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MONITORING THE PLANT GROWTH USING SENSOR NETWORK

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ABSTRACT

A Sensor Network (SN) is a group of sensor nodes work collaboratively to perform a common task. Sensor Networks plays a major role in the development of monitoring air, soil and water, habitat monitoring, agricultural monitoring, military surveillance, inventory tracking etc. Sensors are used in agriculture to monitor Temperature, Humidity (soil, leaf, ambient), Soil moisture, Wind (speed and direction), Pressure, Ph and Redox. In the existing system microcontroller, bridge rectifier, PAR sensor, solar power system and GPRS are used to find the canopy growth. The circle node of canopy which receives the total solar radiation for data processing to calculate a leaf area index and the Moderate Resolution Imaging Spectroradiometer (MODIS), is used to observed the data continuously, Advanced Spaceborne Thermal Emission and Reflection radiometer (ASTER) is used to collect details about maps of land surface temperature, reflectance, and elevation. GPRS is used to collect the data; if it fails data collection is lost. To overcome the failure in data collection, GSM is used with LDR sensor. In proposed system, when a canopy growth reaches a defined threshold value a message will be displayed in the printed circuit boards (PCB) LCD, and a SMS will be sent to the user's mobile phone.

Keywords: sensor network (SN), sensors, GSM.

1. INTRODUCTION

A sensor network is a group of sensor nodes work collaboratively to perform a common task. Recently sensor make revolution into many segments of our economy and life, from environmental monitoring, to automation in the transportation, to manufacturing and business asset management and health care industries. In environmental monitoring agriculture need for increasing the production and simultaneously the efforts for minimizing the environmental impact and for saving costs make the sensor systems the best. The continuous increasing demand of the food requires the rapid improvement in food production technology. In order to increase the quality and productivity of the crop yield, the proper management of the crop is essential.

The productivity of plant growth is heavily influenced by the change in environmental. When nutrients in the soil, solar radiation, density of weeds, humidity and all factors affecting the production are and this gets better to use of chemical products such as herbicides, fertilizers and other pollution products can be reduced growth. The crop management can be carried out by gathering the present status of these parameters of the field and farmer can take necessary action to improve the growth. In a sensor network each node consists of processing capability (one or more microcontroller), may contain multiple types of memory (program, data and flash memories), have a Zigbee, GSM, RF transceiver (usually with a single Omni-directional antenna), have a power source (e.g., solar cells and batteries), and accommodate various sensors and actuators. Wireless Sensor Network is widely used in electronics. The design to implement for monitoring the growth of canopy using sensor network which manages information.

2. SENSORS IN AGRICULTURE

Sensor collects information from various environment the actuators takes place to produce the outcome for the collected information to know the status of that environment. The actuator can control the environment changes. The sensors stores information that analyses the environment and identifies location, object, people and their situations. Sensor provides a multiple contribution in various domains that depend on variety of attribute and variant in time. Agriculture is one of the domain which sensor provides its contribution to identify context. Agriculture domain poses various requirements that are following

- Distributed land monitoring.
- Single piece of land which have multiple crops.
- Different weather and soil conditions are monitored due to diversion of various reasons.
- Proactive solutions are provided compared to reactive solutions.
- Collecting weather, crop growth and soil information.
- Measuring different fertilizer and water requirement of uneven land.

3. SYSTEM ARCHITECTURE DESIGN

A new architectural model was developed for the measuring leaf growth of canopy and data is transmitting by GSM. Figure 1 illustrates the workflow of sensor data transmission. The main principle behind the design is user will receive the data at any place.

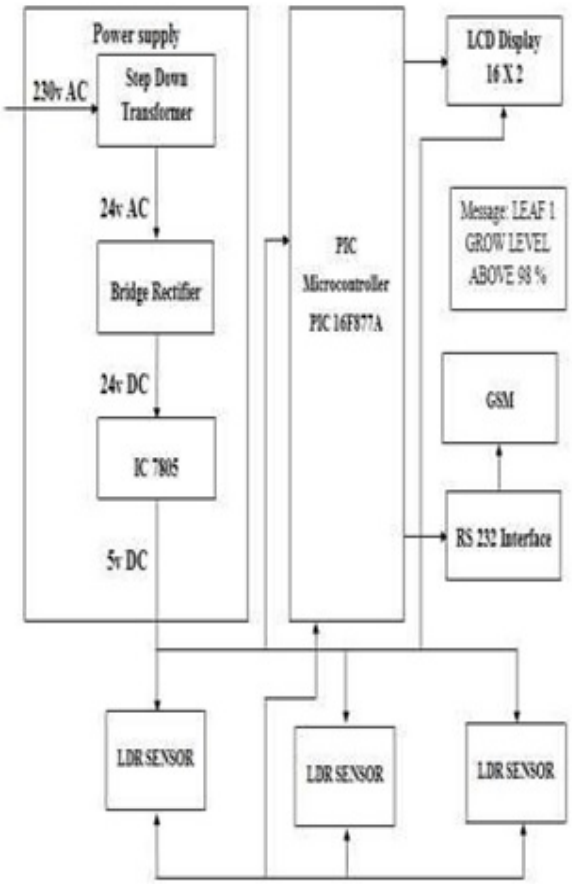

Figure-1. System design.

