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Mobile Agriculture Automation System

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Abstract: ***The impact of environment and other surrounding parameters on local agriculture quality and individuals exposure are major public policy concerns and have stimulated a substantial body of research aimed at improving underlying automated robotic technologies and parametric management schemes to minimize the impact of environment changes on the field. A particularly exciting direction for future development of such environmental sensor data sources is the use of mobile system and people themselves as platforms for outward facing environmental sensor systems, enabling them to operate as mobile environmental probes. This project aims to address these challenges by combination and extension of sensor and positioning technologies, data fusion, traveller behavior, traffic modeling and surveillance based on combinations of software and hardware vehicle mounted sensors.***

Keywords: ESP8266, ARDUINO(UNO), Moisture Sensor, LDR, LM-35

1. Introduction

The impact of environment and other surrounding parameters on local agriculture quality and individuals exposure are major public policy concerns and have stimulated a substantial body of research aimed at improving underlying automated robotic technologies and parametric management schemes to minimize the impact of environment changes on the field. A particularly exciting direction for future development of such environmental sensor data sources is the use of mobile system and people themselves as platforms for outward facing environmental sensor systems, enabling them to operate as mobile environmental probes.

This project aims to address these challenges by combination and extension of sensor and positioning technologies, data fusion, traveller behavior, traffic modeling and surveillance based on combinations of software and hardware vehicle mounted sensors.

2. System Overview

2.1 Literature Survey

Rural practices and progressions vary internationally since plants have their own particular contrasts and the area assumes a part on their advancement also. Be that as it may, through the trading of information from various agronomically included people from everywhere throughout the world, change of methods can be experienced too. It has had an effect on how data is shared, and having the capacity to utilize this data for the progression of the horticultural area gives an extraordinary positive effect that is useful for everybody. It has turned into a scaffold for individuals from everywhere throughout the world. It underpins new techniques for accuracy agribusiness like modernized ranch apparatus that applies for composts and pesticides. Ranch creatures are sustained and checked by electronic sensors and ID frameworks. Offering or purchasing online started to end up mainstream on the planet. Be that as it may, it's most critical part remains correspondence, and the Internet has furnished us with a perfect chance to do as such.

3. Hardware Implementation

3.1Block Diagram

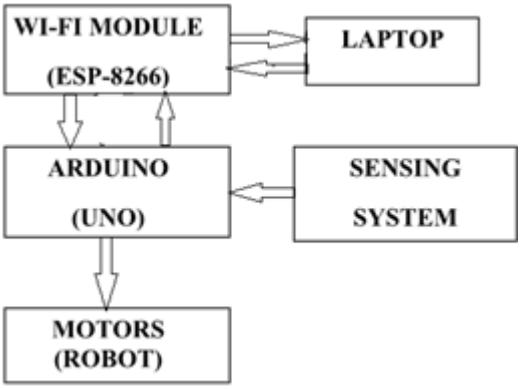

Figure 1: Block diagram of System

The above block diagram shows the basic working of the mobile environment sensing system. The command we give is received by the Wi-Fi module. Depending upon the command, the Wi-Fi module instructs the Arduino to make corresponding pins high or low. The high or low going of the Arduino pins makes the motors to move in the desired direction. This will help us to reach a desired position. Now, the sensing can be done by pressing an "ENTER" key, which makes the servo motor to move that pushes the moisture sensor into the soil. The values of corresponding sensors are received by the Arduino which gives it to the raspberry-pi which acts as a server that displays all the values on your laptop.

3.2 Selection of Components

A. Arduino Uno

Figure 2: Arduino uno board[1]

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform.[2]

B. Wi-Fi Module: ESP8266

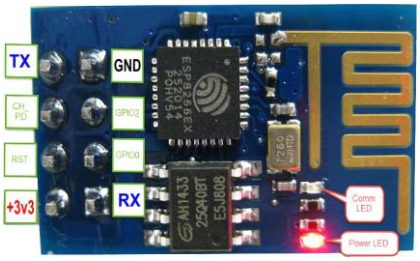

Figure 3: Wi-Fi Module ESP8266 [3]

The ESP8266 is a low-cost Wi-Fi chip with full TCP/IP stack and MCU (Micro Controller Unit) capability produced by Shanghai-based Chinese manufacturer, Espressif Systems. The chip first came to the attention of western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer, AI-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at the time there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact that there were very few external components on the module which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation.

The ESP8285 is an ESP8266 with 1 MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi. The successor to these microcontroller chips is the ESP32.

