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Design of Agro Acres using Arduino UNO and ESP 8266

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ABSTRACT: Agriculture plays an essential role in supporting human life in India. More than 50% of people from India practice agriculture as their primary occupation. But due to the rising population and rise in demands for resources people related to the field of agriculture are facing problems such as soil infertility, water shortage, lack of workforce, etc

Introducing agriculture with technology will ultimately fulfill agricultural needs and also boost income from agriculture. Internet of Things (IoT) technology is one of the fastest-growing fields in different domains including agriculture. Combining it with Web services will provide an ultimate advantage for the growing world.

The Agro Acres is a multipurpose system a mixture of IoT and web services that provide its users to get online information about the farm health, crop health, statistical details, worker availability, jobs for workers, and statistical information about exports and imports, etc through online mode. Agro Acres will help in the culture shift towards smart farming. The goal of our project is to use IoT in order to collect data such as moisture, plant health, soil water level, etc, and automate the process of farming, and web services on other hand will help farmers to shop requirements, rent resources which will provide an additional income, provide agricultural education and hire workers if needed. Also, a mobile app will benefit users to manage tasks and get updates instantly,

The current prototype is developed using Arduino UNO, and ESP 8266 as the main components for farm task automation, and technologies such as flutter MySQL, and Node.js are used to develop the website and mobile app for providing services to the farmer.

Our main goal is to introduce technology to agriculture. This idea will improve methods of agriculture and revolutionize way of agriculture.

KEYWORDS: Agriculture, Technology, Arduino, IoT, Automation, Trade, Arduino Uno, ESP8266, Moisture sensor, Web Services.

I. INTRODUCTION

The purpose of the Agro Acres system is to provide Technological support to improve crop yield, provide quality agricultural education, provide employment, and meet modern-day demands in a modern way. The project basically measures important details related to the soil and crops such as soil moisture level, crop quality, temperature, weather, etc based upon the data the user can control and manage the workflow of the farm also user can get recommendations related to soil health development, crop to be cultivated, nearby agro sellers, current demand and price of the crop, new methods of farming, workers availability, etc

These are the Four main Objectives of our project

- 1-Providing Work for labour
- 2-Easy buy and sell of agro products between farmers and sellers.
- 3-Equipment renting for additional income.
- 4- Automation and introduction of IoT farming.

II. SYSTEM ARCHITECTURE

PRESENT SYSTEM

The Present approach to farming lacks the technological improvements that could be made. Lack of proper agricultural education is leading to soil infertility, wastage of water, and low-quality crops. No use of technological tools leads to hard work without satisfactory results, lack of jobs for workers as workers get jobs based on recommendation and not based on skills, traditional agro product sale, excessive use of soil, etc. Also, the farmers are unable to find nearby labour, buy, sell or rent equipments or buy or sell raw materials and the labour is unable to find nearby work.

PROPOSED SYSTEM

Our proposed solution will enable a platform, on which farmers can communicate directly to labours and labours can get job alerts. Also, farmers or labours can take on rent the raw material required for farming or buy/ take on rent the equipments. This platform also enables smart farming for farmers to use modern technologies with ease and can monitor and control tasks of farms.

