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Research Article

WIRELESS SENSOR NETWORK BASED AGRICULTURE FIELD MONITORING SYSTEM WITH IOT

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Abstract

The massive changes are shaking existing agricultural methods and opening up new avenues of opportunity. Agriculture products will be in high demand by 2050 due to a 30% increase in global population. Due to the migration of young people to big cities, human resources for agriculture development are becoming scarce, and land use for agriculture cultivation is being used for rapid development. As a result, in order to meet food demand, most agricultural activities must be automated. Wireless sensor-based agriculture field monitoring is being developed with various futures in mind, and the device will be a single system with multiple applications. The design that allows you to collect, manage, visualize, and upload data such as water level, temperature, and moisture content to the Arduino, the sensor values are stored in the Raspberry Pi using LoRa, and we can then know the exact situation of the monitoring land via the internet. This is primarily intended to assist formers in monitoring the various changes in the agricultural field.

INTRODUCTION

A wireless sensor network (WSN) is a collection of sensors working in a network created using wireless modules. WSNs monitor environmental conditions such as temperature, humidity, wind speed, and so on. The WSN is made up of "nodes," which can range from a few to hundreds or even thousands, with each node connected to one (or sometimes several) sensors. Each sensor network node typically consists of several components, including a radio transceiver with an internal antenna or a connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors, and an energy source, which is typically a battery or an embedded form of energy harvesting. A sensor node can be as large as a shoebox or as small as a grain of dust, though working "motes" of true microscopic dimensions have yet to be created.

EXISTING SYSTEM

The optimized data are collected from the wireless sensor nodes in this system, and the data are then analyzed for expert irrigation scheduling using fuzzy logic to optimize water usage. The fuzzy logic approach is used, and the Arduino UNO board is used to implement it. This system is also used to determine whether a plant is infected by a disease based on its leaf image, which is processed using image processing techniques and tested using MATLAB.

The system is made up primarily of Zigbee, GSM, sensors, a controller, and a motor. Data from various sensors is aggregated to continuously monitor the soil moisture level, temperature level, and humidity level in the farmland, as well as the plant health status. When the sensor node receives the information, it transmits it to the wireless node using a wireless protocol.

For data transmission from end devices to the web server node, this system employs the Zigbee wireless module. Using the information from the web server node, the farmer can automatically monitor and control the irrigation using an Android application. GSM is commonly used to transmit data to users, and SMS is used to control the water level.

PROPOSED SYSTEM

The proposed idea is to concentrate on the application that will assist farmers in taking care of their yield in a more efficient manner. More techniques for monitoring the field are included in the WSN-based agriculture monitoring system. The system is built with Raspberry Pi and Arduino. Sensors such as soil moisture sensors, temperature sensors, and water level sensors are used to monitor the proposed system. The data is transmitted from Arduino via LoRa technology in this case. The data in this system is processed by the Raspberry Pi, which is a new technology.