C. MQ135

Figure 4: MQ135 (Gas Sensor)[4]

MQ-135 Module sensor is used for the detection of the gases in the surrounding atmosphere. It has lower conductivity in clean air. When the target combustible gas exist, the sensors conductivity is higher along with the gas concentration rising.

Convert change of conductivity to correspond output signal of gas concentration[5]. MQ135 gas sensor has high sensitivity to Ammonia, Sulphide and Benzene steam, also sensitive to smoke and other harmful gases. It is with low cost and suitable for different applications such as harmful gases/smoke detection.

D. Moisture Sensor

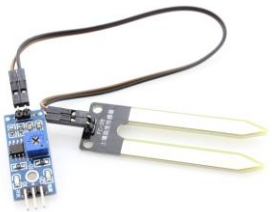

Figure 5: Soil Moisture Sensor[5]

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners. Soil moisture sensors typically refer to sensors that estimate volumetric water content. Another class of sensors measure another property of moisture in soils called water potential; these sensors are usually referred to as soil water potential sensors and include tensiometers and gypsum blocks.

E. Temperature Sensor LM35

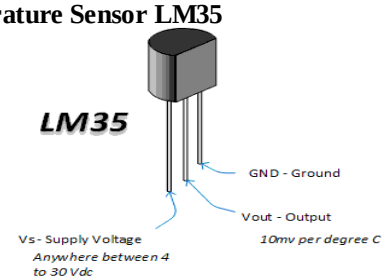

Figure 6: Temp Sensor LM-35[6]

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range. The low-output impedance, linear output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy. The device is used with single power supplies, or with plus and minus supplies. As the LM35 device draws only 60 µA from the supply, it has very low self-heating of less than 0.1°C in still air. The LM35 device is rated to operate over a −55°C to 150°C temperature range, while the LM35C device is rated for a −40°C to 110°C range (−10° with improved accuracy).

F. Light Dependent Resistor

Figure : Light Dependent Resistor (LDR)

A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance. There are many different symbols used to indicate a LDR, one of the most commonly used symbol is shown in the figure below. The arrow indicates light falling on it.

3.3 Software Implementation

The program is written in Arduino IDE (Integrated Development Environment) whose algorithm is as follows:

1) Start.
2) Initialise input pins for all sensors.
3) Initialise all the sensor values to zero.
4) Set baud rate of 115200 for ESP8266.
5) Navigate the robot from control on the GUI.
6) Read values from respective sensors
7) Display the values on serial monitor.
8) Update the values on webpage.
9) Compare the values to threshold values and perform the corresponding task.
10) Stop.

3.4 Advantages of System

The quality of soil is the most important parameter when it comes to agriculture. This system helps you maintain the quality of soil by keeping a read on important parameters like soil moisture, temperature, intensity of light and the quality of air. This prevents the degradation of soil which is a very important resource. Since the system is wireless, the user can monitor parameters from a distant place and the robot allows him to cover the entire field area.

3.5 Disadvantages of System

On the user side, it is compulsory to have a network connection to continuously monitor the parameters. Also the range till which the data can be received is limited to the range of the wi-fi module ESP8266 (typically 300-400m). Higher end sensors can be used for improving accuracy but that will increase the overall system cost.

4. Results

Figure 8: Sensor values displayed on the webpage

5. Summary and Conclusion

A. Summary

From the project that we have hereby made we can summarise the basic idea of this project is to automize the process of agriculture and to maintain the quality of soil to enhance the production. The graphic user interface allows the user to use the robot to navigate through the field area to reach a particular location. With a simple command, the user can start the process of receiving the sensor data and can monitor all the useful parameters.

Also, if the value of useful parameters are less than or more than the specified thresholds, the system will do the needful to bring them to an ideal value (for e.g. Switching ON the water motors to pump water if the moisture level is below threshold).

B. Conclusion

The system implemented is user friendly and reliable that it can be handled by all the people. As it is compact in size it can be easily handled by anyone and hence becomes a portable system. The important feature in this project is that more than one vital parameters of the farming technique (moisture level, temperature and light intensity) are measured in single system. This project also combines engineering field and the biomedical fields so as to make more advancement in these respective fields.

6. Future Scope

In future for better performance and to increase range, the GSM module instead of Wi-Fi module can be used. So this will increase the range up to whatever miles required. Additional vital parameters can be added to be measured in the device for future implementation.

It is also possible to interface it with mobile for more ease and comfort motors.

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