An Intelligent Agriculture Environment Monitoring System Using Autonomous Mobile Robot

[1]Sujaya Bhattacharjee, [2]C.Yaashuwanth
[1]Student, [2]Assistant professor
[1]Information Technology,SRM University, Kattankulathur-603203 ,India
[2]Information technology,SRM University, Kattankulathur-603203 ,India
[1]sujayabhattacharjee09@gmail.com, [1]yaashyaashuwanth@gmail.com

***Abstract*— The primary concern of "An Intelligent Agriculture Environment Monitoring System Using Autonomous Mobile Robot" is to monitoring the environmental condition of the agricultural field in real time. This project deals with creating a solution for such a situation in the form of a small robot that can do the task. The system uses several sensors that are mounted around the agricultural field and the signals are transferred to the robot using ZIGBEE transceivers so that it can detect the present environmental condition of fields and give information about the environment to the user through message. In this project we develop a smart wireless sensor network (WSN) for an agricultural environment, which can monitors the crop field's environment for various factors such as temperature ,ph level, water level and humidity. Information about the environment are sent wirelessly to a Robot through ZIGBEE and Robot collects the data, stores it and sent the information to the User mobile using GSM module.**

***Index Terms*— Wireless Sensor Network, Temperature, Humidity, Water Level, PH Level, Line Following Robot.**

I. 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. As a brand-new information acquisition and the processing technology, the wireless sensor networks (WSNs) has seeped gradually into agricultural domain by the characteristics such as low power loss, low cost and redundant reliability. Applying Zigbee technology to design an intelligent monitoring system of the agricultural environment based on WSNs and an autonomous mobile robot[11] which is used to give the real time data to the user through message. Several approaches have been proposed for agricultural monitoring using WSNs. However, most of them have focused on one specific aspect of the problem.

In this system focus was more on describing the wireless mesh sensor network for sensing four main crop parameters: the pH level of soil, the water level, humidity and the temperature. 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 using wireless sensor networks where a line following mobile robot perform the task by collecting information from sensor nodes and sends these data to the user. All the sensor data are transferred from the wireless sensor network node to the robot which can give the weather's data in real time by sending message to the user. This system can automatically collect the temperature, humidity, ph level and water level data from the deployment zone, and transmit the data to the robot via ZIGBEE 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 sensor network that can make agricultural processes more efficient. The network senses physical parameters and transmits that information to user mobile .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 line following robot Agricultural monitoring is real time and we get the results in user mobile .In this project we are detecting the water level of field so that we can irrigate at particular place where it actually. As a result we can conserve water needs and solve the water logging problem. On the other hand ,we can measure the humidity by which we can fore caste rain fall thus we can save water as well as power. By analyzing acid level of soil using PH sensor we can apply fertilizer where it needs and thus we can avoid over fertilization of crop, So this system provides real time data about the crop field's climate and here we are using a small line following robot for collecting data which covers large number of area of lands by minimizing human labor, cost and power consumption.

II. RELATED WORK

Several approaches have been proposed for agricultural monitoring using WSNs [1] [2] [3] [4] [5] . 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 four main crop parameters: the pH, the electrical conductivity ,the temperature and the soil moisture. I. Das et al in [2] presented the technical aspects of WSN deployment and its use in agriculture to monitor and compute infection index values based on 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 [3].

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. It focused on irrigation management. F. Reichenbach et al. in [4] focused on an algorithm that reduces the energy consumption for each sensor node to achieve a global WSN energy saving. Yoo et al. in [5] described the results of deploying an IEEE 802.15.4 compliant system to monitor and control the environment in greenhouses of melons and cabbages. 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 wireless sensor network 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. Wire less Sensor Network (WSN) consists of spatially distributed autonomous devices which use sensors to cooperatively monitor physical or environmental parameters such as sound, temperature, vibration and pressure.

WSN 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 WSNs is the project Accenture[7] carried out in Northern California. Accenture Technology Labs installed a WSN at Pick berry Vineyard across a 30-acre area to continually sense the environment parameter such as temperature and humidity. Another application of WSN in agriculture field is Greenhouse monitoring [8]Temperature and humidity, which play a vital role in determining the quality and productivity of crops, are controlled inside the commercial greenhouses using WSNs. Sensors installed at different locations in greenhouses are used to communicate the climate parameters data to the centralized control that helps in the proper working of automation system. The WSN can detect the differences in the greenhouse climate due to the disturbances such as direct sunshine on greenhouse walls and transmit the data to trigger the automation system. The automation system by evaluating the sensor data adjusts the greenhouse interior climate to optimal climate conditions.

