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Autonomous Mobile Navigation Robot For Agricultural Purpose

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Abstract

The prime concern of "Autonomous Mobile Navigation Robot for Agricultural Purpose" is to observe the substantial condition of the agricultural field. This project approach solution, with creating a small robot that can monitor the environmental conditions of the field. The system uses several sensors that are mounted to the robot and uses GPRS transceivers to send the present environmental condition of fields to remote user. In this project mainly focused on monitoring the crop field's environment for various factors such as temperature, water level, humidity and to find pest and spray fertilizers in the agricultural field. Information about the environment is sent wirelessly to a computer through GPRS and Robot receives the commands from the remote user the same GPRS module and the robot executes the instruction.

Keywords: Temperature, Humidity, Water Level, Robotic, fertilizer spraying, GPRS system.

Introduction

The main concern of agricultural area is to produce better quality agricultural products Farmers are adapting latest techniques by implementing modern technologies for producing better agricultural products. Among that important things which are taken into consideration by the farmers are the qualities of agricultural land, weather conditions etc. The advanced sensor technology and the intelligence information processing technology are important method to generate correct and exact environmental data for agricultural environment. Applying GPRS technology to design an intelligent monitoring system of the agricultural environment using an autonomous mobile robot [11] which is used to give the real time data to the remote user by sending message. Several approaches have been proposed for agricultural monitoring using sensor modules. However, most of them have focused on one specific aspect of the problem. In this system focus was more on describing the three main crop parameters: the water level, humidity and the temperature and two main aspects: finding pest intrusion and fertilizer spaying. The problems occurring in the traditional agriculture such as poor real-time data acquisition, small monitoring coverage area, high power Consumption, water logging problem in the land, excessive manpower requirement etc. This paper used to monitors crop field's environment where GPRS controlled mobile robot that perform the task by collecting information from sensor modules and sends these data to the remote user. All the sensor data are transferred through GPRS network from the robot and the robot can give the weather's data in real time by sending message to the remote user. This system can automatically collect the temperature; humidity and water level data from the deployed sensors, and transmit the data to the robot via signals in real time. Traditional farming involves a human labor. With proper information about the field farmer will be able to deliver the quality product to the consumer. Our aim is to design a low cost wireless GPRS controlled robot that can make agricultural processes more efficient. The sensors senses physical parameters and transmits that information to user computer .Improved environment monitoring system for agricultural field, so that any abnormal condition can easily be detected without Human intervention, as the monitoring is done by robot Agricultural monitoring is real time and we get the results in user computer. This autonomous robot is also capable of finding the intruders into the agricultural field and sends the caution to the user and it is capable of spraying pesticide, fertilizer to each plant with regular period of time. On the other hand, we can also measure the humidity by which we can forecast rain fall thus we can save water as well as power. We can apply fertilizers and pesticides where it needs and thus we can avoid over fertilization of crops. So this system provides real time data about the crop field's climate for collecting data which covers large number of area of lands by minimizing human labor, cost and power consumption.

Related Works

Several approaches have been proposed for agricultural monitoring using mobile robots. Among all the approaches most of them have focused on one specific aspect of the problem. In [1] the focus was more on describing the wireless mesh sensor network and the design of a new routing algorithm for sensing main crop parameters: the humidity, the temperature the soil moisture, pesticide and fertilizer spraying. E.J. Van Henten in [2] presented the technical aspects of autonomous mobile robot deployment and its use in agriculture to monitor weather and crop conditions. The focus was on the diseases monitoring for the Grape vine crop. The European 6th Framework project for optimizing water use under deficit conditions, named FLOW-AID, is described. The objective was to contribute to the sustainability of irrigated agriculture. The FLOW-AID system deployment had to adapt the general concept of water management to the local situation, as it has been used in Lebanon, Jordan, Turkey and Italy. After the introduction of Internet of Things, wireless sensor networks become the major part of networking compared to wired network, we adopt the technology of based on GPRS, Zigbee and Web Services[9] .This technology is used to design a set of low cost, low power consumption, flexible and automatic network for temperature and humidity monitoring system of soil. Sensor Networks has emerged as a viable technology in the agricultural sector, where the sensor nodes are deployed in outdoor fields to monitor soil conditions such as level of water in soil, air temperature and environment's humidity. Data collected from the sensors play a key role in crop management and crop productiveness.[6]One example of how crop management can be enhanced using sensor network is the project Accenture[7] carried out in Northern California. Accenture Technology Labs installed a Sensor Network at Pick berry Vineyard across a 30-acre area to continually sense the environment parameter such as temperature and humidity.

