WIRELESS SENSOR BASED SMART HOMES MONITORING AND CONTROLLING SYSTEM

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Abstract: Smart home environments have evolved to the point where everyday objects and devices at home can be networked to give the inhabitants new means to control them. Advances in digital electronics have enable the development of small in size and communicate in short distances sensor nodes. They are low-cost, low-power and multifunctional. The sensor nodes consist of sensing, data processing, and communication components, leverage the idea of Wireless Sensor Networks (WSN) based on collaborative effort of a large number of nodes. There are a large number of reseaches dealing with WSN applications, but it is still possible to explore in WSN development and maintenance. This paper examines the possibility of integration WSN and the service robots into a smart home application. The service robots can be considered to be mobile nodes that provide additional sensorial information, improve/repair the connectivity and collect information from wireless sensor nodes. On the other hand, the WSN can be considered as an extension of the sensorial capabilities of the robots and it can provide a smart environment for the service robots.

Keywords: Microcontroller, Sensors, GPRS, Robot, Camera, Devices, Zigbee.

Introduction

A smart environment is a physical world that is interconnected through a continuous network abundantly and invisibly with sensors, actuators and computational units, embedded seamlessly in the everyday objects of our lives .A smart home is a residence in which computing and information technology apply to expect and respond to the occupants' needs and can be used to enhance the everyday life at home. Potential applications for smart homes can be found in these categories: welfare, entertainment, environment, safety, communication, and appliances .Wireless Sensor Networks (WSNs) have become an attractive technology for the research community, particularly with the proliferation in Micro-Electro Mechanical Systems technology which has facilitated the development of smart sensors . Typically, a WSN is a distributed system that is composed of autonomous units with sensing capabilities (sensor nodes), interconnected by wireless communication system. This network offers potentially low-cost solution to several problems including military target tracking, health care monitoring, environment control systems, animal monitoring, and Smart Homes .The WSN is built of sensor nodes, from a few to several thousands, where each node is connected to one or several sensors.

I. The Hardware System

Micro controller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler

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than those of Complex Instruction Set Computer (CISC) designs.

Liquid-crystal display (**LCD**) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

II. Design of Proposed Hardware System

In this work we use WSN to create a smart environment. The wireless sensor Nodes can be embedded into the smart devices, and they can communicate each other by wireless. By placing slave sensor nodes everywhere in the house, the temperature, illumination, fire, gas leakage, water leakage, intruders detect information can be passed to a PC collecting the information from the master node. Whenever, the critical condition arises, a buzzer will alert the user to take required action through the PC.

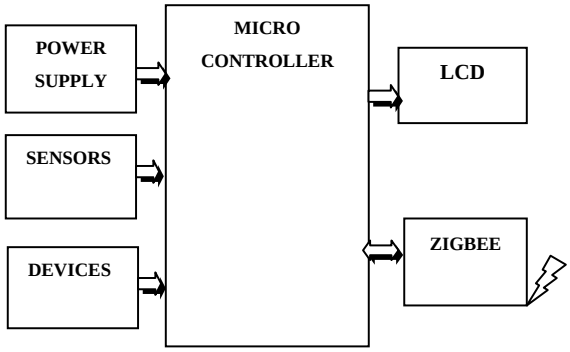

Fig.1.Block diagram

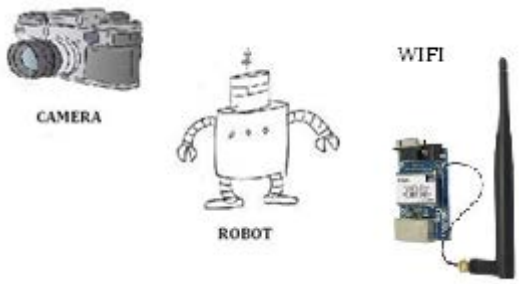

Fig.2.Block diagram

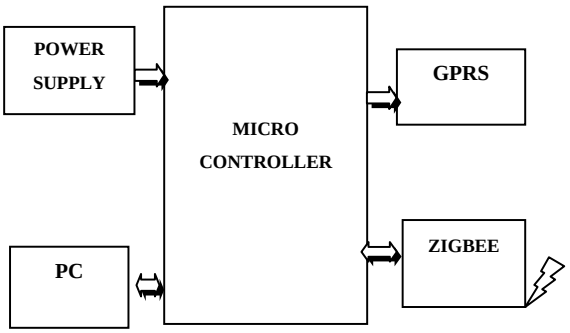

Fig.3.Block diagram

The service robot in the smart home environment has the following key functionalities: navigation, object picking and object Handling. To execute the functions, a classical robotic platform should be equipped with sensors such as Temperature sensor, an ultrasonic sensor, a LDR sensor, humidity sensor or a camera as well is fitted on its top.

