Empowers And Elevates Farmers And Protect Important Natural Assets In Agriculture Sector Using AI And Iot

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Abstract: This paper aims to improve the overall performance of the agricultural sector. Currently, the agriculture sector in India is facing a lot of issues due to the lack of proper implementation of automated systems. However, in this paper, we are aiming to advance the overall agriculture sector with the help of Artificial Intelligence and the Internet of Things. In this paper, we emphasized on various problems faced by farmers and automate it by taking into the weather conditions. When it comes to automation, AI and IoT top the list. In technical evolution Internet of Things is the mother of automation. IoT helps us in many areas where automation is required and agriculture is one of the most important sectors in India. With the help of automation in the agriculture sector, we can advance and automate various things.

Index Terms: Automation, Sensor

I. INTRODUCTION

This paper solely focuses on making the agricultural sector automated with the help of AI & IoT. Through analyzing the different conditions like soil moisture, climate & water availability, we are trying to make agriculture effective and productive. This paper not only empowers and elevates farmers but also helps protect important natural assets. There is no certainty in the agriculture sector and there is no assurance that crops will be safe and farmers will benefit from it. Instead of farming as the primary occupation, many farmers grow alongside other occupations. The period these farmers are able to dedicate to these crops is very low in their busy schedules. This initiative is partly inspired by an automation system for these farmers that aim to solve all the above problems, saving time, power, money and workforce. The essential goal of this paper is to help farmers to automate the farming process with the help of AI and IoT.

II. METHODOLOGICAL APPROACHES

This paper involves the introduction of crops that are best suited for production in a specific agricultural area after understanding the geo location weather and climatic conditions. The above assessment includes various artificial intelligence techniques. The plan also provides for an integrated water management system [7] after constant monitoring of the soil condition throughout the production. Including soil, parameters like temperature and humidity. All these sensor values are collected and transferred to a Raspberry Pi, which has an Apache web server, using Arduino's UNO or custom MEGA. Raspberry Pi also has a friendship repository and a list of containers. The ZigBee module provided communication between the array sensors and the database. The farmer could access the network at any time, minimizing resources and time everywhere. A multi-hop network has been introduced to expand the range of contacts. For their neighboring sensor arrays, information from the sensor arrays is sent to their neighbors. So after a few jumps, the data comes to the customer at the end. A series of sequential sensor arrays were mainly intended to increase the total volume and insure that information is distributed smoothly from all storage sets. As a function of the sensor array is the transfer of its own information and the transmission of data received from neighbors, confusion, and interleaving of data is possible. TDMA [10] is nevertheless used to eliminate this confusion.

III. DESIGN AND ARCHITECTURE

Figure 1 shows clearly the design and architecture of this paper's overall structure. The data flow in the model is thus mirrored.

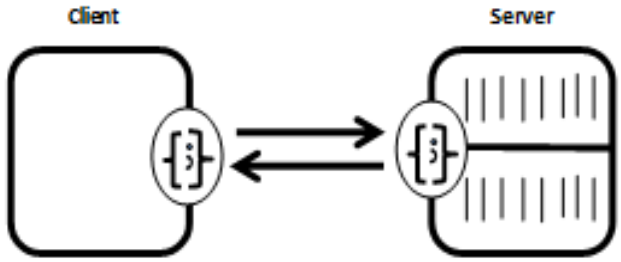

***Fig.1**. Design and architecture*

As mentioned in the example showcasing in the picture, the values of the sensors are obtained from the soil and sent via the ZigBee module either to the database or to the next consecutive array of sensors. Such sensors include a sensor for humidity, a sensor for soil moisture, and a detector for water depth. To allow multi-hop communication, such data is obtained and transmitted to the following sensor arrays. The Raspberry Pi sits in the Apache web server repository and functions with it.

IV. TECHNICAL SPECIFICATIONS

A. Hardware Specifications

The DHT22 is a cheap electronic machine that is fitted with a thermistor for measuring ambient air and a moisture meter able to determine humidity. The capacitive moisture detector monitors relative humidity by placing a thin strip of metal oxide between the two electrodes. Based on the relatively low temperature the energy in metal oxides differs. This capacitive moisture meter has a total moisture content between 0 and 100%. The relative humidity is considered the water balance in the atmosphere to the maximum pressure at the air