System Architecture

This system consists of five parts. In this autonomous mobile robot system we use multiple sensors like temperature, humidity and ultrasonic sensor for sensing the agriculture environment where as the microprocessor will collect information from sensors through GPRS network to remote user

The autonomous mobile robot receives the data from the sensor modules and transmits to the respective remote users through the GPRS module, data about acquisition of the temperature, water level, humidity.

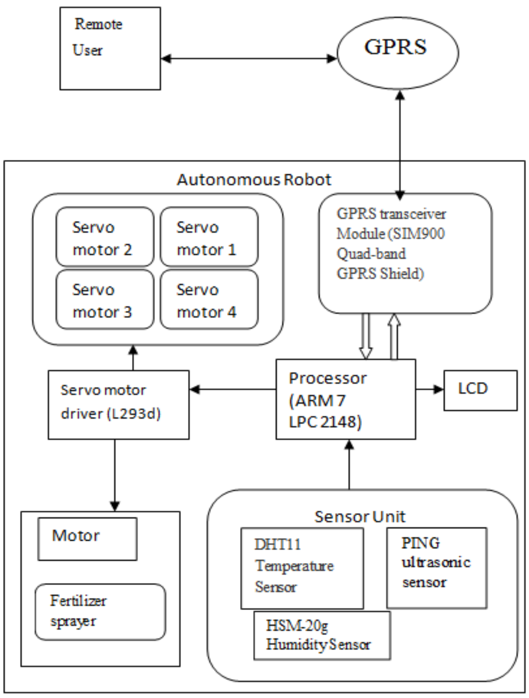


Figure 1: System Architecture

Proposed System

The humidity sensors, indirectly calibrates the soil water measurement. It is an electrical capacitance sensor, the assembly accompanied with casing of Intelligent Soil humidity sensor which measures the electrical capacitance and transmits to an embedded processor ARM7 LPC2148. A calibration table is stored in sensor system memory where the pre-acquired different standard reference values of capacitances are stored in the memory map (calibration table) for processing which is done by the intelligent humidity sensor embedded processor. That is, the humidity sensor uses the calibration table stored in the memory map of the embedded processor for displaying the calibrated reading of soil water tension. The humidity sensor can play a vital role in soil moisture measurement technology and hence can be very useful for the precision agriculture. The intelligent humidity sensor is an ideal solution for both agricultural and landscape applications. Its electrical characteristics make it perfectly suited to use with a central master/base station electronic data processing equipment for collecting and processing data from various sensors deployed in agriculture field for precision agriculture applications. The DHT11 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The output of sensor converted to digital that easy connecting with microcontroller. The ARM7 LPC2148 Tyro board uses the ADC pin for reading temperature from temperature sensor DH11.The ultra sonic sensor is used to sense the presents of any unwanted intruders or animal in the agricultural field. If the ultrasonic sensor detects any unwanted object like anima, which would cause damage to the plants, a caution is sent to the remote user. To protect the crop and to enrich the fertile capacity for the plant, fertilize module is mounted to the autonomous robot. For every period of time, autonomous robot is instructed to spray the fertilizer/pesticides to field it is then displayed to the remote user via GPRS.

Implementation

The system which is implemented is divided into three parts. They are sensor unit, autonomous mobile robot, client side. The architecture diagram in figure 3 shows the implementation.

