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IOT BASED SMART FARMING SYSTEM

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Abstract

Farming plays an essential role for economic development of any country. The GDP of any country having maximum population depends upon agriculture and farming. In this paper our proposed aim to develop a smart farming system that monitor farming electrical equipment. With the help of IOT technology and Artificial Intelligence (ALEXA).Feature of this paper is to monitor the temperature, moisture and water level by using wireless sensor and to help the farmers to providing them information about the field. So that they can take a precision decision based on collected data. Smart agriculture is an emerging concept, because IOT sensors are capable of providing information about agriculture fields and then act upon based on the user input. In this Paper, it is proposed to develop a Smart agriculture System that uses advantages of cutting edge technologies such as Arduino, IOT and Wireless Sensor Network. The power consumption of the total system is 12V and the 8.7 version of proteus system is used. The system is reliable and robust. It is portable and economical system.

Key words: IOT, Artificial Intelligence, Sensing device, ALEXA.

INTRODUCTION

India is agricultural country, about 70% of population in India is dependent on agriculture. Agriculture contribute about 50% to the total GDP of India up to 2020. But the traditional practice has some limitation such as lack of organization. To overcome all the drawback we have to practice "smart farming". It can be done by using various modified technologies such as cloud computing, IOT and many other. Thus we used IOT as reliable and cost efficient new modified technique. IOT is Internet of Things, which is capable of analysing the sensed information and then transmitting it to the user. IOT cover all aspects of life such as smart cities, home automation, Industrial control, security and emergency, E-health and smart agriculture. So to overcome all the challenges faced by farmer even if they are manual or technical it should be overcome and do the farming with ease. By using IOT we can expect the growth in production with a minimum cost, storage monitoring capacity and also theft detection in agriculture.

RELATED WORK

The Internet of things is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these objects to connect and exchanges data. The item which are connected to IOT are capable to generate, exchanges and consume data with least human interference. There are two main aspect of IOT "command and control" which makes our lives much easier and safer and reduces our impact on environment. Internet of Things cover all aspects of life and implemented in various field environmental monitoring , infrastructure management , manufacturing, energy management, medical and healthcare system ,tracking and transportation, building and home automation, security and surveillance.

- Environmental Monitoring: Protection, monitoring and development of natural resources.
  Eg. Agriculture, livestock, recycling and management of environment.
- Medical & health care: It can be used in various machines such as MRI, CGA & ventilator. Rememberized doses of medicine and time procedure. It analysed or detect the recovery of patients suffering from various diseases through inside out.
- Tracking & Transportation: Among goods transport are fresh product such as fruit and meat also dairy, they are vital product of our foods. For transportation of 1000km it should be monitor to avoid uncertainty of level of quality of goods.
- Security and Surveillance: Smart surveillance is IOT based application and it uses internet for various purpose. The proposed system intimates about the presence of any person in premises, also providing more security by recording activity of that person.

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- IOT technology set to enhance security along Hostile borders: Defence ministry is evaluating testing internet of things tech modules and application which can talk to one another irrespective of distance and time.

It has backbone such as RFID, Zigbee, Bluetooth networking, Z-Wave, Wi-Fi, QR codes and barcodes all of which has a certain range of signal. Thus they can determine certain elements which are useful in increasing the production, such as temperature, humidity, soil moisture. A system that consist of six parts that are supervision, management, organization, information disbursement, analysis and control action.