temperature. Active input voltages differ from 3 and 5 V with a peak permitted current of 2.5 mA. Ideal for the temperature measurement of-40 ° C to 150 ° C with a precision of 0,5 and-0,5 ° C and moisture level of 0-100% with a specificity of 2-5%.Sensor for Soil Moisture–It measures the ph of the ground. The soil water content can be measured by measuring the dielectric constant of the soil, based on the water content. This is perfect for studying the surface. This unit consists of two samples, which are used to determine the volumetric water content. These two samples cause the soil to flow. The humidity level is calculated based on the resistance value. That is, if the soil has more water content, then it is said that there will be more energy because there will be less resistance. Therefore, the humidity level is lower. Electricity in desert soils will be relatively poor as there will be little heat. So resilience is a help to be high and therefore the humidity is low. Usually, these moisture levels are expressed as a percentage, ie measuring values from 0-1023 to 0-100, which are used for further processing. Nevertheless, we've expressed that quality in our plan between 0-1023 and 100-0. So close to null values mean quite low humidity and the soil is dry and near-1023 values indicate that the humidity level is very strong and the soil is quite saturated.

Item	Min	Max	Unit
Voltage	3.3	5	V
Current	0	35	mA
output Voltage	0	4.5	/
output Value	300	700	/

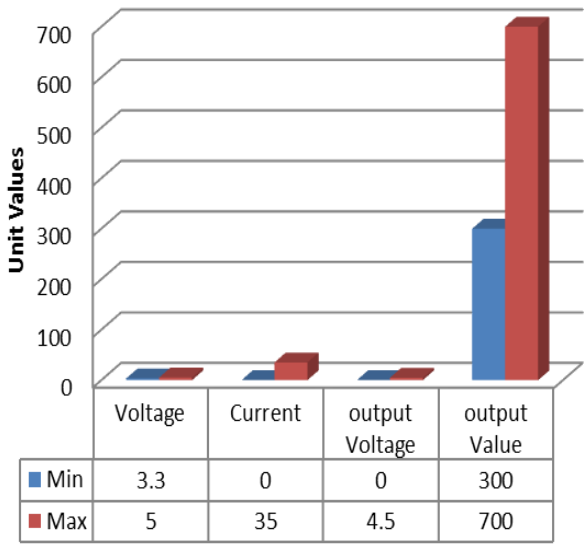

Fig.2 *Soil Moisture Sensor Samples*

ZigBee-Raspberry Pi is therefore put at the center of the field, as it is an IEEE 802.15.4-based specification for a range of high-level communication protocols for developing private areas with lightweight, power-less wireless radio networks such as home automation, medical device data collection, and other low-performance communications criteria. ZigBee is an open standard for low power systems that are high in data. ZigBee has been developed for command and sensor networks under IEEE 802.15.4 Wireless Standard for wireless Personal Area Networks (WPANs). The ZigBee WPANs work at 2.4 GHz, 900 MHz and 868 MHz rates. There are several reasons to use the ZigBee protocol with other WSN protocols[1][2]. ZigBee is uniform on every ground. All communication between the sensor arrays or between the database and the sensor array is accomplished using ZigBee wirelessly. The delivery of all data is the duty of ZIGBEE. Arduino UNO-It is an Atmega328P microchip microcontroller unit. It is fitted with a 5v working voltage and can range in voltage from 7V to 20V. For the 3,3V connections, the DC voltage is 50Ma, for the I / O port the DC voltage is 20mA. It has a 32 KB flash memory, which requires 0.5 KB for the boot loader. The Arduino UNO has 2kB of static RAM (SRAM), which is a random access memory (RAM) for which bits of information is stored in its storage as energy is supplied. The speed of the United Nations is 16 MHz for this mission; UNO gathers information from different sensors in the sensor array (used for soil condition). Such material is also widely distributed to the UN and transmitted through mobile ZigBee contact. Detector for Water Level Depth-The depth of the water level in the soil is measured by this tool. It is crucial to find out the depth of water level prior irrigation process and thus this detector is beneficial during the irrigation process. This meter can conveniently be used to measure the water level in the soil, whereby the amount of water delivered to fields during the irrigation process can be calculated. It guarantees that the excess water is not sufficient and is also beneficial in ensuring that the crops in the field do not have water shortages. This device has a functioning voltage of 3 V to 5 VDC and working current of less than 20 mA. The operating temperature for this system is between about 10oC and 30oC. Raspberry Pi-It is an affordable small machine connected to a computer monitor and to a visual board with a common mouse and keyboard. The energy consumption is also relatively low from 0.5 watts to 1 watt. The new Out Of Box technology (NOOBS) helps the consumer to choose a default OS. Raspbian is Raspberry Pi's best standard operating system. In this operation, Raspberry Pi is used specifically for two purposes. Additionally, the friend's server and storage. On this Pi[11] the Apache web server operates with the SQL database. As Figure 4 shows. The Raspberry Pi can be used for internal communications in various electronic manufacturing companies–from audio producers and parent detectors to weather stations and indoor bird cages. We want to see how children around the world use the Raspberry Pi to grasp the function and the programming of machines.