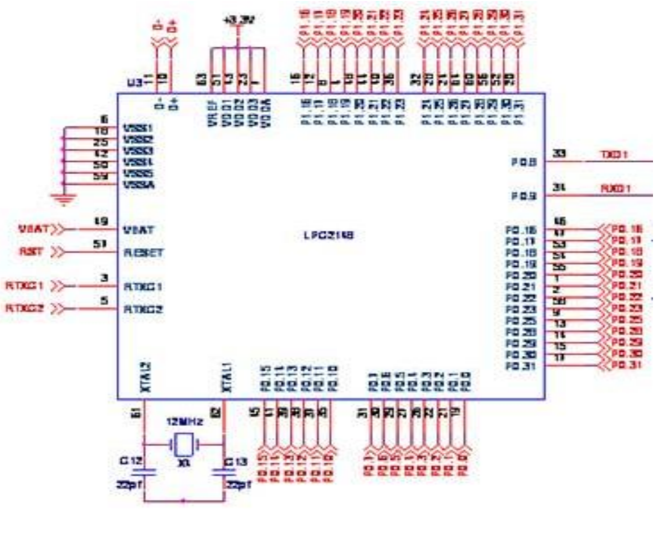
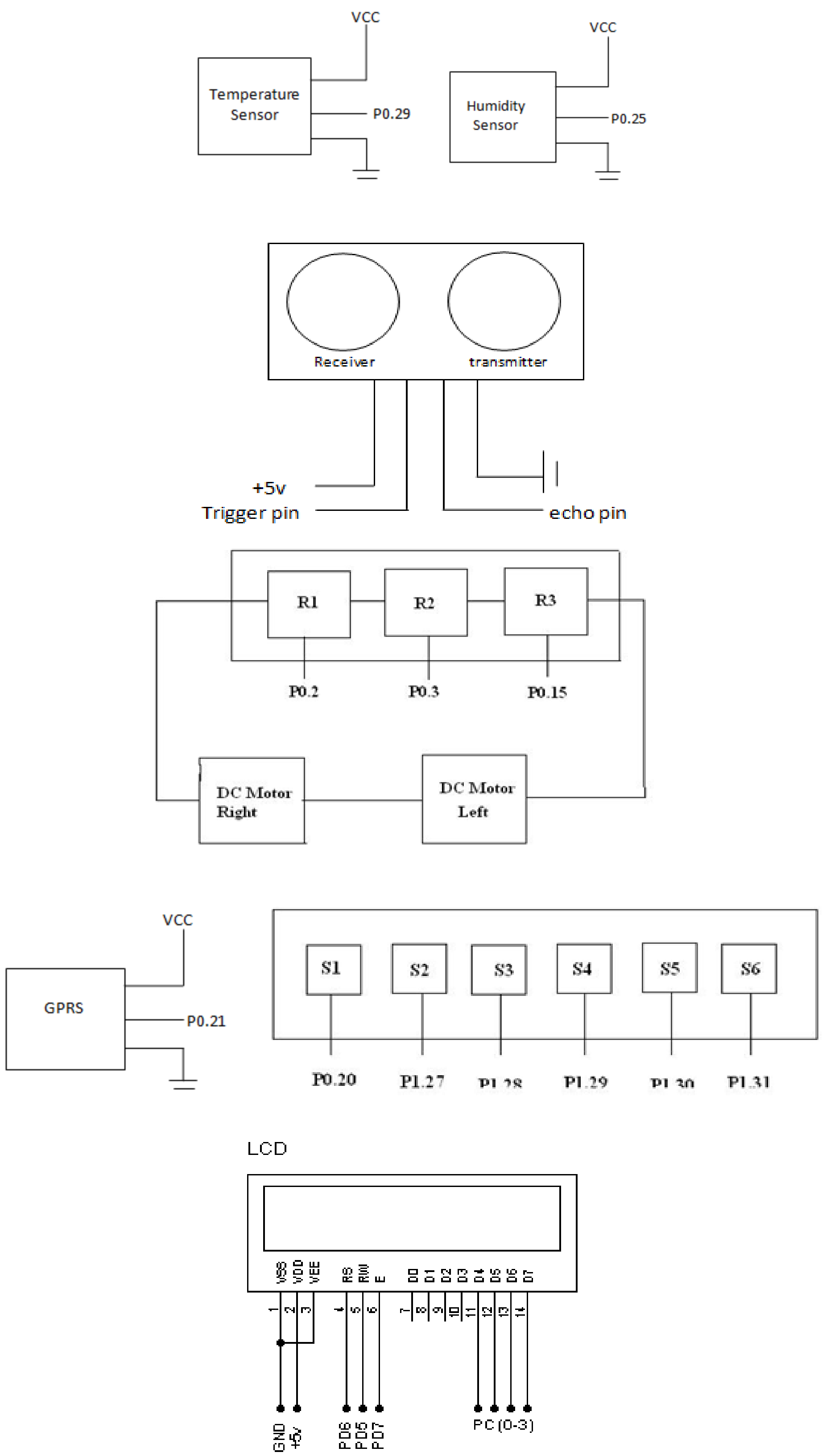
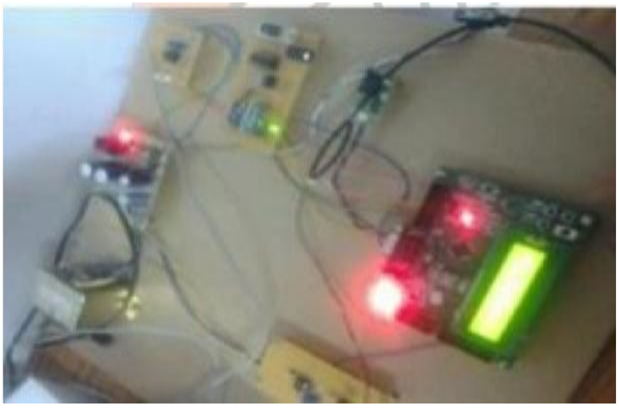


