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# Intelligent Poly House Environment Monitoring System using Intel Galileo and Sensor Network Based on IOT

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**Abstract**

Poly house Cultivation is being developed to achieve good crops with less labor cost. Poly house is made up of polyethylene sheet having rectangular shape to grow the crops in a controlled environment even in unfavorable conditions. By using automated control system, crucial parameters like temperature, humidity and water level necessary for the growth of plants can be maintained and controlled automatically. The thickness of the sheet can be varied according to the requirement that depends on the crop type to be grown. This model has developed with various nodes which are deployed inside poly house and are controlled by IOT technology

Keywords— Agriculture, environment monitoring, Poly house, Internet of Things (IoT), Sensors, Zig Bee, Android mobile Application, Intel Galileo, PHP, Web server, Arudino Introduction

## Introduction

Polyhouse is made up of polyethylene sheet having rectangular shape to grow the crops in a controlled environment even in unfavorable conditions. By using automated control system, crucial parameters like temperature, humidity and water level necessary for the growth of plants can be maintained and controlled automatically. The thickness of the sheet can be varied according to the requirement that depends on the crop type to be grown. Generally Polyhouses are directed from east toward west to utilize the maximum amount of sunlight.

This model has developed with the mesh topology consists various nodes which are deployed inside polyhouse and are controlled by IOT technology

As an important part of the Internet of Things IOT, sensor networks provide with a new technology in to observe and interact with the physical world. Connecting real world things to the IOT with sensor networks to obtain, organize and gather information, and able to develop applications in a variety of sectors such as environment, agriculture etc. The new poly house technology in agriculture is to automation, and with the IOT (Internet of Things) technology rapid development and wide application. Implementing sensor network assisting cultivation and production, which shows promising potential application of sensor networks in agriculture. Parameters such as temperature, humidity, CO2 levels, Ph of soil, soil moisture content and water level plays an important role for the growth of plants. The aim is to help farmers for better understanding of plant growth by equipping them with a new instrument for their observations. The various sensors data through wireless method send to Intel Galileo, a microcontroller board based on the Intel Quark SoC X1000, can be maintain desired atmospheric conditions by using various output devices in the poly house or greenhouse.

Using sensor networks and the Internet, the agronomists can collect live data from various farmland, and polyhouses from different areas, which helps them to breed or improve specific crop varieties with its properties for specific areas.

This paper takes Intel Galileo, a microcontroller board based on the Intel Quark SoC X1000 as the core, presents the design and implementation of agriculture Poly house Environment monitoring system based on ZigBee technology.

Through the Android application farmer may view, analysis the real-time data for agricultural.

## DESCRIPTION TO THE SYSTEM

This IOT system is applied in a poly house environment as a typical example of IOT technology application in agriculture. Parameters like temperature, humidity, CO2 levels, Ph. of soil, soil moisture content and water level, data are collected by sensors as the sensor layer. ZigBee are used to, connected to sensors, collecting data and transmitting them to Intel Galileo.

The design of wireless sensor network (WSN) is the key to connecting agriculture to IOT. The following requirements are needed during the design of sensor networks for agricultural applications:

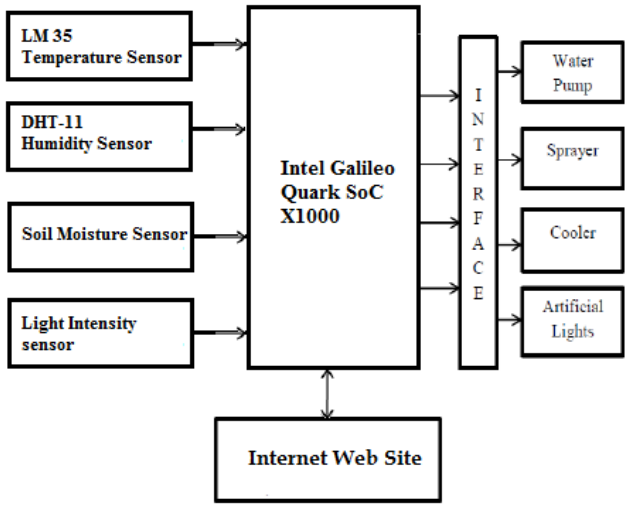
Reliable: wireless Sensor networks must work reliably in all the environments and work for a long period of time.

Manageable: Wireless Sensor networks must be able to manage remotely so that the actions like configuration, and software upgrading can be performed easily.

Low cost and commercialization: The design must be simple and affordable for farmers and easy for future commercialization.

In the following sections, we continue with the overview of the system architecture, and then we detail the design of hardware and software respectively.

DESIGN OF THE SYSTEM




### Hardware Design of the System.

In the given environment (poly houses or greenhouses), deployed sensor nodes periodically take relevant environmental measurements and send the data directly to the Intel Galileo.

The measurement data, humidity, CO2 levels, Ph of soil, soil moisture content and water level. The Intel Galileo repackages the received data from the different sensors and sent these data to web server and store the data in the data base.