III. . METHODOLOGY AND DESIGN

This system consists of three parts one is the wireless sensor network nodes in field side, second one is the line following robot and the third one is client side. In this Wireless sensor network system in the field side we use multiple sensors like temperature, PH, humidity and water level sensor for sensing the agriculture environment where as line following Robot will collects information from sensors node through zigbee and then robot will sent message to the user mobile through GSM.

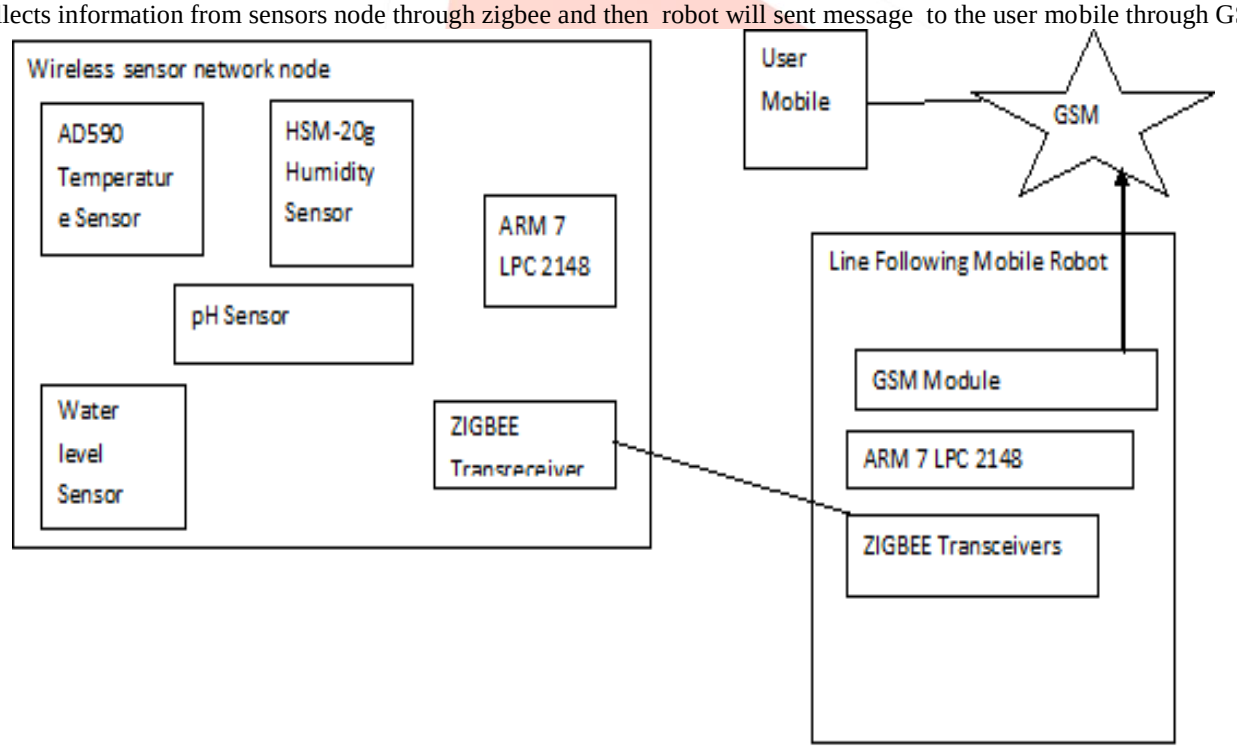
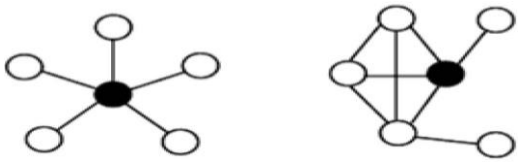


Fig 1: Block diagram of the system.

Zigbee node respectively transmits acquisition of the temperature, water level, humidity and ph data to the Zigbee stations of gateways node.



