Smart Agriculture System

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 06 | June - 2021 ISSN: 2582-3930

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Abstract: Agriculture plays a vital role in framing up the economy. In the present scenario huge scientific advancement has been implemented in various agricultural fields for the betterment of the future, but some of the features are still lagging behind with a few drawbacks. We have tried different scientific applications which could be put together in agricultural field for better accuracy with better productivity using less man-power. During this paper, we've projected a unique methodology for sensible farming by linking smart irrigation systems through wireless communication technology. The aim of this analysis work is to make sensible agriculture system victimization embedded systems and smartphones to connect the tools used for farming. Out system focuses on the look to check the specified parameters of the soil, and recommend the simplest doable pointers relating to crops, pesticides and fertilizers. Supporting the parameters of soil, the hardware i.e. NodeMCU triggers the pump to sprinkle water over the crops to take care of an appropriate atmosphere for the expansion of crops. The modeling and management methods irrigator and smart farming system square measure are incontestable during this paper.

Keywords: Embedded Systems; NodeMCU; Smart Phone;

I. INTRODUCTION

India is an agricultural country having tons of fertile land and 3 different cropping seasons. It suggests that we are able to use our land throughout the year for the aim of cultivation that covers a significant part of our gross domestic product further joined by our basic wants, food that is one among the foremost primary issues for the individuals worldwide. Without doubt there is not any substitution of food and higher farming method is that solely thanks to increasing the assembly of food. So as to supply a comfortable quantity of food we have a tendency to have to realize some ways to build agriculture easier, time saving and digital. Once, over sixty % of our total occupied individuals were directly and indirectly concerned in farming. As time passes by, we have a tendency to currently see a fully completely different situation. Nowadays, in our country individuals are individually centralized towards cities as a result of farming is not a straightforward task and farmers don't get enough earnings through farming. Recent statistics show North American countries that the expansion rate of farmers in India has stalled over the last decade and is inflicting the autumn in rice production growth. Here we've got to return up with a thought wherever farming will be thought of as a less sophisticated task. Individuals will simply monitor cultivation methods from time to time even once they are a unit not on the market in the field. We have a tendency to area units living in the trendy era wherever everything is obtained digitized and farming is not exceptional among them however here we have a tendency to area units proposing one thing terribly that will farm itself and will offer all types of data that is incredibly essential for a farmer. During this time, most of the farmers lack correct data concerning farming and agriculture creating it additional erratic. Most a part of farming and agricultural connected activities area units supported prediction and statement. Once it fails, the farmers have to be compelled to bear Brobdingnagian losses and a few find yourself committing suicide. Since we have a tendency to area unit alert to the good thing about quality of soil and air, irrigational and within the growth of crops such parameters can't be neglected.

II. LITERATURE SURVEY

Research is carried out under the following Constraints, such as Understanding the existing approaches and methodology, Understanding the requirements, developing a better system.

In [1] the proposed model (Smart Digi-farming) aims at providing smart solutions to the farming community. The farmer needs to here and there for all the different and integral work of farming. This model emphasizes the use of technology for efficient and feasible solutions. Several important works which they can easily and remotely manage. The process of farming which is mainly divided into three parts: 1.Sowing seeds 2. Maintaining crops 3. Crop ready for Digi-farming. The main focus of the model is on the crops and it's monitoring using IOT sensors and cameras. The main objective of the model is limited to Crops only.

In [2] this paper, they have proposed a novel methodology for smart farming by linking a smart sensing system and smart irrigator system through wireless communication technology. They had used two modules, namely a smart farm sensing system and movable smart Irrigator that moves on mechanical bridge slider arrangement. Both the systems consist of microcontrollers, sensors, and the GSM module to communicate with each other and with the external environment. The smart farm sensing system senses the moisture content with the aid of the soil Moisture sensor. The measured data from the smart farm sensing system are sent to the smart irrigator via the GSM module. The farmer can have control over the system by having a wireless communication with a gsm module through his mobile phone. Smart irrigator is mounted on an overhead crane system and it consists of two main sensors that are connected to different pins of the microcontroller. It receives the signal from the smart farm sensing system via the GSM module. The recorded readings are then transferred to a central database server from which all the crop-growth details are analyzed and transferred to the irrigator system. In the meantime, sensors trigger the optocouplers that are connected to green manure, seeds, compost, and water containers. After the triggering action, the necessary components are splashed on the field. As Solar panels and GSM modules are used, Solar panels will be unable to sustain so many motors, as a result more panels will be required. High maintenance is required.

In [3] this research paper, this system was useful for monitoring the soil moisture condition of the farm and controlling the soil moisture by monitoring the level of water in the water source. The farm would be regularly irrigated automatically at particular time intervals. The motor will be turned ON and OFF by the microcontroller as the soil moisture sensor indicates availability of moisture in the soil. The farmer will be informed via an SMS. A GSM modem is used to 1] SMS Gateway i.e. to send and receive SMS 2] Telemetric i.e. to collect data from remote terminals. The main objective of the model is limited only to Automated Irrigation .The main drawback of the system is GSM Modem which has a particular range.