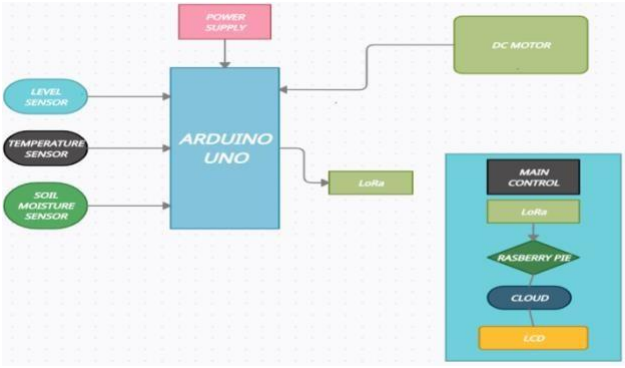


Figure: Block diagram

SCHEMATIC DIAGRAM

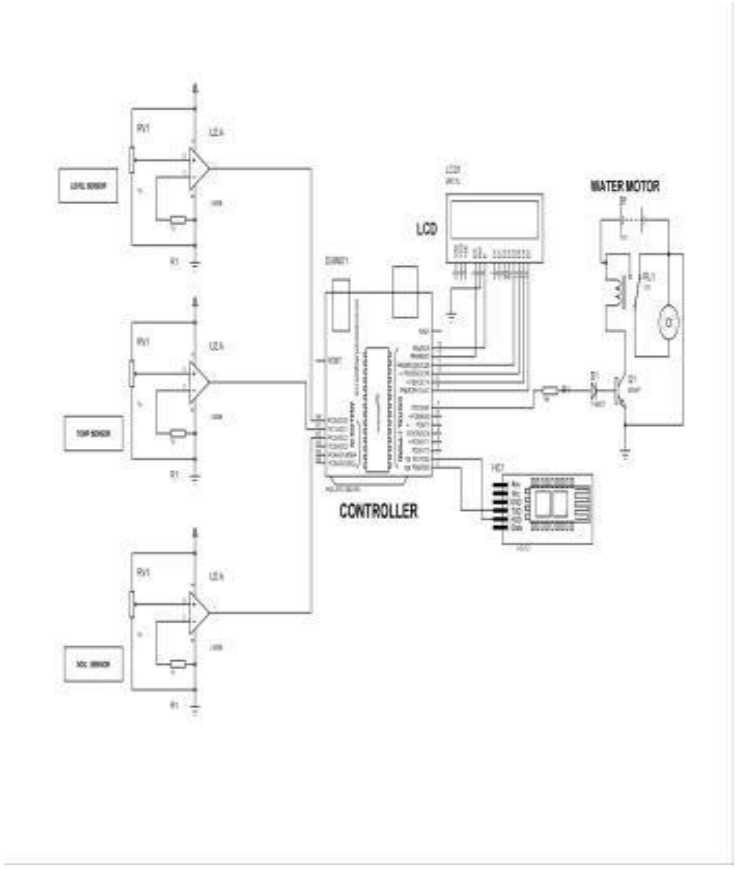


Figure: Transmitter side

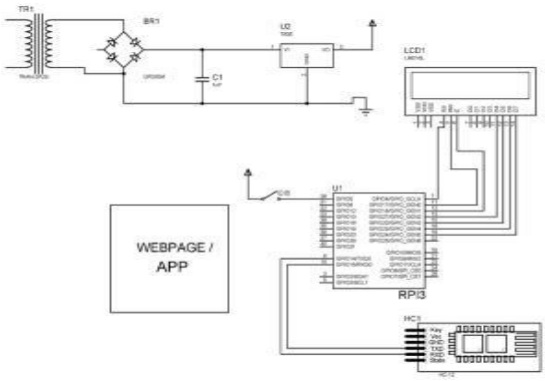


Figure: Reciever Side

HARDWARE DESCRIPTION

Arduino Uno

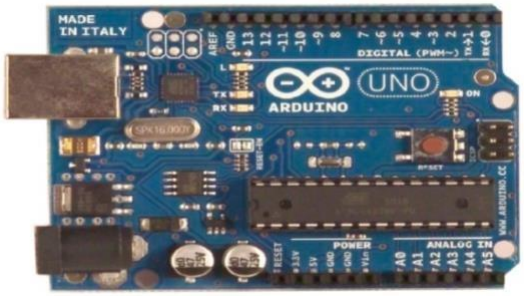


Figure: Arduino Uno

The ATmega328-based Arduino Uno is a microcontroller board (datasheet). It has 14 digital I/O pins (of which 6 are PWM outputs), 6 analogue inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. Voltage: 5 Volts

Raspberry PI-3

Figure: Raspberry pi

The Raspberry Pi3 is the central processing unitof this work and serves as the system's heart.
The Raspberry Pi3 is a small, low-cost computerboard that runs Noobs, a Debian-based version of the Linux operating system. It has a faster processor and more processor cores than previous Raspberry Pi models. It already has
Wi-Fi and Bluetooth built in. Because it is asmall computer, the Raspberry Pi can communicate serially with the Arduino.

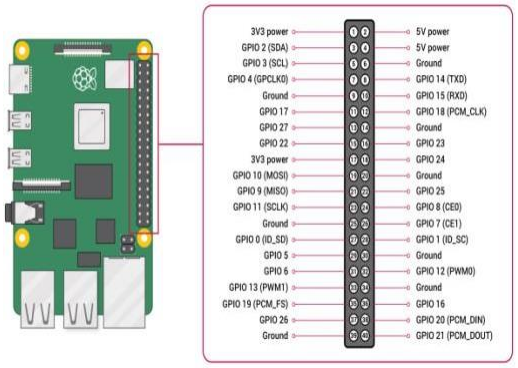


Figure: Pin description of Raspberry pi

Power Supply

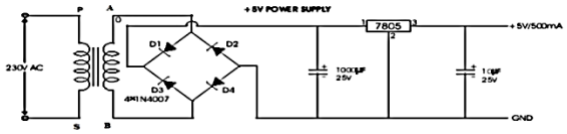


Figure: power supply

A power supply is an electrical component that provides power to at least one load. It is made up of a transformer, a rectifier, and a voltage regulator. It converts 230 volts alternating currentto +5 volts direct current. The power supply provides electric power to the components.

