status devices, sensors used in conservatory.
- The devices can be controlled manually, like turn on/off cooling fan, artificials unlight etc.
- Simple UI to easily use app for the farmers.

Module3: AI/ML Module.
- Two model 1. Crop recommendation model, 2. Plant disease detection.
- The tested soil data (fertility tested data) from government is given as the input to the system, the system recommends the next crop that can be grown in the crop field.
- Farmer captures the image of the diseased plant, uploading image to the machine learning model, the model processes the image and detects the disease of the image. Cure of the disease is also given.

Module4: Web Development Module.
- Chatbot or Help-bot is a helpful chatbot for the farmer to clear their doubts, or to solve the problem related to the conservatory setup.
- Problems like trouble in uploading the image to the mobile app.

III. OBJECTIVES:

We collect data from the sensors and try to control environmental factors such as temperature, water moisture content in the soil and light using IoT.
Create an app with basic and easy to use user interface for the farmers to visualize thein formation from the monitoring system which can be accessed from the cloud. In case of anomaly function from the setup is notified via alerts.
We collect the soil fertility data and predict which crop can be grown next, or if the soil fertility is low then recommend which soil fertilizer can be used to enhance the fertility using AI/ML
We develop a simple website to get a suggestion to proceed with which crop to be grown next, or which fertilizer to be used to increase the soil fertility if it is low.

REQUIREMENT SPECIFICATION
LDR: (Light Dependent Resistor):
An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits.

Light Dependent Resistors (LDR) are also called photoresistors. They are made of high resistance semiconductor material. When light hits the device, the photons give electrons energy. This makes them jump into the conductive band and thereby conduct electricity.

SOIL MOISTURE SENSOR:

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Soil moisture sensors measure the volume of water in the soil. Since a precise gravimetric measure of free-soil moisture requires removal, drying, and weight of the sample, soil moisture sensors measure water volume indirectly through other soil sources, such as electricity resistance, dielectric constant, or interaction. neutrons, as are presentative of moisture content.
A fork-shaped probe with two open conductors, acts as a flexible resistor (like a potentiometer) whose resistance varies depending on the water content in the ground.
This resistance goes hand in hand with soil moisture. Too much water in the soil means better conductivity and will lead to lower resistance. Low ground water means poor mobility and will create high resistance. The sensor generates an output voltage according to the resistance, which by measurement is able to determine the humidity level.

DHT11:

1	Vcc	Power supply 3.5V to 5.5V
2	Data	Outputs both Temperature and Humidity through serial Data
3	NC	No connection hence not used.
4	Ground	Connected to the ground of circuit.

The DHT11 is a commonly used Temperature and humidity sensor that comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data.

Specifications:
- Operating Voltage: 3.5V to5.5V
- Operating current: 0.3mA (measuring) 60uA(standby)
- Output: Serial data
- Temperature Range: 0°C to 50°C
- Humidity Range: 20% to90%
- Resolution: Temperature and Humidity both are16-bit
- Accuracy: ±1°C and±1%

WIFI Module ESP 8266 - ESP01:

The ESP-01 ESP8266 Serial WIFI Wireless Transceiver Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre- programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost-effective board with a huge, and ever growing, community.

Specifications and Features:
- 802.11 b/g/n
- Wi-Fi Direct (P2P),soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLLs, regulators, DCXO and power management units
- +19.5dBm output power in 802.11bmode
- Power down leakage current of <10uA
- 1MB Flash Memory
- Dimensions: 25 x 15 x 11 mm(LxWxH)
- PCB Thickness: 1mm
- Weight: 2gm
- Integrated low power 32-bit CPU could be used as application processor
- SDIO 1.1 / 2.0, SPI,UART
- STBC, 1×1 MIMO, 2×1MIMO
- A-MPDU & A-MSDU aggregation & 0.4ms guard interval
- Wake up and transmit packets in <2ms
- Standby power consumption of < 1.0mW(DTIM3)

CH340 NodeMCU V3 Lua:

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Node MCU is **an open-source Lua based firmware for the ESP8266 WIFI SOC from Espress if** and uses an on-module flash-based SPIFFS file system. Node MCU is implemented in C and is layered on the Espress if NON-OS SDK.

1. Uses CH340G instead ofCP2102.
2. Wireless 802.11 b/g/n standard
3. WIFI at 2.4GHz, support WPA / WPA2 security mode
4. Support STA/AP/STA + AP three operating modes
5. Built-in TCP/IP protocol stack to support multiple TCP Client connections (5MAX)
6. Support UART / GPIO data communication interface
7. Remote firmware upgrade(OTA)
8. Support Smart Link Smart Networking
9. ESP8266 has IOP in
10. Don't need to download resetting
11. A great set of tools to develop ESP8266
12. Lowest cost WI-FI
13. FOR Arduino like hardwareIO
14. Greatly speed up your IOT application developing process
15. Open-source, Interactive, Programmable, Low cost, Simple, Smart, WI-FI enabled
16. WI-FI MCU ESP8266 integrated and easy to prototyping development kit.
17. We provide the best platform for IoT application development at the lowest cost.
18. NodeMCU has built-in USB-TTL serial with super reliable industrial strength CH340Gfor superior stability on all supported platforms.
19. Advanced API for hardware IO, which can dramatically reduce the redundant work for configuring and manipulating hardware.
20. Event-driven API for network applications, which facilitates developers writing code running on a 5mm* 5mm sized MCU in Node js style.

IV. METHEDOLOGY:

PROBLEMS IN AGRICULTURE:

- Nowadays water scarcity is considered to be major concern in the cultivation process.
- Agriculture is considered as the backbone of the country where 70 percent of the economy relies upon it. An astonishing factor is that 60 percent of the water diverted or pumped for irrigation is wasted via runoff into waterways or evapotranspiration.
- Farmers not getting high quality and quantity of crop production. And having huge losses during Heavy rain or drought conditions.

V. CONCLUSION:

Agriculture has the industry occupancy in India. Most of the rural people is dependent on agriculture and some are getting better yield depending on the environmental factors which contribute most to the best yield but in drought conditions or heavy rains even the good places that are well fitted for growing crops will also face problems.
So, the proposed system will make the environmental factors stable make it best place to grow crops.

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