In [4] this research a device was established in the Arduino platform in order to detect the soil moisture to save such excess quantity of water being wasted by the farmers. It shows slow response to changes in soil water content after rainfall or irrigation. And also, it requires intensive labor to collect data regularly.

This [5] proposed work includes an embedded system for automatic control of irrigation. This project has a wireless sensor network for real-time sensing of an irrigation system. This system provides a uniform and required level of water for the Automation of irrigation system using IoT 81 agricultural farm and it avoids water wastage. When the moisture level in the soil reaches below threshold value then the system automatically switches ON the motor. When the water level reaches normal level the motor automatically switches OFF. The sensed parameters and current status of the motor will be displayed on the user's android application.

I. METHODOLOGY

The target of this project is to automate the farming system. It covers many different ideas like-

- Providing the suitable treatment to the farmers with a proper irrigation schedule. To get this treatment the farmer need to submit the soil parameters based on that the farmer will receive guidelines from the agriculture expert.
- Also, the agriculture expert will suggest the suitable crops, fertilizers and pesticides to be used on their field. The farmer will have choice of crops to be planted Based on the selection of the crop a proper irrigation schedule will be given by the agriculture expert.
- A proper plan for farming will be provided to develop a system which will optimize the use of time and cost.

II. ARCHITECTURE

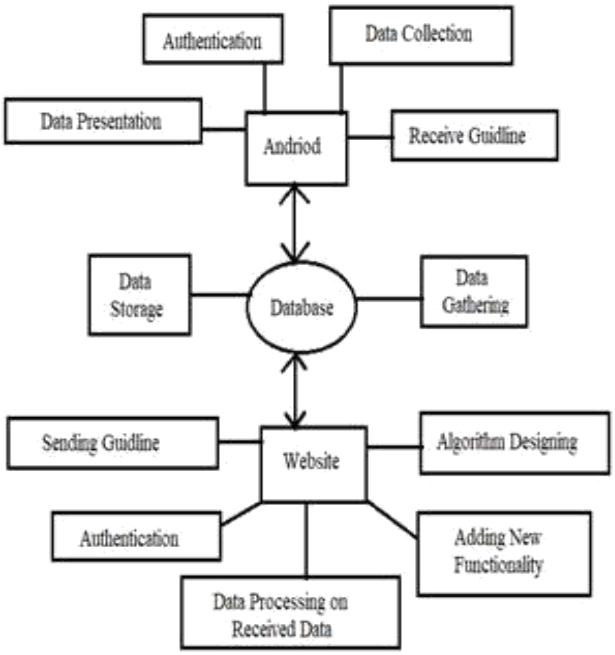

Fig.1. Architecture of the System

III. HARDWARES USED

A. *NodeMCU Development Board*

NodeMCU is a low-cost open-source platform for all the users. It has the firmware which runs on the ESP8266 Wi-Fi SoC from Expressive Systems, and hardware based on the ESP-12 module. NodeMCU can be connected using Micro USB jack and External Supply Pin. It also supports UART, SPI, and I2C interface. The NodeMCU Development Board can be easily programmed as it is easy to use.

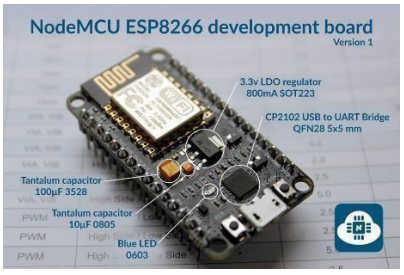

Fig.2. NodeMCU Development Board

B. *12V 1 Channel Relay Module*

It is an interface board with screw terminal, it can be controlled directly by using microcontrollers such as Arduino, AVR, PIC,

ARM and so on. Power input and relay control signals are brought to header pins on the board so that the board can be easily interfaced with our development boards using jumper wires. The relay acts as a switch between external voltage source and pump. It is used for switching action. If the relay would not be used when there is a chance that the pump might destroy the development board.

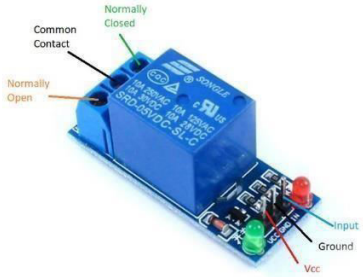

Fig.3. 12V 1 Channel Relay Module

C. *Electric diaphragm water pump*

A diaphragm water pump uses the same principles to operate as the cylinders on your vehicle's engine are used. Inside the water pump there is a diaphragm made of rubber or plastic material. When the diaphragm is triggered, the pressure inside the pump lowers, which draws in fluid. The pump works using the water suction method which drains the water through an inlet and releases it through the outlet. These pumps are durable and easy to maintain. It is the actuator that waters the crop when required. When the soil becomes humid, then the pump comes into action. Using a pump reduces labor cost and time.