Star Topology Mesh Topology

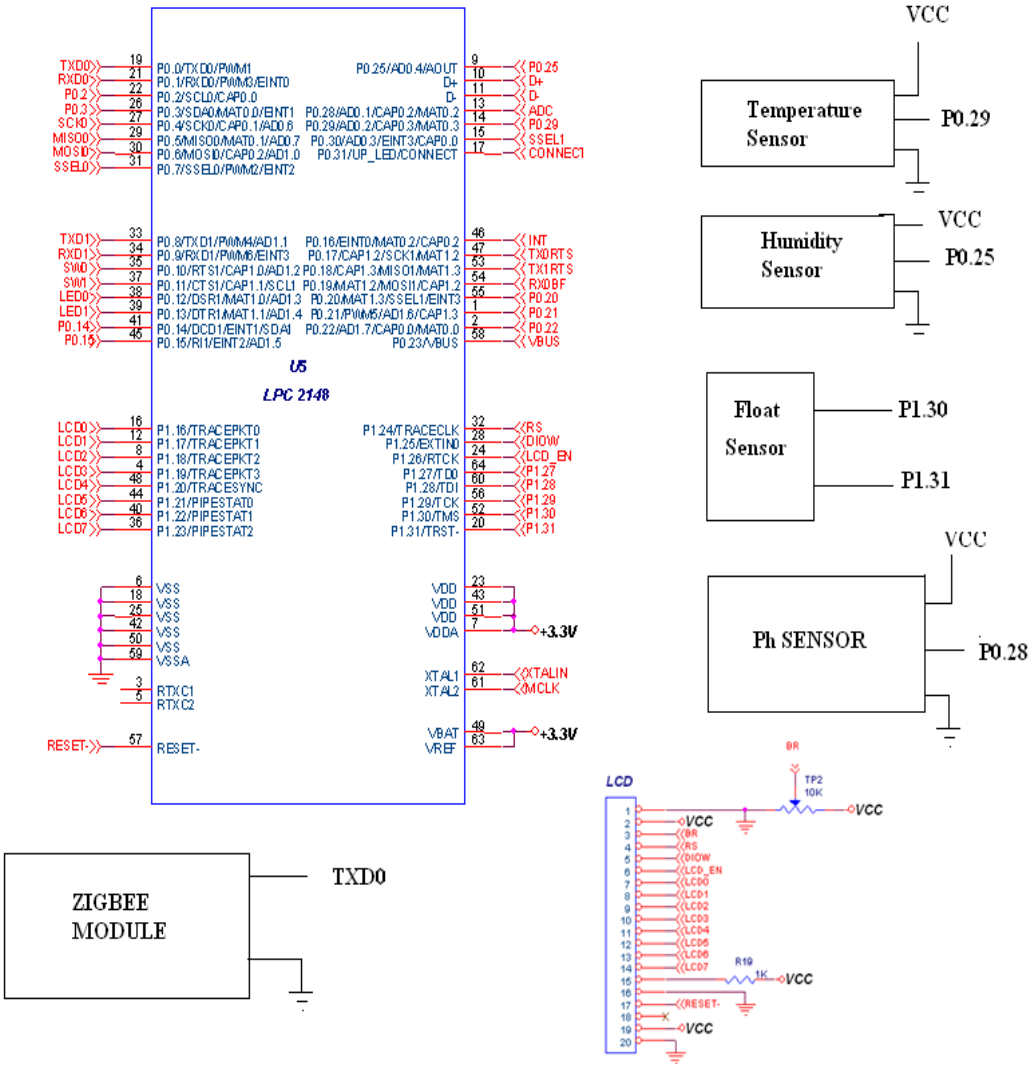
Fig2: Zigbee topology

The automatic networking realizes through the many jump routing form between each node and tuner network. Then pass the data to user's mobile to view the environmental data real-time . The whole system designs an intelligent environment monitoring system using a mobile robot ,which can provide real time information about the weather to the user. Here we used a small line following robot, which can follow a black line with white surface. Robot consists of six IR sensor for sensing line , two sensor for moving forward, another two IR for moving right and other two IR sensor for moving Right side of the robot. We are using Ultra sonic sensor in robot for avoid the obstacles.

IV. IMPLEMENTATION DETAILS

The system which is implemented is divided into three parts. They are field side, line following robot side and client side. The architecture diagram in figure 3 shows the implementation.