In this system design is used to measure the canopy leaf growth using LDR sensor. The workflow of system design the power supply 230v sends to step down transformer alternating current (AC) is to reduce the high voltage into low voltage. It reduces the voltage into 24v AC and bridge rectifier produce a current which is purely direct current (DC) of 24v. The voltage regulator IC 7805 reduces the 24v into 5v current supply. At last the power supply output is 5v to Microcontroller and sensors. The Peripheral Interface Controllers (PIC) has memory storage, flash memory to reprogram for the process. The microcontrollers which maintain process all operation like transmit, receive and calculate value of data. Light Dependent Resistor (LDR) sensor is a component that has (variable) resistance that changes with the light intensity that reflects on it.

When the leaf grows and falls on LDR, the LDR becomes dark, when LDR is dark resistance become low and the current flow will be high. This can be used for sensing the growth % of the leaf. Then leaf level be reached a microcontroller sends a message to LCD display and to GSM. LCD displays a message continues and a same message are sending to farmer using GSM. By this a farmer will receive a message at when a leaf reaches its growth.

4. CIRCUIT OPERATION

a) Microcontroller GSM circuit

PROTEUS

Proteus is an application which allows the user to make PCB (printed circuit board) designs, simulate microprocessors. This software uses various interfaces which simplifies the task. It includes various modules which combined together to offer several services. Proteus combines ARES PCB layout and ISIS schematic provides a program very powerful. ISIS (Intelligent Schematic Input System) module offers a large number of applications and controlled by using a user interface. It allows the design plane of electric circuit which uses many different components, such as different microcontroller or microprocessor, simple resistors, power supplies, signal generators and many others.

Proteus incorporates powerful design environment which are designed by using powerful components. The designs are simulated in real-time by using VSM (Virtual System Modeling). It is designed with a mixed-mode animated component, SPICE simulation, microprocessor models which facilitate the simulation. Extension of VSM is integrated with ISIS module that simulates the tasks for the program to carry out, and to handle the microcontroller and its outputs. By using low level and high level code the simulations can be designed.

Proteus is a ARES (Advanced Routing and Editing Software) tool which route, edit and locate components for the printed circuit boards production. It provides the functionality such as editing the layers such as welding and surface layer. Very friendly for novice users who are interested on obtaining board designs, schematics and high level simulation.

FEATURES OF PROTEUS

- Creation of basic simulation.
- Proteus owns Schematic capture module.
- Proteus used to design PBC Layout module.
- Offers display technology which accelerates hardware.
- Proteus provides a 3D visualization (VSM) of the board.
- It includes navigation.
- Configure dynamic teardrops.
- ODB++ CAD/CAM format are exported.
- Proteus provides gate-swap optimization in automatic manner.
- Per each layer provides unlimited shape-based power planes.
- Unlimited number of pins in a netlist.
- Proteus tool automatically places a component in the netlist into the board.

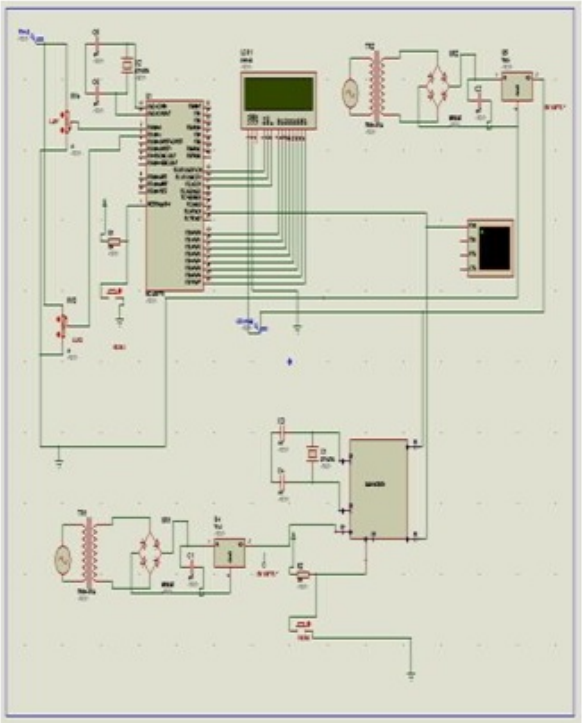

Figure-2. Circuit of a microcontroller GSM.

b) LDR sensor

A light-dependent resistor (LDR) is a light-controlled variable resistor. An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to sense the light which is placed in the circuit. When the Leaf grows and falls on the LDR, the LDR becomes dark, when LDR is dark resistance becomes low and the flow of current will be high. This can be used for sensing percentage of the growth of the Leaf. The LDR symbol which be shown in the circuit Figure-3.