PROPOSED SYSTEM MODEL

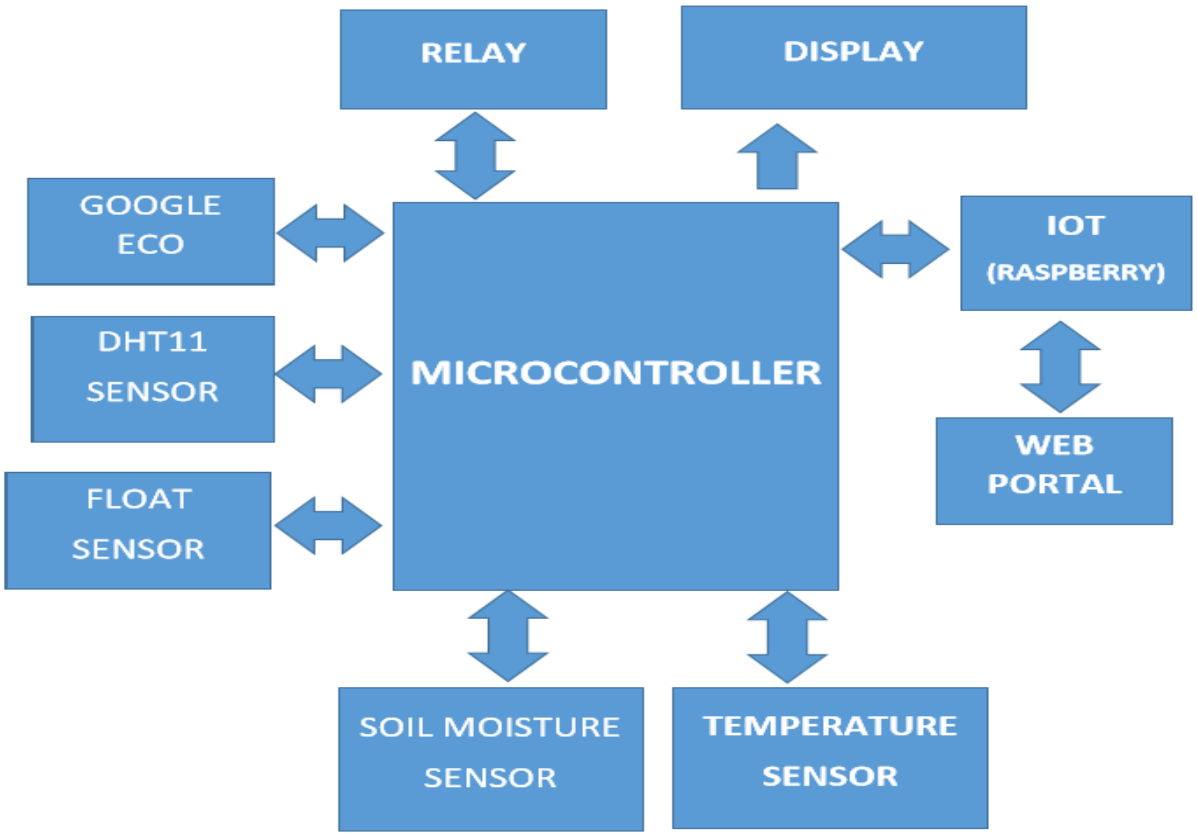

Fig-1: Block diagram

The main block diagram of the proposed system consist of microcontroller network processor sensor and Wi-Fi module. The target of system is to predefine the schedule of farmer as per his ease. The layer of information transfer is based on network of IOT & communication technologies by using android app and internet. The system consist of variety of sensor & server & it main function involves the collection , conversion (modification) and evaluation of data gathered / collected, as well as orientation and activate things for users. In the agriculture production, the most crucial part is collection of data at present instance thus, by means of web server and other methods, it is possible to gather the real time data. The critical index in crop growing like air temperature, moisture, soil temperature, and so on. The central control system receives the information /data, evaluate and explore / disburse it. As the environmental parameter goes beyond the predetermined value , it is activate the alarm system , which gives notification to the user Monitoring system is composed by three parts –

1) Sensor node – sending the information like atmosphere collected by the sensor in periodicity to the monitoring.

2) Located, in the edge of sensor network realizing the interconnection and communication between the sensor network and internet.

3) Monitoring and management centre of agriculture environment (user), being responsible for the information storage, procession, evaluation and so on.

The smart agriculture consist of dispersed network of wireless sensor such as soil , moisture sensor , temperature sensor and water level sensor , located at root of crops . The sensor persistently record the parameters and transmit it to the Arduino kit, after a certain process, it will activate the IOT. IOT access through the Wi-Fi module, which will be updating the data to the cloud .The data being transfer to the cloud enable to user to super the parameters according to their ease. The smart agriculture, control and supervise every aspect of farm for eg. – Soil moisture sensor which is a primary factor to sense the water moisture level and suggest the water essential for crops of farm. In the deficiency of the system the farmer has to personally investigate the state of crop, the soil in the farm which is draggy, wrench and time consuming which convey the message to the user about the real time condition of the farm/ soil.

Disturbance due to animals like as cow , dogs ,rats , monkeys , squirrels is a usually seen in every farm , to avoid this farmer used to plant scare crow in the field . But in smart farming this problem can be overcome by using sensor, to sense the movements and presence of animals in the farm and the message via internet send to the user. Then the user has to take the corrective action over the present condition. The web server used to transmit and receive the real time data. Testing is done under area of ……sqm and the system is installed at particular place. This project also aim or target the reliability, safety of crops from assaulation of rodents or insects in the farm precisely smart i.e. system based on new technology i.e. IOT describe the hardware construction , network construction and software system here by using the android app. in the smart agricultural system . The system is portable.

