Monitoring Environment with Wireless Sensor Network based on IoT

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Abstract— This paper presents the functional design and integration of a complete WSN platform that is used in distant environment monitoring and goal for IoT implementations. WSN is used to collect information about physical phenomenon in different application. It measures environment conditions like temperature and humidity, pressure etc. Air sensor is used in the system to feel the occurrence of dangerous compounds in the surrounding and persistently transmits the data to microcontroller and describe it to the online server over Internet of Things. The microcontrollers have contact with the sensors which perform action with this data and communicates it over internet. These approaches can improve the system performance, provide a suitable and competent method and can also achieve functional requirements.

Key words: Modbus, Pinguino, Pressure Sensor, Raspberry PI, Telaire ChipCap2

I. INTRODUCTION

Monitoring the surrounding explains the process that needs to take place to illustrate and monitor the value of the atmosphere. It is used in the preparation of environmental control valuations in which human activities carry a risk of dangerous effects on the regular atmosphere [1]. A new method of environment monitoring system based on a WSN technology is proposed [2]. In order to provide pioneering environment monitoring procedures and methodologies, Wireless Sensor Networks are the crucial factor that enables more malleable real time environment.

II. WIRELESS SENSOR NETWORK

In Fig1, WSN can normally be explained as a link of node that cooperatively feel and control the environment which enables the interface between users or computers and the surrounding environment. Using coordinator node and several sensor nodes, the Wireless Sensor Network is constructed and the gateway acts as a workstation.

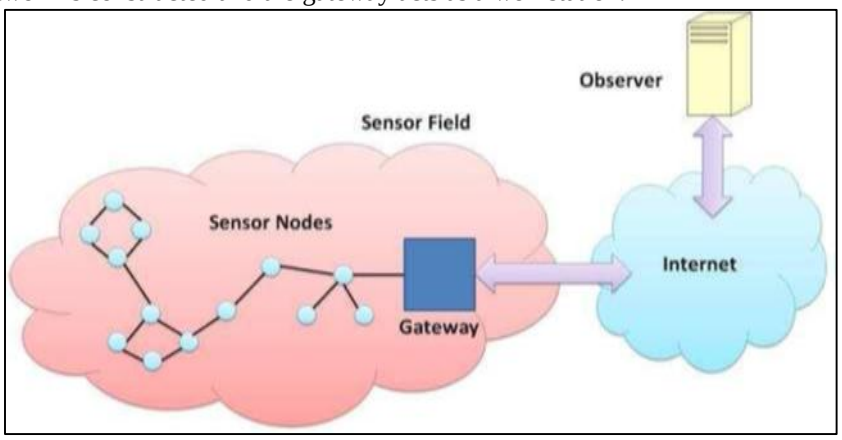

Fig. 1: Wireless sensor network

III. INTERNET OF THINGS (IOT)

The internet of things or IoT is a system of interrelated calculating devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the capability to transmit data over a web [3]. The sensors and the objects are connected to distribute the data obtained from various sites and process the data according to the utilizations.

IV. OVERALL SYSTEM ARCHITECTURE

Fig 2 demonstrates the overall system architecture. Sensor node is a major part of the system. It is responsible for information or sensor data. Raspberry Pi manages numerous sensor nodes. The sensors collect the real time data and it will be fetched by the web server. The access node of wireless sensor network that is Raspberry Pi (source location).

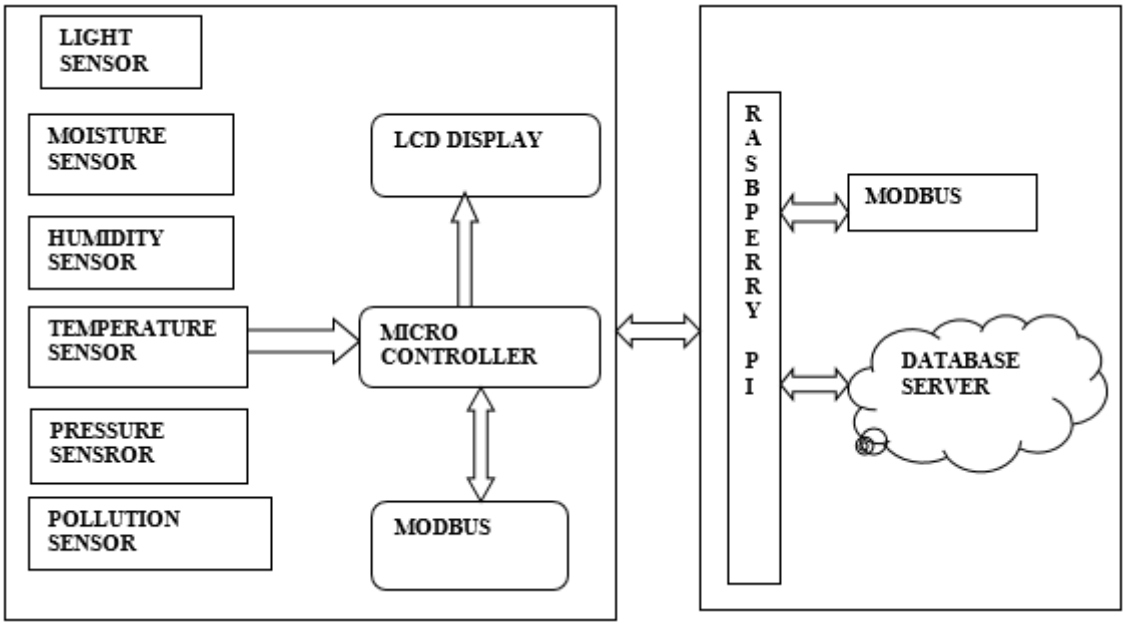

Fig. 2: Overall System Architecture

A. Raspberry Pi

The Raspberry Pi device appears like motherboard, with mounted chip and ports revealed but it has the components that need to connect input, output, and storage device and starts calculating [4]. The Raspberry Pi is low expensive, smart card sized computer that fits into a computer screen or television and uses a standard input device.