Using the PHP application, Decision support system (DSS), compare the received data with various agricultural models, analyzes the data, and sent related guidance, to the farmers via SMS and Android application in the user mobile phone.

The android application can create alerts and perform actions in the poly house such as , power on/off the cooler in the poly house to control air pressure, on/off the water pump, controlling sprayer, and control artificial light.

SENSORS

Sensor node is the main part of the ploy house Monitoring network, which is responsible to collect environment parameters, and sending them to the Intel Galileo board

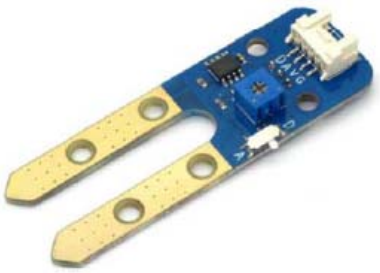
Temperature sensor

LM 35 has taken for measuring the temperature values inside poly house. It has high accuracy levels and doesn't require further requirement of any external calibration. The wide range of temperature about -55° to +150 °C can be sensed using LM35.

Humidity Sensor


DHT-11 provides the information about both temperature and humidity values. And it provides high quality, quick response and low price.

Soil moisture sensor

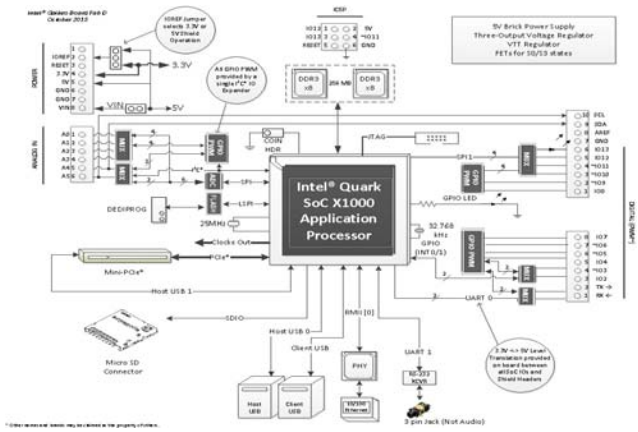


used to detect the moisture content in the soil of the proposed model. This sensor provides either analog or digital outputs which can be selected by choosing the corresponding button on the board. By varying the potentiometer the suitable threshold value for the moisture content can be made. Analog data provides over wide range and where as digital provides the information about whether the soil is wet or dry.

Light detection for the proposed model can be achieved by using this sensor.

This sensor also provides both the analog and digital outputs. The attached control board receives the analog information about light through the attached light dependent resistor (LDR) and gives the proportionate output, specifically the resistance of photo resistor decreases with the increase of the light intensity in the surroundings.

INTEL GALILEO




**Intel Galileo Block Diagram**

Intel Galileo is a microcontroller board based on the Intel® Quark SoC X1000 Application Processor, a 32-bit Intel Pentium-class system on a chip. It's the first board based on Intel® architecture designed to be hardware and software pin-compatible. It has 14 digital I/O pins, 6 analog inputs, a serial port, and an ICSP header. 14 digital input/output pins, of which 6 can be used as Pulse Width Modulation (PWM) outputs; Each of the 14 digital pins on Galileo can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions.

A UART (Universal Asynchronous Receiver/Transmitter) port pins (0 and 1), this is also known as the Arduino 1.0 pinout. operate at either 3.3V or 5V The core operating voltage of Galileo is 3.3V. Galileo board is also software compatible with the Arduino Software Development Environment (IDE)

Other ports A full sized mini-PCI Express slot, 100Mb Ethernet port, Micro-SD slot, RS-232 serial port, USB Host port, USB Client port, and 8MByte NOR flash come standard on the board.

The ZigBee receivers are directly connected to the Intel Galileo, for collecting the data which are transmit from the ZigBee, from each sensors.

SOFTWARE

The system software includes monitoring system data acquisition software, remote data acquisition receiver software, and web application software. The software made up of user interface module, data collection module, data processing module and system configuration module. The web application software include three parts of user authentication, data access, data query and download, which access the database.

Intel Galileo board is is compatible with the Arduino Software Development Environment (IDE). Arduino software used to process the data which are revived from ZigBee receiver. Using the Ethernet port, the processed data are sent to web server.

The PHP web application software Decision support system (DSS), used to analysis the received data from the Intel Galileo board and makes decisions and sent through SMS and Android Phone application in the farmer phone.

Android application software used received messages from the PHP web server application and display the notifications to the farmers and agronomists. From these notifications, the farmer can maintain and control the devices in the poly house.

## CONCLUSION

The low cost and low power wireless ZigBee technic used in poly house monitoring system. The system can control and manage the room equipment's through internet with Galileo. It improve the efficiency and flexible by using wireless sensor network and reduce the man power cost. The environment data of the poly house can transfer and control lively. So this design is help full for farmers in planting crops.

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