SYSTEM DESIGN

MCU kit:

This module contain all sensors and other component such as capacitors of 1000F and 100F, relay (12V), LCD 44780 (display) and voltage regulator Ic7805. The display is interfaced with the MCU kit and the connectivity of Google Eco Alexa can be check through ESP8266 Node MCU Wi-Fi module devkit.

Amazon echo:

Amazon Echo (shortened to **Echo** and known colloquially as "**Alexa**") is a brand of smart developed by Amazon. Echo devices connect to the voice-controlled intelligent personal assistant service *Alexa*, which responds to the names "Alexa", "Echo", or "Computer". Users may change this *wake word* to "Amazon", "Echo" or "Computer". The features of the device include voice interaction, music playback, making to-do lists, setting alarms, streaming podcasts, and playing audiobooks, in addition to providing weather, traffic and other real-time information. It can also control several smart devices, acting as a home automation hub.

According to confirmed reports, Amazon started developing Echo devices inside its Lab126 offices in silicon and in Cambridge, Massachusetts as early as 2010. The device represented one of Amazon's first attempts to expand its device portfolio beyond the Kindle e-reader.

ESP8266 Node MCU Wi-Fi Devkit:

The ESP8266 is the name of a micro controller designed by Express if Systems. The ESP8266 itself is a self-contained Wi-Fi networking solution offering as a bridge from existing micro controller to Wi-Fi and is also capable of running self-contained applications. This module comes with a built in USB connector and a rich assortment of pin-outs. With a micro USB cable, you can connect Node MCU devkit to your laptop and flash it without any trouble, just like Arduino. It is also immediately breadboard friendly

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RECTIFIER:

Rectifier's used to rectify the negative half cycles of the output signal of the secondary of the transformer. So at the input of the rectifier We have AC signal with both positive and negative cycles and at the output of the rectifier We have signal with only positive cycles but as this signal is also AC We have to use capacitor to filter out the AC of the output signal. There are mainly three types of rectifiers namely half wave, Full wave and Bridge rectifier. Out of these three we have used Bridge rectifier since it give more efficiency. A full wave rectifier converts the whole of the input waveform to one of constant polarity (positive or negative) at its output by reversing the negative (or positive) portions of the alternating current waveform .The positive (negative) portions thus combine with the reversed negative (positive) portions to produce an entirely positive (negative) voltage/current waveform. For single phase AC is center tapped, and then two diodes back to back (i.e. anode to anode or cathode to cathode) form a full wave rectifier.
Rectifier designing 1N4007 diodes are used to build circuit of full wave bridge rectifier

- Surge overload rating - 50 amperes peak
- Ideal for printed circuit board
- Reliable low cost construction utilizing molded plastic technique results in inexpensive product
- Mounting Position: Any

For diode design:-

PIV = Vm

Vm = E0 max + 2 Vf

= 10.7 + 1.4 V

= 12.1 V

I0 = Il/2

= 116.2 mA/ 2

= 58.1 mA

Peak repetitive current

Ifm = [I/ (t1+t2)]/t2

T2 = time for 90° - time for θ1

= 5ms - 3.4ms

=1.2ms

Ifm = 116.2mA (8.6ms+1.2ms) /1.2ms

= 833mA

From above specification diode 1N4007 is selected

FILTER CAPACITOR:

As mentioned above we have to use filter capacitor to remove the AC signal from the output of rectifier. Filter capacitor is used in order to remove ripples from the pulsating DC and convert it to unregulated DC.A capacitor is an electrical device that can store energy in the electric field between a pair of closely spaced conductors (called 'plates'). When voltage is applied to the capacitor, electric charges of equal magnitude, but opposite polarity, build up on the plate. Capacitors are used in electrical circuits as energy storage devices. They can also be used to differentiate between high frequency and low frequency signals and this makes them useful in

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electronic filters. These small deviations from the ideal behavior of the device can become significant when it is operating under certain conditions, i.e. high frequency, high current, or temperature extremes.

