

Regional Environmental Monitoring and Management (An Integrated System Based on Internet of things)

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ABSTRACT

This paper proposes an approach to build a cost-effective standardized environmental monitoring device using the Raspberry-Pi (R-Pi) single-board computer. The system was designed using Python Programming language and can be controlled and accessed remotely through an Internet of Things platform. It takes information about the surrounding environment through sensors and uploads it directly to the internet, where it can be accessed anytime and anywhere through internet. Experimental results demonstrated that the system is able to accurately measure: temperature, humidity, light level and concentrations of the carbon monoxide harmful air pollutant. It's also designed to detect earthquakes through an assembled seismic sensor.

Keywords: GPIO; IoT; monitoring; Raspberry-Pi; Sensor; Xively.

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I. INTRODUCTION

Environmental consequences like changing climate condition received much attention in recent years, we can gain a deeper understanding of the environmental condition because of environmental monitoring and management. For cognition of environmental parameter we have to track them by using the various sensor.

Tracking the environmental parameters' variation in environmental condition is essential in order to determine the quality of environment. The collected data encompass important details for a variety of organizations and agencies. With the results of monitoring, governments can make informed decisions about how the environment will affect the society and how the society is affecting the environment. Outside the governments and other organizations, the information is used by many people, because of the weather's effect on a wide range of human's activities, such as: agriculture, transportation and leisure time.

The information can be used by municipal engineers to design flood control systems or public health experts to design effective policies. Timely and effective responses to environmental emergencies, such as spills, are impossible without adequate information. Unfortunately, data provided by agencies are sometimes overwhelmingly ambiguous and un-confined to the environment, with samples generally sparsely taken across large regions despite that some environment parameters variance occurs across smaller areas.

Therefore this data might not be very helpful on a personal level. Internet of Things (IoT) is a concept and a paradigm that considers pervasive presence in the environment of a variety of things/objects that through wireless and wired connections and unique addressing schemes are able to interact with each other and cooperate with other things/objects to create new.

II. RELATED WORK

Environmental monitoring and management an integrated system based on IoT is an wear proof and active topic, not only for the scientists and engineers, but also for the public and the administrators, and it covers broad issues of climate change. The IoT applications are limitless, few examples are; smart cities, smart energy and the smart grids, smart transportation and enabling traffic management and control [1].

The R-Pi, is a linux-based, low cost, credit-card sized single-board computer system that can be directly used in electronics projects because it has general purpose input/output (GPIO) pins right on the board [2]. The GPIO connector has 26 pins where up to 17 GPIO pins (8 existing GPIO + 9 reconfigurable) are available for hardware interfacing.

In regional environmental monitoring and management system two part client and server. Various sensor are use for detect the environmental parameter . Sensing The purpose of this unit is to track (sense) all the parameters desired using a collection of sensors that were chosen cautiously to achieve the best performance. Detected data on LCD.

Zigbee use for the data transfer.In the server part raspberry's processing working includes: uploading, monitoring, displaying and interpreting the data from the units. This paper focuses on theIoT application in the new generation of environmental informatics,and provides a new paradigm for environmental monitoringand management in the future. In the last decade, the Internet of Things (IoT), a concept describing how the Internet expands into people’s daily lives through a wireless network of dentifiable objects [3].the entire process of environmental monitoring, modeling, and management, as well as to support sustainable decision-making.

III. SYSTEM DEVELOPMENT

Regional environmental monitoring and management system comprised two system client and server.

A. client

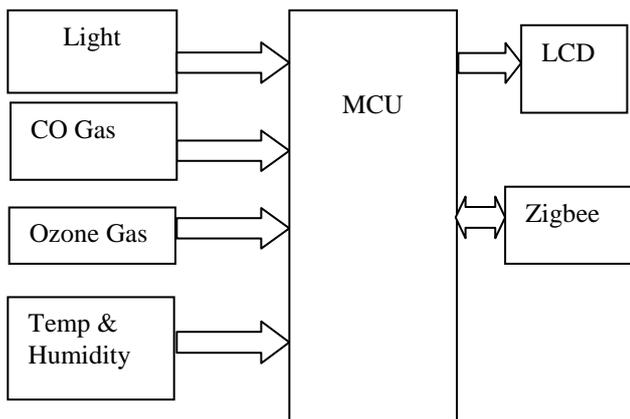


Fig.1 Block Diagram of Client

To detect the environmental parameters used sensor as shown in fig.1. Microcontroller can be considered a self contained system with a processor, memory , peripheral and can be used as an embedded system. Detected data display on the LCD. Zigbee is an IEEE 802.15.4 based specification for a suit of high level communication protocols used to creat personal area network.