B. Pinguino

Pinguino exist together both with 8-bit (PIC18F with built in USB module only) and 32-bit (PIC32MX) Microchip microcontroller without conflict.

C. Modbus Module

Modbus has become a tangible standard communication protocol and it is a serial communication standard. It is available as a mean of connecting industrial electronic device fig3.

Fig. 3: Modbus

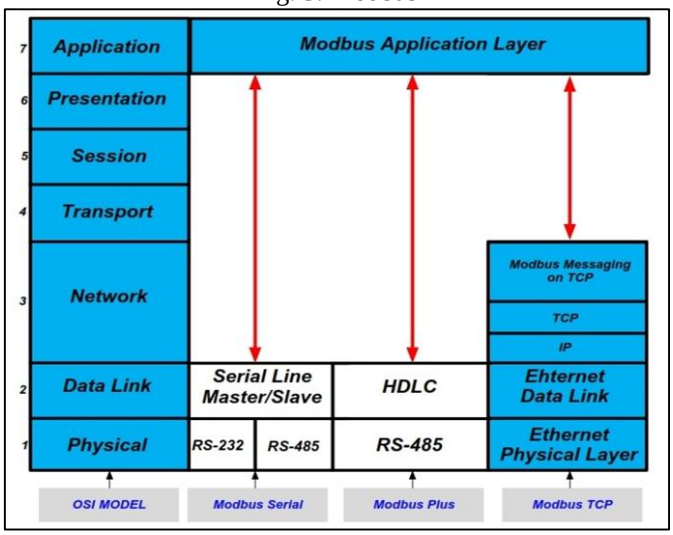

Fig. 4: Modbus Protocol

In Fig4, Modbus RS232 and Modbus RS485 are used as the physical layer. In Modbus applications, Raspberry Pi is possible to be used as a Master or Slave, but the interface RS485 is needed. A Modbus variant, Modbus TCP/IP or Modbus TCP is used to exchange information over TCP/IP networks, linking over port 502.Modbus Plus (Modbus+MB+ or MBP) where Modbus Plus is peer-to-peer communication between several masters.

V. SENSOR AND ITS CHARACTERISTICS

A. TELAIRE ChipCap2|Humidity and Temperature Sensor

Telaire ChipCap2 (fig 5) sensor detects the relative moisture of the immediate environment. The relative humidity can be expressed as a percentage of the ratio of moisture in the air to the determined quantity that can be held in the air. The Telaire ChipCap2 offers the most progressive and cost-effective moisture and temperature sensing solution for essentially any type of application.

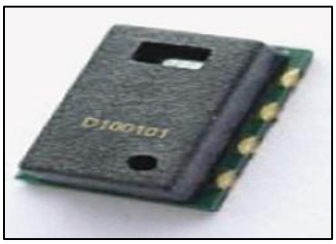

Fig. 5: Telaire ChipCap2

B. Pressure sensor

Pressure sensor (fig 6) is a device for measuring the pressure of gases or liquids. Pressure is an expression of the force essential to stop a fluid from enlarging and is usually specified in terms of force per unit area. Pressure sensors usually act as a transducer. It generates a signal as a function of the pressure enforced.

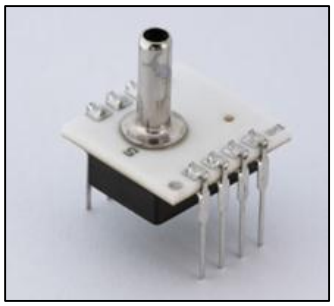

Fig. 6: Pressure Sensor

VI. INTERFACE BETWEEN RASPBERRY PI AND MODBUS

MODBUS is situated in the level 2 of the OSI model and uses master-slave (or Client-Server) architecture. Simple and robust, it has then become a tangible standard communication protocol. Modbus allows exchanging information between numerous devices connected to the similar network (fig 7), for example the temperature and humidity is measured by the system and the result is communicated to the computer. Most of the data types are given names from its use in driving relays: a single-bit physical output called as coil, and a single-bit physical input called as a discrete input or a contact.

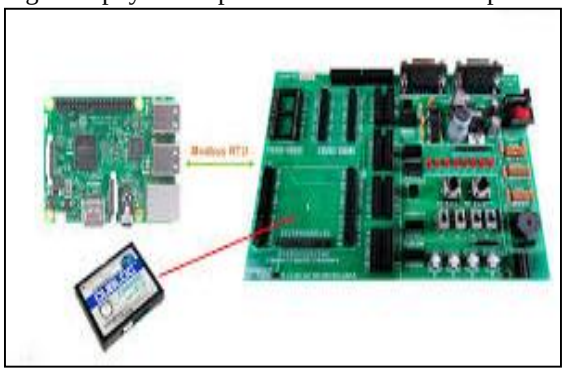

Fig. 7: Interfacing between Raspberry Pi

VII. RESULT AND DISCUSSION

The three sensors perform the sensing task and after finishing the sensing task reading from the sensor is displayed on the PC Monitor. The information gathered from the sensor are unceasingly updated. According to the continuous updating, the changes in the environment takes place.

VIII. CONCLUSION

Comparing data collected in the source location this system has low-cost, low power consumption, and easy to maintain. This paper designs a wireless sensor network system using Raspberry Pi as a source location, Modbus as a networking protocol, and sensor node as combination of sensors, controlled by modbus. Raspberry Pi can be configured to run without peripheral devices. It is very useful in many environmental monitoring.

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