Field side



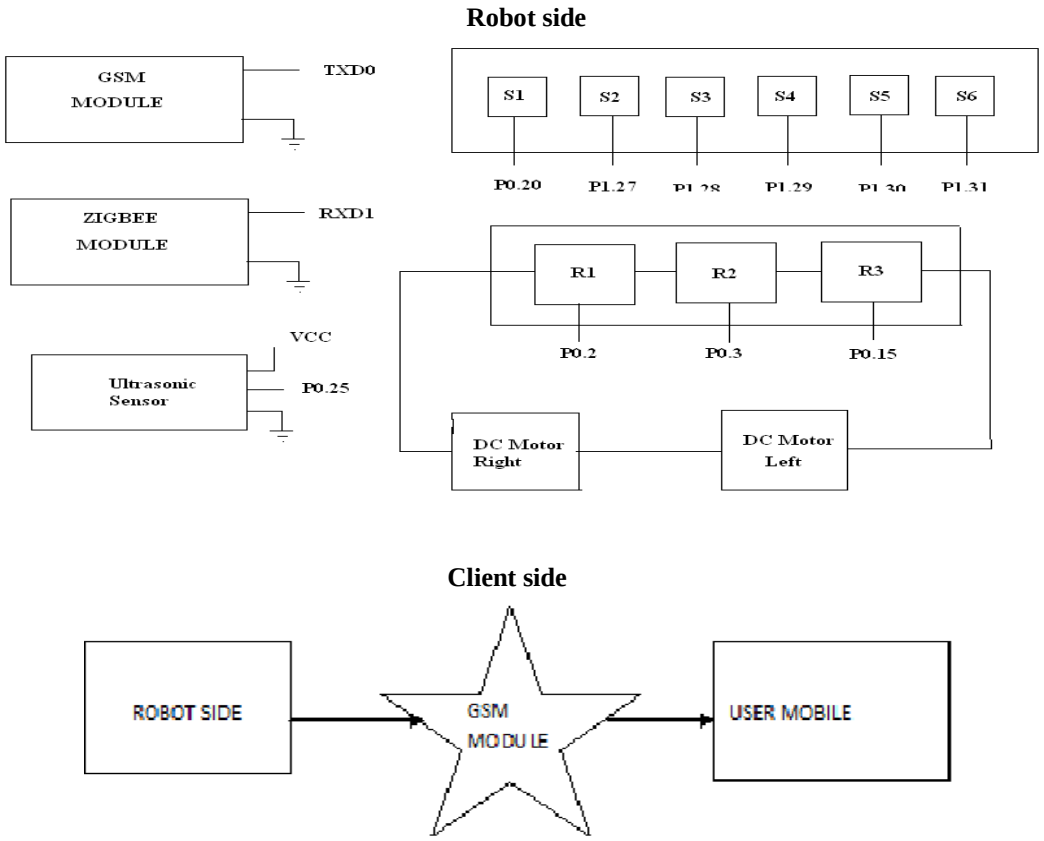


Fig 3.Architecture Diagram

The hardware circuit in the field side measure the environmental parameters using the sensors such as **HSM- 20g Humidity** sensor, **AD590 Temperature sensor**, **Water level sensor**, and **PH** sensor. This information is collected by the hardware controller **ARM 7 LPC 2148** and transmitted using **Zigbee** transceiver and other side all this information are received to by the line following robot through the **Zigbee** transceiver, the range of zigbee is 75 meters, Then the information which is collected by the line following robot is send to the mobile of the user using the **GSM** technology.

4.1 Field Side:

Two hardware controller circuits have been developed and shown below:

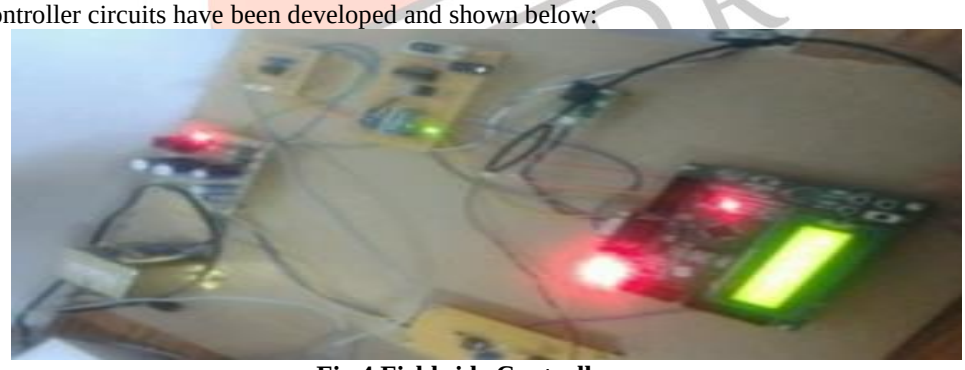


Fig 4 Field side Controller

Fig 5 Controller Display

A hardware board has been implemented where the hardware gets the Humidity ,temperature, water level, and ph level data from corresponding sensor in hardware circuit which sends all the information to the line following robot using the Zigbee transceivers.