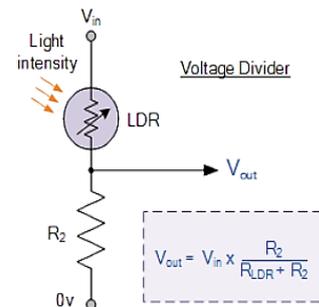
The design process included designing the basic units for detecting the air quality, The samples absorbed by the electro-catalytic sensing electrode contain gas molecules. Next, they pass through a diffusion medium and electrochemically react to an appropriate sensing electrode potential. The electric current generated by the reaction is directly proportional to the gas concentration. This current is converted to voltage for a meter or recorder readout [4].

The diffusion limited current, I_{Lim} , is directly proportional to the gas concentration according to the simplified equation:

$$I_{Lim} = \frac{nFADC}{\delta}$$

where is the diffusion limited current in amps, F is the Faraday constant (96,500 coulombs), A is the reaction interfacial area in cm², n is the number of electrons per mole reactant, D is the diffusion path length, C is the gas concentration in mol/cm³, and delta is the gas diffusion constant, representing the product of the permeability and solubility coefficients of the gas in the diffusion medium [4].

1. Temperature sensor



The core of the temperature sensor is a band gap core that divided four transistors: Q1, Q2, Q3 and Q4. Transistors Q1 and Q2 are biased by Q3 to approximately 8 μ . The band gap core operates both Q1 and Q2 at the same collector current level; however, because the emitter area of Q1 is 10 times that of Q2, the VBE of Q1 and the VBE of Q2 are not equal [5]. sensor and, simultaneously, the resistors are used to scale the VBE of Q1 as an offset term in VOUT.

The band gap core is buffered by the output voltage of the temperature sensor that is available at the emitter of Q4. The short-circuit current limit of the devices is set to 250 μ by the current gain of Q4 [6].The results is scaled using two resistors; to produce the output voltage transfer characteristic of each temperature.

2. Humidity.

Honeywell HumidIcon Digital Humidity/Temperature Sensors, HIH6000 Series, are digital output-type relative humidity (RH) and temperature sensors combined in the same package. These sensors provide an accuracy level of ±4.5 %RH. By water adsorption on the ceramic surfaces, their electrical properties would change and this change encompasses the resistance, capacitance or electrolytic conduction depending upon the sensor type [7]. In ionic type sensing elements, by increasing the humidity, the conductivity increases and thus the dielectric constant increases [8]. The R-Pi's digital-only input makes digital sensors the best choice for our system.

3. Light Level

Photo-resistor is a resistor which made of semi-conductor material and the conductance changes with luminance variation. Performances and Features: Coated with epoxy, Good Reliability, High Sensitivity, Small Volume, Fast Response and Good Spectrum Characteristic.

4. CO Concentration

The sensor was chosen to be MQ-7, which can detect COgas concentrations anywhere from 20 to 2000 ppm in an easyto- use method. The sensor's detection range can be altered using a potentiometer.

B. Server

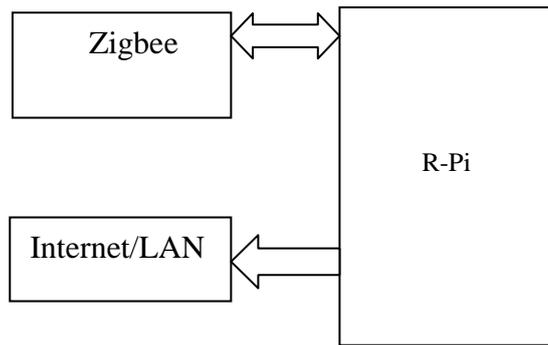


Fig.2. Block Diagram of Server.

The detected data given to the R-Pi through the zigbee send to the application layer by server. To transfer the data to the application layer internet or LAN used as a network layer.

1.R-PI
The R-Pi is a linux based, low cost, credit card sized single board computer that can be directly used in the electronics. The RPi's LXTerminal which used Linux commands. The methods needed to transform some sensors' readings into real-time measures were implemented [5].

IV. CONCLUSION

The Regional environmental monitoring and management system might offer various benefits. It provides monitoring services for remote areas Due to its ability to automatically upload to the internet, one correctly placed system can provide easily accessible weather data for the whole community. It can be used to predict the foray of bad climate using signs such as changing temperature and humidity. Increasing the consciousness of how society is affected the region's environmental policies and have the knowledge basis to push for the change.

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