

COMMUNICATION PROTOCOLS

BLUETOOTH TECHNOLOGY

Bluetooth (IEEE 802.15.1) is considered as one of the suitable technologies for WSNs and especially in cases where the WSN is composed of a relatively less number of sensors and covers small areas, personal area networks (PAN). BT wireless technology is a low-cost, low power; short-range (10-100m) radio technology.

In a Bluetooth based system, the various sensors via a microcontroller are connected to a Bluetooth module. BT consists of the Network layer that provides a packet delivery service, capable of releasing data across the network. Then is the application layer, where information is received and compared. Next layer is the control layer, which gathers the agro climate data from the sensors (temperature, pH, and humidity, light) with management models and makes suitable decisions for the control of the agricultural environment. This layer is composed of the Control Unit, which gathers and stores in a local database all the agro climate information collected from the sensors. Thus the information is interfaced to the user. It uses 868 and 915MHz and 2.4GHz radio bands to communicate at 1Mbps between up to seven devices.

The replacement of regular cable networks can introduce several advantages. Firstly, cable exclusion enables stations' mobility. Another advantage is that the networking becomes faster and easier.

ZIGBEE TECHNOLOGY

Zigbee (IEEE 802.15.4), a wireless networking standard is used for sensor applications and remote control and can be used in rough radio environments and isolated locations, where comparatively low level of information throughput is needed with low power consumption. Having frequency band of 2.4GHz, 915MHz for North America and 868 MHz for Europe, therefore it works worldwide with 250 kbps data rates. It is highly reliable in congested environments

The zigbee based sensor node also consists of a microcontroller to function as an end device, router or coordinating sensor node, which is capable of being reprogrammed. As an end device sensor node, it can only interact with the router or coordinator to pass the data from the sensor. The sensor node acts as a router and routes the data from other routers to the coordinator or to other routers, which are closer to the coordinator. The coordinator sets the channel for the network to use. The base station also with the same zigbee module is responsible for data collection from the sensor nodes. It is sent to the user via a RS232 protocol

As the duty cycle is very small, to send and receive messages with low power consumption, two 1.5 V batteries can be used to support for six months to two years. It achieves energy saving effect and provides a rich application space

WI-FI TECHNOLOGY

Wi-Fi (Wireless Fidelity) is a wireless technology, which uses radio frequency to transmit data via air. Wi-Fi has data rate of 1 mbps to 2mbps and transmits information in the frequency band of 2.4 GHz. It utilizes frequency division multiplexing technique and the range is 40-300 feet

A chosen Wi-Fi module is connected to various sensors in the field with analogue outputs via a multiplexer. The multiplexer channels can be selected based on the General Input/output (GPIO) on the WSN module or only on the GPIO output values. At user-defined intervals, the signals are measured, transferred and recorded into the server on the network. The standard wireless router connects the server to the network. Thus the server can be run on a Wi-Fi enabled system in the field. The system usually takes 3-3.6V DC supply along with two ADC and four primary GPIOs. Triggered measurements of ADCs along with any GPIO values programmed as inputs are transferred to the server. The data of various parameters namely temperature, pressure, humidity, pH etc., is collected by the sensors. Then the sensor nodes send the data to the base station via a sink node. The farmer can access the data through user interface

Also it is user-friendly for an Indian farmer. With moderate cost, serving large number of nodes with the flexibility of mobility, it can be a sought after alternative.

RF TECHNOLOGY

An **RF module** (radio frequency) is an electronic device used to transmit and receive radio signals between two devices (Sensor nodes). The module interacts with sensor nodes, thus transmitting the sensed parameters (temperature, moisture). An RF module are mostly interfaced with a micro controller and works freely at 433/868/915 MHz frequency and has about 400 m range.

It basically consists of transmitter and receiver .The transmitter, a small PCB assembly is able to transmit and modulate a radio wave. Energy flows as current in conductors, changes to waves to travel in air and reaches receiver to as current to move along conductor. The transmitter circuit is used for low power, low voltage wireless application. The receiver circuit is also a single-chip receiver module. It also uses very low power and voltage levels for functioning. It's sensitive to signals it receives and demodulates it. A LCD attached, helps in conveying field data

However, the entire functioning is controlled by programming microcontrollers at field and central station in a field for transmitter and receiver respectively