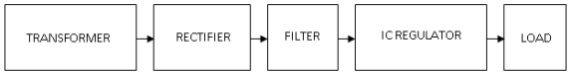


Figure : Block diagram of power supply

The alternating current voltage, typically 220V, is connected to a transformer, which reduces the alternating current voltage to the desired dc output level. A diode rectifier then produces a full-wave rectified voltage, which is first filtered by a simple capacitor filter to produce dc voltage. The resultingdc voltage usually has some ripple or alternating current voltage variation.

d. Level Sensor

Figure:Level sensor

A level sensor is a device used to monitor,maintain, and measure liquid (and occasionally solid) levels. After detecting the liquid level, the sensor converts the perceived data into an electric signal.
Head protection class: IP67. Temperature range: -40° to 85°C Pipe length: up to 1,200 mm Materials: PA and aluminum.

e.Temperature sensor

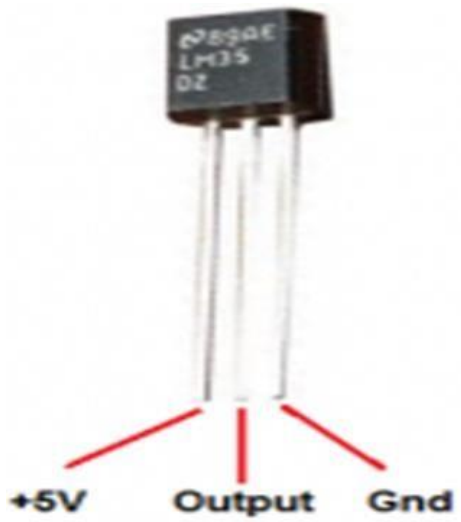


Figure: Temperature sensor

A temperature sensor is an electronic device that measures the temperature of its surroundings and converts the measured data into electronic data in order to record, monitor, or signal temperature changes.Based on LM-35 design Communicates using 1-Wire method Operating voltage: 3V to 5V Temperature Range: -55°C to +125°CAccuracy: ±0.5°C
Output Resolution: 9-bit to 12-bit(programmable)

f. Soil sensor

Figure: Soil moisture sensor

The soil moisture sensor operates in a fairly straightforward manner. This resistance is inversely proportional to soil moisture: the more water in the soil, the better the conductivity and thus the lower the resistance. The less water in the soil, the lower the conductivity and, as a result, the higher the resistance.
Operating Voltage: 3.3V to 5V DCOperating Current: 15mA
Output Digital - 0V to 5V,Output Analog - 0V to 5V

g. Dc Motor

Figure:Dc motor

A direct current (DC) motor is an electric motor that operates on direct current power. The operation of any electric motor is dependent on simple electromagnetism. When a current carrying conductor is placed in an external magnetic field, it will encounter a force proportional to the current in the conductor and the strength of the external magnetic field. It's a device that converts electrical energy into mechanical energy. It operates on the principle that a current carrying conductor placed in a magnetic field experiences a force that causes it to rotate in relation to its original position.

h. LCD

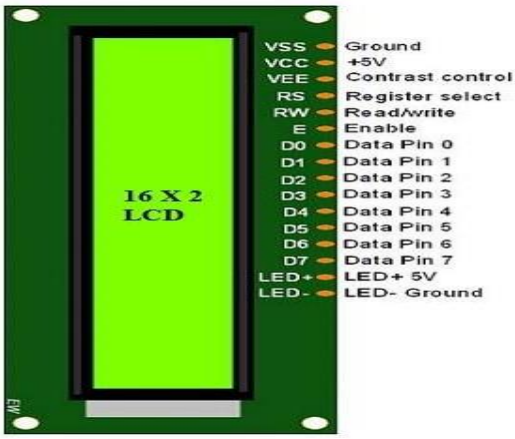


Figure: LCD

A liquid-crystal display (LCD) is a flat- panel display or other electronically modulated optical device that makes use of the light-modulating properties of liquid crystals in conjunction with polarizers.

Liquid crystals do not emit light directly, butrather use a backlight or reflector to producecolor or monochrome images.