III. HARDWARE IMPLEMENTATION

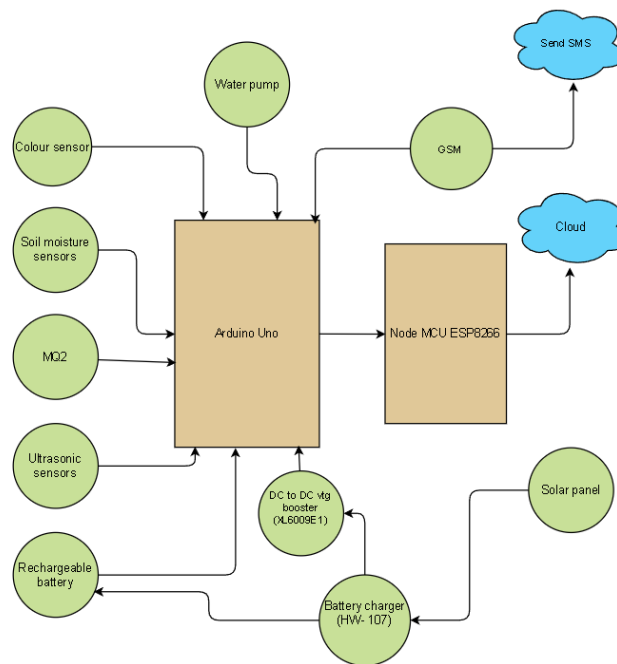


Fig. 1 Block Diagram of the Hardware System

1) Arduino Uno

Arduino UNO is a low cost, ready to use, open-source, credit card size microcontroller board that can be used in a variety of electronic projects, it consists of ATmega 328 microcontroller and 16MHz ceramic resonator with 14 digital pins, 6 analog, a USB port, a power jack, ICSP header and reset pin., Arduino can be connected to external modules such as ESP8266 for wifi connection and also to sensors such as soil moisture sensors, Ultrasonic sensors etc .

2) ESP-8266

ESP8266 is a Wifi module that was manufactured by Espressif Systems. It was released in August 2014. It has a clock frequency of 80-160MHz. It is a 32-bit Microcontroller. Due to its low cost and good functionality, it is used a lot in prototyping IoT products. Its cross-functionality with Arduino makes it easy to program with Arduino IDE. due to its popularity, it has many variants - ESP 8266 -01, ESP 8266-12E with the 12E version being the most popular.

3) Colour Sensor-

Detection of color can be done by a color sensor, usually, the color is detected in RGB format, i.e. the sensor can categorize the color as red, blue, or green. It is equipped with UV filters for rejecting unwanted UV light

4) Soil Moisture Sensor -

It is an analog sensor that can be used to measure the moisture level in the soil, basically, it works on capacitive sensing i.e. capacitance is varied on the basis of water content present in the soil and the capacitance is converted into a voltage which may vary between 1.2V to 3.0V, They are made of corrosion-resistant material giving it a long life

5) MQ2 Sensor-

The Gas Sensor(MQ2) module is useful for gas leakage detection, MQ2 gas sensor can be used to detect the presence of flammable gases and smoke. It is provided with 5-volt power. Smoke sensors indicate smoke by the voltage that it outputs. More smoke more output. A potentiometer is provided to adjust the sensitivity.

6) Ultrasonic Sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, usually between 23 kHz and 40 kHz, much higher than the typical audible range of human hearing at 20 kHz, hence the term ultrasonic and converts the reflected sound into an electrical signal. Ultrasonic sensors have two main components: the transmitter and the receiver

7) Water Pump

The water pump is a device used to transfer water from one point to another by supplying power to it in our project we are using a 12v water pump as a prototype

8) Solar Panel

Solar panels often consist of an array of photovoltaic cells arranged in a way that produces the desired power output at a given voltage and current configuration. Photovoltaic cells, commonly referred to as PV cells, are responsible for the conversion of solar energy into electricity.

9) Battery charger (HW- 107)/TP4056

The TP4056 is a complete constant-current/constant-voltage linear charger for single-cell lithium-ion batteries. This module can charge batteries consisting of single cells. This module offers a 1-ampere charging current TP4056 is also a battery charger that has a fixed charge voltage of 4.2 volts.

10) DC to DC voltage booster (XL6009E1)

The XL6009 module is a DC to DC BUCK-BOOST converter module which has a switching frequency of 400kHz. In such high frequency, it provides smaller-sized filter components compared with low frequency switching regulators. This DC-DC switching boost converter is capable of driving a 4A load with excellent line and load regulation

11) Rechargeable batteries

Rechargeable batteries consist of one or more electrochemical cells. it is also known as a secondary cell as its electrochemical reactions are electrically reversible i.e after the stored charge has been drained, the battery's chemical reactions can occur again, in reverse, to store a new charge.