B. Software Specifications

Apache Web Server -Apache Software Foundation develops and actively supports, open-source web server software. It works on 67% of the web servers in the country. It's easy, safe and trustworthy. It can be specifically customized to the needs of many different environments by plugins and modules. In this plan, this repository is expected to record the information obtained and perform the necessary tasks after data interpretation and storage. The server is responsible for monitoring the health of the plant and also taking control of the automatic water irrigation system. The database in this paper is based on the Raspberry Pi[11]. Arduino-It is an open-source platform based on hardware and software that is simple to use. It is designed for anyone making interactive papers. The

Arduino senses the atmosphere and adjusts through gathering input from sensors and monitors the behavior by different actions and drives. Arduino will compile the appropriate UN keys and upload them. A number of microprocessors and controllers are used by Arduino system designs. The boards are fitted with electronic or analog I / O pins that can be paired with different boards for extension, dashboards and other circuits. Many models of the boards include serial network interfaces, including Universal Serial Bus (USB), and are also used to access PC software. It is possible to code microcontrollers using the programming languages C and C++. The Arduino software offers an IDE focused on the Processing language framework in addition to using conventional programmer tool chains. Raspbian OS-It is the Debian-based computer operating system for Raspberry Pi. There are several variants of Raspbian available including Raspbian Extend and Raspbian Jessie. While Raspbian is not meant to operate the Pi as a desktop computer, it provides users with an LXDE desktop environment. The Pi doesn't have much power and storage, but it has enough resources to run LXDE and a range of apps like the basic Epiphany web browser and much more. SQL Database-In a Relational Database Management System (RDBMS), it is a domain-specific language used in programming and built for data management. To efficiently add, check, update or erase database information, SQL programming can be used. In reality, it can do many things like managing and preserving servers, but not limited to them. SQL is important to safely store information showing the soil conditions (sensor values from the sensors) of the farmland for analysis and further storage. Microsoft SQL Server is available in a number of models, allowing different workloads and specifications. A data center edition is targeted for higher consumer engagement and scalability rates, while the Express model is a scaled-down, free software type. Languages & Packages–PHP language is used as the language for database scripting. Python language is used to implement an algorithm for weather forecasting. Scikit-Learn [9], pandas, numpy, matplotlib are some of the packages needed to implement the same. Combined, Html, JavaScript, and CSS provide an interactive Interface to users/farmers.

V. MODULES FOR PAPER

Data Processing-Various numerical methodologies are used, including classification and regression. It module encourages farmers to grow with the best crop alongside future development. Details of where the plant is to be grown are taken and fed into the already developed machine learning class with which the best sustainable growth crop is anticipated in that farmland. These criteria include climate, average temperature, total humidity, etc. The data set is used for forecasting to train a classifier system. It is observed that the ID3 Decision Tree Classifier[9] provides a decent percentage of accuracy (around 94%) as it classifies based on the range of values that each attribute can drop (homogeneity) and that is what we hopefully need here because each crop does not have a specified temperature, humidity or moisture content quality, but instead each crop can have a range of values for each a. Plant attributes are taken along with plant name and production per unit area is estimated with the aid of regression. Such characteristics include growth location, growing season, rising length, and much more. When calculating performance per unit area, aggregate field area information could be used to calculate the total possible output. Map diagram shows different production amounts from specific farmlands per unit area. Each nation plots the same crop-wise. Production is measured per unit area along the Y-axis. Upon planting in different areas in a particular state in real-time, production per unit area quality is calculated. Data points of the X-axis are obtained. Such maps are plotted for all Indian states including the Uttar Pradesh. Data Collection-In any automation paper, data collection plays an important role because each automation requires training and training is done with the data. The data shown in the above figure is the values from different sensors that are used to calculate the parameter of the soil. These sensors were combined into one array to build a sensor array connected to Arduino's UNO board. Many of these sensor arrays are located equidistantly with the field center server in a matrix setup as shown in Fig.4. The sensor values obtained from the above sensors were extracted from Arduino UNO. Therefore UNO integrates these values in a unit block and makes them available for database transmission. The precise floor during the data collection is clearly shown by these sensor data. Data is aggregated using ZigBee for multi-hop connectivity to UNO in neighboring sensor arrays. Agricultural area of the sensor array For Raspberry Pi in the middle of the panel, the sensor arrays are placed in a matrix-like setup. Data Interpretation -The server continues processing the incoming data once the information is processed at the top of the database. Database analyzes and tracks the data received for abnormalities on a continuous basis. The server also ensures that the soil conditions for the plant are as desirable as they are necessary. Transmission of the data- In any paper transmission of data is the crucial part and thus in this paper, we have developed a system to transfer the data between the sensor arrays and the Raspberry Pi. In contrast to the SQL database, Raspberry Pi runs the Apache application server in data storage. The Pi is at the center of the field in order to reduce costs and risks of propagation. Therefore, the node in the middle of the field reduces the number of hops necessary to reach the database by growing the necessary power for all sensor arrays values. That's an important advantage with the server and the storage in the center of the field. The length from a sensor array to the database is not less than the scope of the ZigBee network, and therefore the concept of a Multi-Hop Connection extends the communication range. The shortest route between a sensor array and the network through which data needs to be conveyed can be checked using Dijkstra's Shortest Route Algorithm. The data is transmitted, once the distance is calculated, via the nodes defined by the route. Each sensor set or node in that determined route is allowed to receive and send to the path successor node. The data can, therefore, be transferred from one end to the next without any issues. Confusion and information alteration can occur due to data packet intervention, as the sensor arrays conduct all roles, i.e. the data collected and the transfer of their data. This ambiguity was removed using the Time Division Multiple Access (TDMA) concept[10]. A specific time slot is allocated for each transmission of end-to-end information from each sensor array to the database. The migration route nodes are allowed only for a certain period of time. It avoids software modification and preserves data integrity in every sensory set while having a designated data transfer timeslot. Execution of Task-Various functions is implemented by the database depending on the soil conditions. One of the main tasks of the database is to