PIV =100V

I = 1A

For filter capacitor design:-

C= (I1 * t1)/Vr

Vr= ripple voltage

Il = load current

T1= time during which the capacitor being discharge by load current

Vr = ripple voltage 10% of output voltage

Vr = 1.0 V

Frequency 50 HZ

T1 = 1/50 = 20 ms

T for 360° = 20ms

For 180°= 10ms

For 60°= 20ms * (60°/360)

= 3.4ms

For bridge:-

T1 = [time for 90° + time for θ1]

= 5ms + 3.4ms

= 8.4ms

I1 = load current supplied to various IC

I1 = current required for LCD + o/p current of 89S51 +

O/p current of max232 + current required for LM35 +

+ Current required for heart beat sensor + current required

For GPS SR-87

= 3mA + 40mA + 8mA + 0.060mA + 22mA + 40mA

= 113.06Ma

C = I1 * T1/ Vr

= 113.06 * 8.4 * 10^-6 / 1

= 949.704 µF

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Thus this 949.704 µF value can be approximated to 1000 µF. Thus we will use 1000 µF capacitor before IC 7805, which is used for improving Frequency Response

Voltage Regulator:

Two separate voltage regulators are used after the filter capacitor so as to generate constant DC voltage supply of 5 volts and 12 volts. We have used 7805 and 7812 as a voltage regulator. Both of them are three pin IC which are namely input, ground and output. We have to give output of filter capacitor to the input of regulator, and we get 5 volts and 12 volts supply at the output pin of the respective regulator.

Transformer selection: we require 12V for min input for IC 7805

= Drop across IC 7805 + Required Output voltage

= 3 V+ 5V

= 8 V

So at Input of 7805 we required 8 V with margin

Consider drop across diode 0.7V so 2 diode conducts drop is 1.4 V

= 1.4 V +8 V

= 9.4 V

So at secondary we required 10 V

Fixed voltage regulator IC 7805 produces +5V regulated output voltage with respect to the ground.

- Output Current in Excess of 1.0 A
- No External Components Required
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limiting
- Output Transistor Safe–Area Compensation
- Output Voltage Offered in 2% and 4% Tolerance
- Available in Surface MountD2PAK, DPAK and Standard 3–Lead
- Transistor Packages

Temperature Sensor:

A temperature sensor is a device, typically, a thermocouple or RTD, that provide for temperature measurement through an electrical signal. A thermocouple is made from two dissimilar metals that generate electrical voltage in direct proportion to changes in temperature. It is prewired and waterproofed. It is measured something far away on in wet condition. It is operate up to the range of 150°C. Fairly precise (±0.5°C over much of range).

Water Level Sensor:

A level sensing device is design to measure the level of flow substances including liquids, slurries, and granular materials. It is used to detect the level of water within the tank. This type of sensor is very essential in drought farming area, as it detect the water level in the tank or in the river so that the farmer can operate the irrigating system accordingly. It is very easy to operate and it is accessible to installed in the water tank. It is waterproof and has a great longevity. As it interfaced with the IOT system, it analyzes and refresh the real time data by the delay of 2min.

Soil Moisture Sensor:

A soil moisture sensor is a device which measure the quantity of water contained in a material, such as soil on a volumetric or gravimetric basis. To obtain an accurate measurement, a soil temperature sensor is also required for calibration. In IOT based smart farming we used M413 Soil Moisture Sensor in cubic meter. This sensor can be easily interface and installed in the system. It measure moisture level of dry and wet soil sample. It is easy to operate. The cost of this sensor is approachable. It sensed and refresh the data and send it to the webserver, which hits the system and resulting data is represented in the form digital value as well as graph, which shows on the webpage.

CONCLUSION AND FUTURE SCOPE

The IOT agricultural applications are making it possible for ranchers and farmers to collect meaningful data. Large landowners and small farmers must understand the potential of IOT market for agriculture by installing smart technologies to increases competitiveness and sustainability in theirs productions. With the population growing rapidly, the demand can be successfully met if the ranchers, as well as small farmers, implement agricultural IOT solutions in a prosperous manner. IOT and smart farming will change the way agriculture operations and farms are managed, which will bring various benefits to farming, including enhanced crop quality and quantity; improve uses of resources and farming equipment's; real time monitoring of farm, machines, and automated irrigation system , fertilizers spraying and pest control. Government of India said that in upcoming days the satellite technology will be used for land and resources mapping pesticide management, soil health mapping, crop yield estimation as well as assessment of natural calamities. In future we modify this system by implementing agricultural drone. The major benefits of using drone includes crop health imaging, integrated GIS mapping, ease of use, time efficient and the potential to increases yields. From the drone data, we can draw insights regarding plant health indices, plant counting and plant height measurement, field water ponding mapping, scouting reports, stockpile measuring, chlorophyll measurement, nitrogen content, drainage mapping, and so on.

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