12) GSM

GSM stands for Global System for Mobile communication, it is designed for wireless radiation through SMS, It can receive data from Arduino and transmit the data like text SMS to a server

SOFTWARE IMPLEMENTATION:

1. Flutter

Flutter is an open-source UI framework using which we can create a native and mobile application. flutter was released by Google in the year 2017, by using flutter developers can build mobile applications, and websites using a single code base and programming language

2. MySQL

MySQL is a open-source database that is based on a relational database management system (RDBMS) , It was developed by Oracle based on structured query language (SQL), it is basically a structured collection of data

3. Node JS

Node JS is an open-source server-side javascript runtime environment that runs on Google V8 engine , it is basically used for backend, it was developed by openJS

4. CSS

CSS stands for Cascading Style Sheets language used for styling webpages, it is written in a markup language such as HTML. it is used for developing the UI of a webpage

5. HTML

Hypertext Markup Language or HTML is a markup language used for front-end development it is basically used to structure a web page and its content. It can be assisted by technologies such as Cascading Style Sheets and scripting languages such as JavaScript.

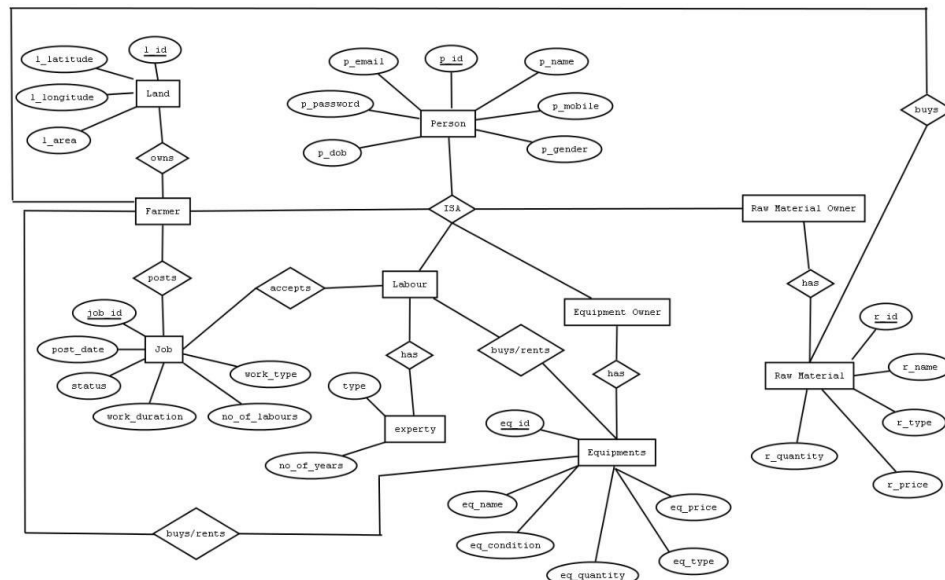


Fig. 2ER Diagram of database used for Mobile App

IV. METHODOLOGY

After signing in to the mobile app, the farmers can post the job and the labours with similar experty and in nearby locations can accept the job and can contact the farmer. The equipment owners can sell or give on rent the equipments to the farmer or labour, and every raw material owner can sell the raw materials to the farmer or labour. In this way, the agriculturer's community is connected.

Farmer can buy the smart farming product in order to monitor the farm and control the activities physically or virtually or can start automated mode. The product is powered by solar and hence requires no electricity. Even to turn on water motor pump, user will get to know about the electricity failures through the website. The level soil nutrients such as nitrogen, phosphorus and potassium will be displayed and farmers can use appropriate fertilizer. Based on the crop and weather, if the soil moisture gets below the minimum level then the water will be supplied to plants. The water level of the tank will be monitored and if it gets below the 50 percent then automatically the water pump will start to fill the tank up. The smoke and LPG are detected and if it goes beyond the dangerous level, the user will get notified. The data will get updated on the website in real-time as well as the user will get SMS of alert messages.