Fig.4. Electric diaphragm water pump

IV. SOFTWARE IMPLEMENTATION

Android module consists of following four phases Authentication, Data Collection, Data Presentation, Receiving Guideline
Authentication is only authorized user can able to access feature and functionality of proposal system so here authentication is provided to the user by the time of the user registration process if user registration is done successfully then user become an authorized person to use proposal system feature and functionality. The Data Collection process can be done by user registration with three-phase:

- User- Bio Data, where user enter bio-data manually.
- Land Data, in which the user needs to submit land-related data manually.
- Atmosphere Data, which can be collected automatically from the user's land location.

All this collected data stored in the database server at a remote location from where admin and agriculture expert can easily access this user data Now Web Application consists of two Panel admin and agriculture expert Panel Admin Panel consists of the following functionality Authentication, User and Agriculture expert Monitor, Adding new features and functionality, Authentication in which only authorized admin can use the proposal system User and Agriculture expert monitor in this phase admin can view which agriculture expert appointed for user crop treatment and also admin can manage user as well as an agriculture expert Adding new features and functionality, in this phase admin can add a new feature like Product, Crop, Pesticides, Weather information at run time and also manage where user and agriculture expert can easily access this information at runtime Agricultural expert Panel consists of the following functionality;

View Report, View Treatment Request, Create Treatment, Send Guidelines.

View Report in this phase agriculture expert view user data which is collected from user android panel and stored in a database server so agriculture expert can easily access this data agriculture expert send the suggestion to the user for which crop is suitable for land, which pesticides and fertilizers user need to use which irrigation system is good to use and send all farming-related information than user from android, interface go through agriculture expert suggestion and choose the crop, irrigation system type and send a request for treatment to agriculture expert agriculture expert view this user treatment request and create a treatment with user choice in fixed algorithm format where this treatment can modify from agriculture expert panel but not from user panel user only view treatment and follow this treatment when the user follows this treatment by the time user receive a notification like its time to irrigation, its time for pesticide when user receive notification for irrigation then the user can turn on the water pump from any remote location, even user don't want to need to turn off water pump it will turn off automatically with the help of sensor detection then the user needs to follow this

treatment.

V. RESULT AND ANALYSIS

Farming systems for sustainable crop production intensification will offer a range of productivity, socio-economic and environmental benefits to producers and to society at large, including high and stable production and profitability.

This farming system will be based on three technical principles:

- Simultaneous achievement of increased agricultural productivity and enhancement of natural capital and ecosystem services.
- Higher rates of efficiency in the use of key inputs, including water, nutrients, pesticides, energy, land and labor.
- Less use of water by using smart irrigation system.
- Provide information on the productivity of agricultural systems now and under different scenarios.

Test Case Description	Test Data	Expected Result	Actual Result	Status
Proper registration with area selection can help expert to understand the climate conditions.	Farmer's Details	Better Treatment	Better Treatment	Pass
Verify soil parameters entered by a user that provide better treatment.	Soil Parameters	Better Crop	Better Crop	Pass
Verify response after crop selection is done.	Soil pH	Proper Treatment	Proper Treatment	Pass
Expert suggest pesticides and fertilizers according to the soil contents for particular crop.	Soil Parameters	Better Crop Production	Better Crop Production	Pass
Expert schedule irrigation timings for a particular crop.	Crop	Water level in the soil will be maintained	Water level in the soil will be maintained	Pass
Verify schedule timings and allow the motor Fto irrigate field.	Irrigation Schedule	Maintaining water level	Maintaining water level	Pass
Admin can verify users and experts and can allow/disallow them.	Registration Details	Better System	Better System	Pass

ig.5.Experimental Result

- Test Cases:

- Add telecommunication technologies such as advance networking and GPS.
- Add drones for gathering data around the clock for total field. This information is then forwarded to the IT systems for tracking and analysis which makes remote monitoring possible.
- Precision farming i.e. monitoring climate conditions.
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VII. CONCLUSION

This project gave us the chance to learn new technologies and work with new tool. In general, the project was successful and worked properly and succeeded in delivering the prototype on due time. This embedded system will bring revolution to our agriculture business. It will ease farmer's life by reducing farming prices, reducing labor prices, and time. The irrigation is going to be machine-controlled with none labor intervention and with none water wastage. It will increase the assembly of crops. A rise in production will bring a leap in our economy. All these techniques projected within the system are economical for farmers for cultivating crops and for correct use of fertilizers and pesticides. Smart Farming also has the potential to boost consumer acceptance and their trust. This kind of system can take agrobased industries' tone weights. Smart Farming System will always provide helping hand to farmers for getting accurate results.

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