4.2 Line Following Robot side:

Line following mobile robot is an automatic mobile machine, which can follows black line in white surface.

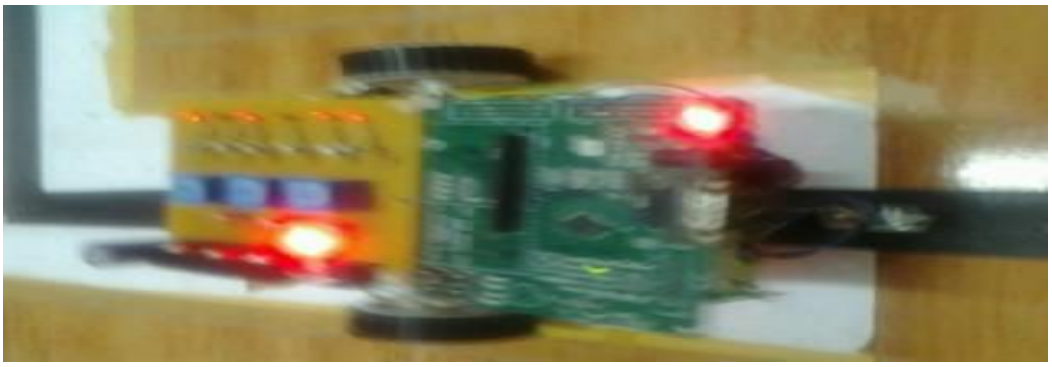


Fig 6 Line Following Robot

In this system the robot will moves through the line and collects all the sensor parameter's information from the field side through the Zigbee.

4.3 Client side:

The received data is stored in line following robot and the stored real time information is securely send to user or client by using GSM technology between user's mobile and line following robot So that user can able to get real-time information about the land at anywhere at any time. The received data in mobile is shown in the Figure4.

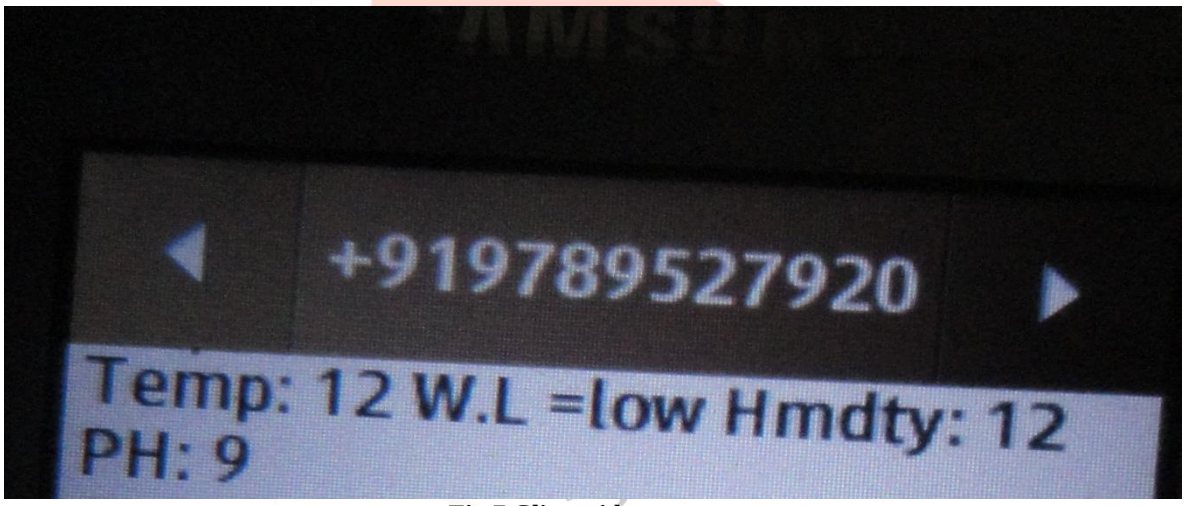


Fig 7 Client side message

V. CONCLUSION

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 ,ph level and water level in an agriculture field. A line following robot used here for collecting sensor data from wireless sensor network node and it sends the information to the user through message This system uses Zigbee transceiver for transmitting and receiving signal. Thus this system serves as a reliable system, for efficiently monitoring the environmental parameters. Wireless monitoring of field not only allows user to reduce the human power, but it also allows user to see accurate changes realtime. It is much cheaper in cost and consumes less power. Thus wireless sensor network plays a important role in agricultural management and its productiveness

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