FLOWCHART OF SYSTEM

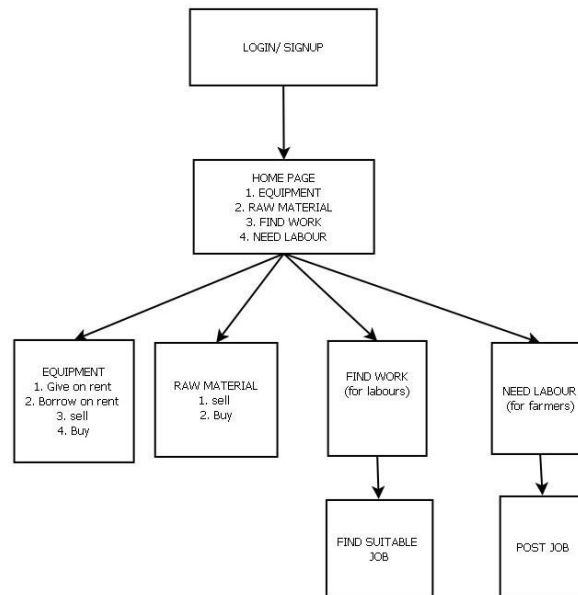


Fig. 3Flow Chart of Mobile App

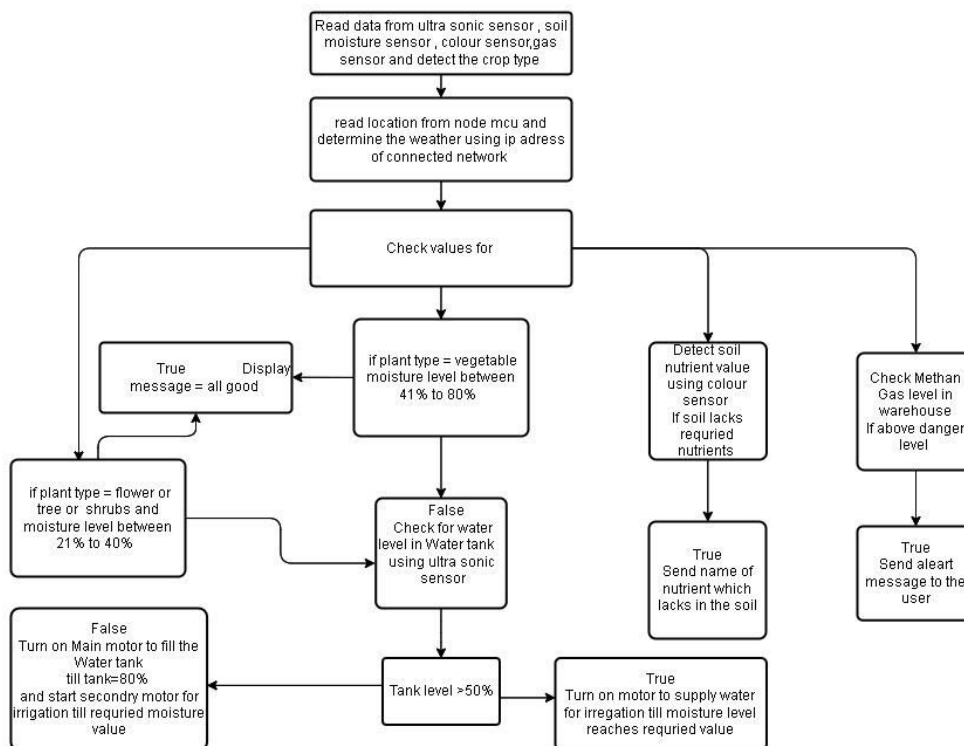


Fig. 4Flow Chart of Smart Farming using IoT



V. RESULT

The Mobile App connects all the agricultural community and provides work to labours, farmers are able to find nearby labours, every equipment owner can sell or give on rent the equipments and every raw material owner can sell the raw materials to the farmer or labour. The farmers are able to buy the smart farming product that provides smart irrigation system based on crop type and weather, soil nutrients to use accurate fertilizer and detect the smoke or gas in store room or house.

VI. CONCLUSION

This proposed system will help to grow technology in agriculture and ease the process. This solves problem of unemployment and helps farmers or land owners to find labour, monitor their farm and control activities both physically and virtually.

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