Operating Voltage - 4.7V to 5.3V. Consists of 2 rows, 16 characters. Works on both 8-bit and 4-bit mode.

LoRA Technology

LoRa is a spread spectrum modulation technique derived from chirp spread spectrum (CSS) technology.. Semtech's LoRa devices and wireless radio frequency technology are a long-range, low-power wireless platform that has become the de facto technology for global Internet of Things (IoT) networks.

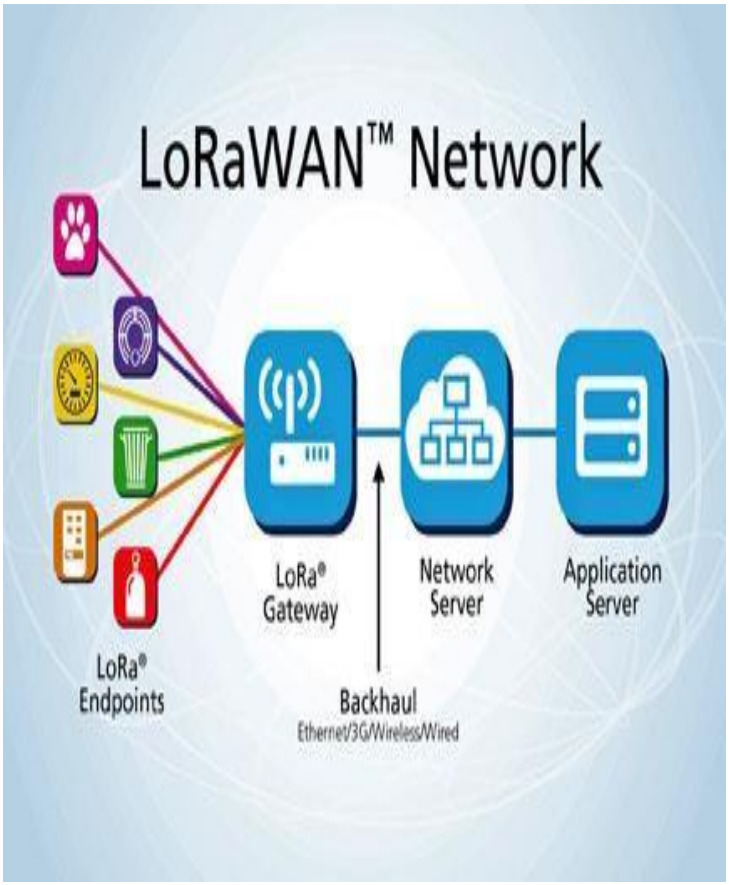
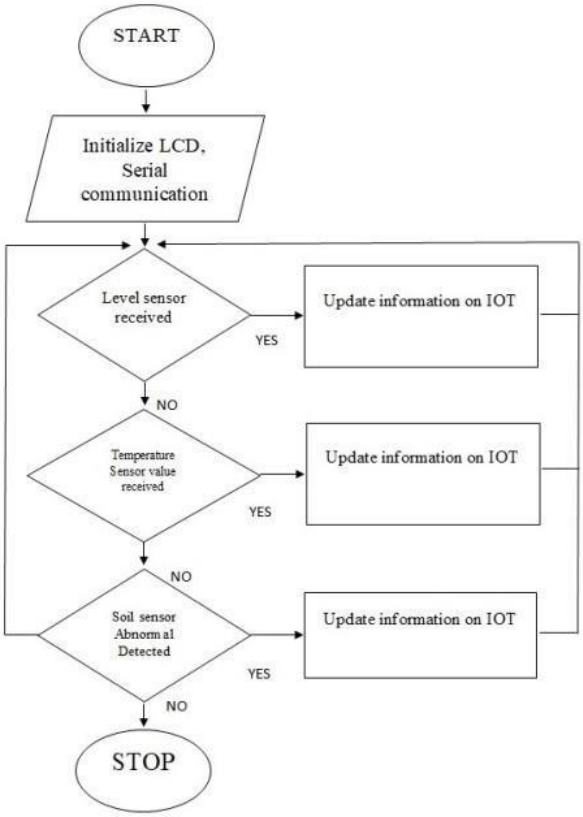


Figure:Hc-12 module

The HC-12 is a half-duplex wireless serial communication module with 100 channels in the 433.4-473.0 MHz frequency range and a transmission range of up to 1 km.
Working frequency: 433.4MHz to473.0MHz.
Supply voltage: 3.2V to 5.5VDC. Communication distance: 1,000m in theopen space.
Serial baud rate: 1.2Kbps to 115.2KbpsReceiving sensitivity: -117dBm to - 100dBm.
Transmit power: -1dBm to 20dBm.Interface protocol: UART/TTL.