track the irrigation process while analyzing data. The database can calculate and name the amount of water needed for irrigation after an examination of the daily water requirement of the plant and the water supply in the field. The registry is also used to control the automated irrigation system of the ON and OFF valves for the irrigation of the fields. During the information analyzes, the irrigation cycle is calculated by the quantity of water to support the day. The server must also advise and notify the farmer when any perceived information goes beyond the necessary conditions.

VI. RESULTS

Sensor data is obtained during the time period and the values for the sensors are reflected over time. The graph of sensor values and time is shown in figure 3 and 4 respectively. For a while, measurements are interpreted and evaluated from the detectors to evaluate how the environments in the earth shift over that period of time. Figure 4 demonstrates the same thing. The values of the sensors used for one include atmospheric temperature and soil moisture and humidity. The amount of water is supplied to the soil between the measured time and the rapid increase in the soil moisture resistance at the site. Even after the water was added to the soil, the air temperature did not change significantly. Soil moisture also remains constant, despite many years of changes.

Humidity	Temperature
50	34
50	33
50	33
50	33
50	33
50	33
51	33
50	33
48	33

***Fig.3**. Visualization of sensor Sample data*

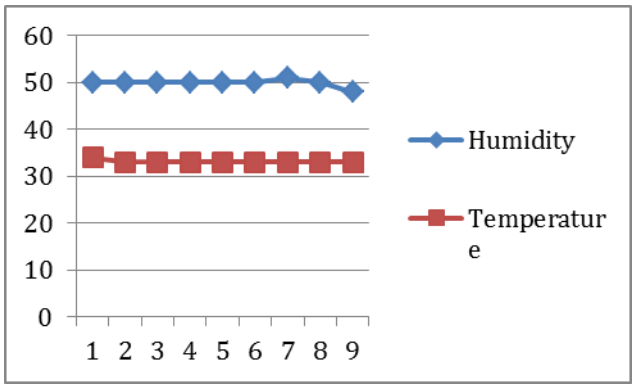

***Fig.4** Visual Representation of Sensor Sample Data*

VII. CONCLUSION

The paper aims to increase efficiency and accuracy in the agricultural sector through the transformation of the whole agriculture process through the internet of things and machine learning. It also seeks to avoid over-use of critical resources which might soon disappear. The entire requirement of the farmer is mentioned in this paper. This program focuses entirely on the agricultural sector and for the betterment of farmers. This allows farmers with the whole cycle of cultivation from beginning to end. It saves peasants from their suffering, and in the end this provides a great deal of production and takes care of these plants. It also accounts for plant health and nutrition. Addressing these issues is not just a benefit for this program, but also something necessary to improve each country's well-being. That program not only saves you money and energy, it also saves you time and work. Since this paper has so many benefits, it would be that farmer's dream to adapt it to their region. As this plan is cost-effective and viable, many farmers in India would certainly be commercially successful. Go with Agricultural Automation..!! Make farming easy and advanced.!!'

VIII. REFERENCES

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