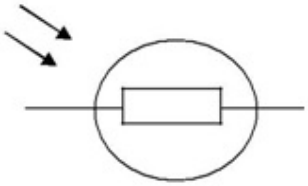

Figure-3. LDR symbol.

c) GSM

A Global System for Mobile Communication (GSM) is a type of modem that accepts SIM card, and operates on a subscription through a mobile operator. From the mobile operator view, a GSM modem looks like a mobile phone. A GSM modem is a modem device with a serial, Bluetooth connection or USB, or it is a cellular phone that offers GSM modem capabilities. The GSM network can be divided into Mobile station, Base station system, Network sub system. A GSM modem be a GSM mobile phone with the cable and software driver for connecting with a serial port (microcontroller) or USB port on computer. Figure 4 shows GSM modem interface with microcontroller that to transmit and receive data between them.

Features of GSM

- Single supply voltage 3.2v-4.5v
- SIM300 tri-band
- SMS storage: SIM card

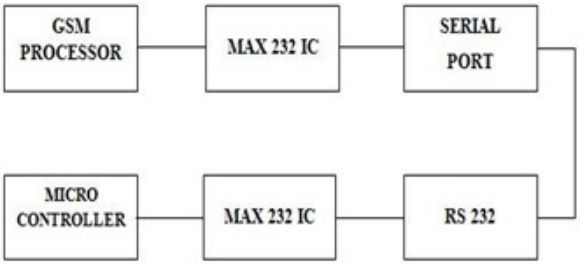

Figure-4. GSM modem interface with microcontroller.

d) RS232

Electronic data communications between elements falls into two broad categories: single-ended and differential. Independent channels for two-way (full-duplex) communications. The RS232 signals are given as voltage levels with respect to a system (power / logic ground). The "idle" state (MARK) has signal level which are negative with respect to common, and the "active" state (SPACE) has the signal as positive with respect to common. RS232 has numerous handshaking lines (primarily used with modems), and also a communications protocol. The RS-232 interface contains a common ground between the DTE and DCE. This is a assumption while short cable connects the DTE to the DCE, but with longer connections between devices that may be different electrical busses with various ground levels, this is not accurate.

RS232 data is bi-polar.... +3 TO +12 volts indicate an "ON or 0-state (SPACE) condition" while A -3 to -12 volts indicates an "OFF" 1-state (MARK) condition. Conventional computer equipment omits the negative level and accepts a zero voltage level as the "OFF" state. In fact, the "ON" state achieved with less positive potential which means circuits powered by 5 VDC are capable of driving RS232 circuits directly, however, the range of the RS232 signal may be transmitted/received may be reduced. The output signal level usually varies between +12V and -12V. The "dead area" between +3v and -3v is designed to absorb noise. In the RS-232 definitions this dead area may differ. For example, the definition for V.10 has a dead area from +0.3v to -0.3v. Many receivers designed for RS-232 are sensitive to differentials of 1v or less. Data is transmitted and received through pins 2 and 3

respectively. Data Set Ready (DSR) is an indication from the Data Set (i.e., the modem or DSU/CSU). Similarly, DTR refers Data set that the DTE is on. Data Carrier Detect (DCD) indicates that a good carrier is being received from the remote modem.

e) Power supply

A power supply is a device that supplies electrical energy to one or more electrical loads. The term is most commonly applied to devices that convert one form of electrical energy to another, though it may also refer to devices that convert another form of energy (e.g., solar, mechanical, chemical) to electrical energy. A energy regulated power supply is one that controls the output voltage or current to a specific value, the controlled value is held nearly constant despite variations is either load current or the voltage supplied by the power supply's energy source. Every power supply must obtain the energy it supplies to its load, as well as any energy it consumes while performing that task, from an energy source. A power supply may be implemented as a discrete, stand alone device or as an integral device that is hardwired to its load. In latter case, for example, low voltage DC power supplies are commonly integrated with their loads in device such as computers and household electronics.

An AC powered unregulated power supply usually uses a transformer to convert the voltage from the wall outlet (mains) to a different, now a days usually lower, voltage. If it is used to produce DC, a rectifier is used to convert alternating voltage to a pulsating direct voltage, followed by a filter, comprising one or more capacitors, resistors, and sometime inductors, to filter out most of pulsation. A small remaining unwanted alternating voltage component at mains or twice main power frequency (depending upon whether half- or full-wave rectifier is used) is unavoidably superimposed on the direct output voltage. For purpose such as charging batteries the ripple is not a problem, and the simplest unregulated mains- powered DC power supply circuit consists of a transformer driving a single diode in series with a resistor. The output of the rectifier stage will provide the pulsating DC components thus it will convert into a pure DC source by using the filter unit. Here the voltage will be multiplied by the factor of the capacitor unit.

f) Implementation of circuit

5. CONCLUSION AND FUTURE WORK

In agriculture, sensor network plays major role in environmental monitoring like soil, growth, temperature and wind. In our proposed method, the canopy growth is monitored by sensors and the collected data is transmitted to the user's mobile phone by means of GSM network. The reliability of data transmission is achieved by GSM network when compared to previous existing Zigbee network. In future enhancement, monitoring water level capacity and stem growth are monitored through sensors and transmitted to users through the same GSM network.

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