FLOWCHART

TransmitterReceiver



SOFTWARE DESCRIPTION

PYTHON:

Python is a high-level programming language. Its language creates an object oriented approach which is purposed to assist programmers in writing programs.

THONNY:

Thonny is a free Python Integrated Development Environment (IDE) created with the novice Pythoness in mind.

It has a built-in debugger that can help when you run into nasty bugs, and it of course supports step-through expression evaluation,among other really cool features

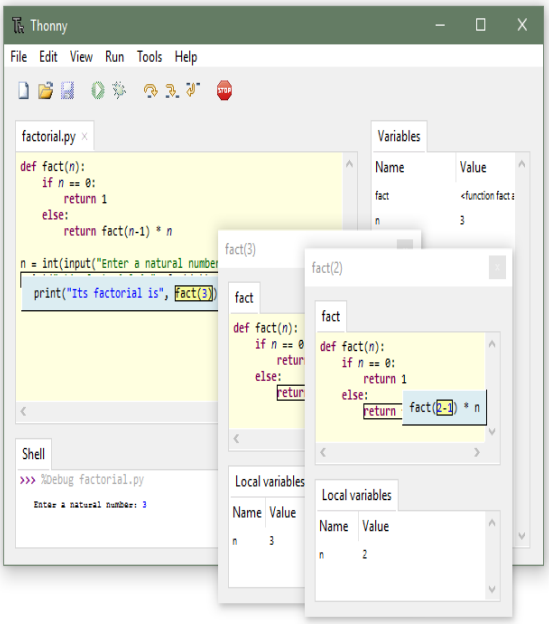
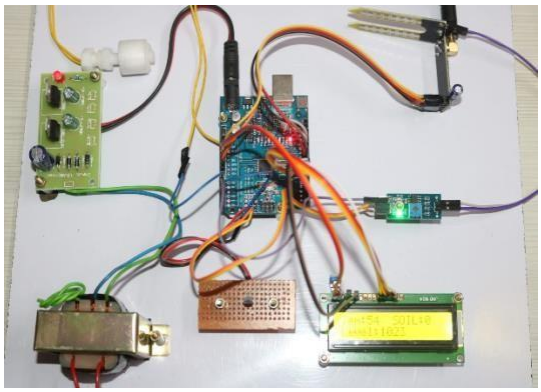
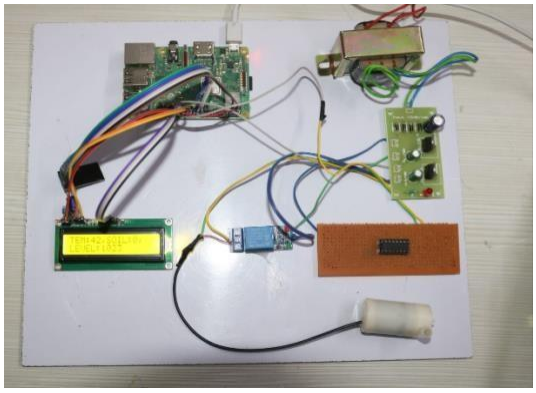


Figure: Thonny





8. RESULTS

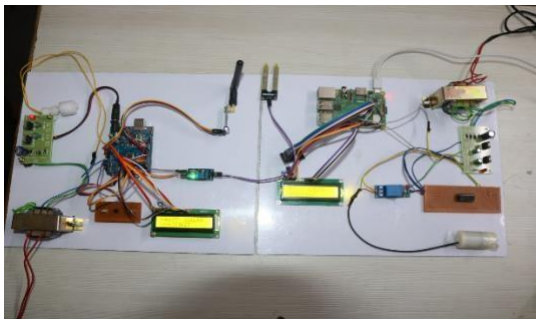


Fig : Circuit Setup

9. CONCLUSION AND FUTURE SCOPE

In conclusion with wireless sensor network based agriculture field monitoring system with IOT, is the concept in which the virtual world of information technology connected to the real world of things. The technologies of Internet of things Sensor make our life become better and more comfortable. This application can be readily implemented in a variety of settings, and new features can be added as needed. Reusability is possible as and when required in the application, and all modules are flexible.

10.REFERENCES

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