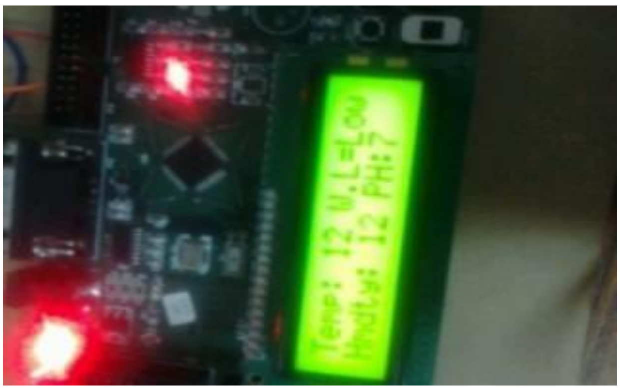
Figure 2: Processor Architecture


VCC
Temperature Sensor
P0.29
VCC
Humidity Sensor
P0.25
Receiver
transmitter
+5v
Trigger pin
echo pin
R1
R2
R3
P0.2
P0.3
P0.15
DC Motor Right
DC Motor Left
VCC
GPRS
P0.21
S1
S2
S3
S4
S5
S6
P0.20
P1.27
P1.29
P1.31
LCD
VSS
VDD
VEE
RS
RW
E
D0
D1
D2
D3
D4
D5
D6
D7
GND
+5v
PD6
PD5
PD7
PC(0-3)

The hardware circuit in the field side measures the environmental parameters using the sensors such as **HSM- 20g Humidity** sensor, **DHT11 Temperature sensor** and **ultrasonic sensor** and **fertilizer sprayer.** This information is collected by the hardware controller **ARM 7 LPC 2148** and transmitted using **GPRS** transceiver to the remote user.

Sensor Unit:
Two hardware controller circuits have been developed and shown below:





A hardware board has been implemented where the hardware gets the Humidity, temperature data from corresponding sensor in hardware circuit which sends all the information from the robot using the GPRS transceivers.

Autonomous Robot Side

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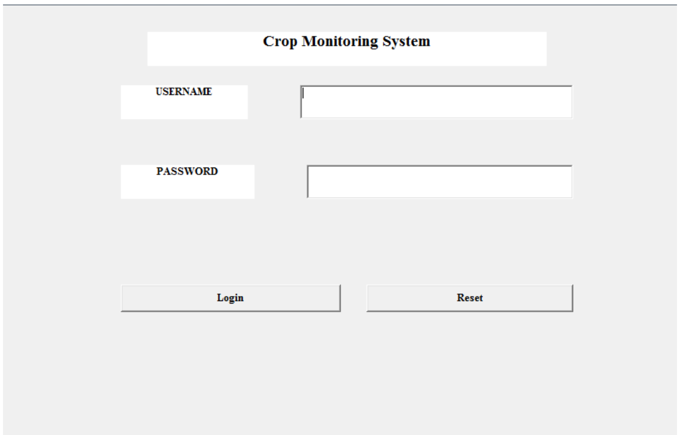
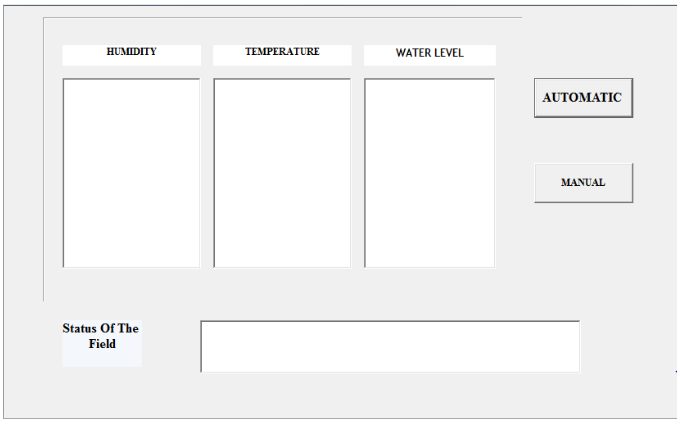
Figure 3: Autonomous Mobile Robot

In this system the robot will moves through the agricultural field and collects all the sensor parameter’s information of the field side and transmit the date to the client through the GPRS.

Client Side

The received data is stored in robot and the stored real time information is securely send to user or client by using GPRS technology between remote computer and autonomous robot So that user can able to get real-time information about the land at anywhere at any time. The received data in computer is shown in the Figure4.





Results

This paper presents a solution for Agricultural field by monitoring its environment and give information to the user in real time, which is more beneficial for the farmers as well as for the society. This system monitors the air temperature, humidity and water level in an agriculture field. An autonomous robot is used here for collecting sensor data from the sensor unit and it sends the information to the user through message This system uses GPRS transceiver for transmitting and receiving signal. Thus this system serves as a reliable system, for efficiently monitoring the environmental factors. Wireless monitoring of field not only allows user to reduce the human effort, but it also allows user to see exact changes real time. It is much cheaper in cost and consumes less power. Thus sensor unit and robotic plays a important role in agricultural management and its productiveness

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