IV.Board Hardware Resources Features

Zigbee:

Zigbee modules feature a UART interface, which allows any microcontroller or microprocessor to immediately use the services of the Zigbee protocol. All a Zigbee hardware designer has to do in this ase is ensure that the host's serial port logic levels are compatible with the XBee's 2.8- to 3.4-V logic levels. The logic level conversion can be performed using either a standard RS-232 IC or logic level translators such as the 74LVTH125 when the host is directly connected to the XBee UART. The below table gives the pin description of transceiver. Data is presented to the X-Bee module through its DIN pin, and it must be in the asynchronous serial format, which consists of a start bit, 8 data bits, and a stop bit. Because the input data goes directly into the input of a UART within the X-Bee module, no bit inversions are necessary within the asynchronous serial data stream. All of the required timing and parity checking is automatically taken care of by the X-Bee's UART

Co Sensor:

They are used in gas leakage detecting equipments in family and industry, are suitable for detecting of LPG, i-butane, propane, methane, alcohol, Hydrogen, smoke.

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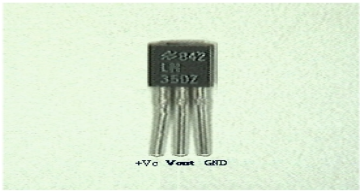
Temperature sensor:

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in ^{o}C) .The LM35 - An Integrated Circuit Temperature Sensor .You can measure temperature more accurately than a using a thermistor. The sensor circuitry is sealed and not subject to oxidation, etc. The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified.



Humidity:

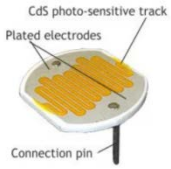
A humidity sensor is an electronic device that measures the humidity in its environment and converts its findings into a corresponding electrical signal. Humidity sensors vary widely in size and functionality; some humidity sensors can be found in handheld devices (such as smartphones), while others are integrated into larger embedded systems (such as air quality monitoring systems). Humidity sensors are commonly used in the meteorology, medical, automobile, HVAC and manufacturing industries.

Humidity sensors can be divided into two groups, as each category uses a different method to calculate humidity: relative humidity (RH) sensors and absolute humidity (AH) sensors. Relative humidity is calculated by comparing the live humidity reading at a given temperature to the maximum amount of humidity for air at the same temperature. RH sensors must therefore measure temperature in order to determine relative humidity. In contrast, absolute humidity is measured without reference to temperature.

The two most common RH sensors are the capacitive and resistive humidity sensors. Capacitive sensors use two electrodes to monitor the capacitance (i.e. the ability to store an electric charge) of a thin metal strip placed between them. The metal's capacitance increases or decreases at a rate that is directly proportional to the change of humidity in the sensor's environment. The difference in charge (voltage) generated by an increase in humidity is then amplified and sent to the **embedded computer** for processing. Resistive humidity sensors operate on a different principle. These sensors utilize a small polymer comb that increases and decreases in size as the humidity changes, which directly affects the system's ability to store charge.

Light Dependent Resistors:

Photo resistors, also known as light dependent resistors (LDR), are light sensitive devices most often used to indicate the presence or absence of light, or to measure the light intensity. In the dark, their resistance is very high, sometimes up to 1 MΩ, but when the LDR sensor is exposed to light, the resistance drops dramatically, even down to a few ohms, depending on the light intensity. LDRs have a sensitivity that varies with the wavelength of the light applied and are nonlinear devices. They are used in many applications, but this light sensing function is often performed by other devices such as photodiodes and phototransistors. Some countries have banned LDRs made of lead or cadmium over environmental safety concerns.



CONCLUSION

In this paper we describe the architecture and implementation of a smart environment with WSN and service robot, in which the home server acts as an intelligent collaborator between our mobile service robot and the environment. To demonstrate the practicability of a WSN and service robot assisted smart home environment, we came up with devices required to provide reliable services, developed them, and

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implemented software for management and control. The goal of our project is to show the usability of the service robots in our daily lives by constructing the smart environment for the service robots. This attempt is expected to enable humans to focus on the important tasks by liberating ourselves from unpleasant daily chores with the help of services robots. Future work will focus on improvement of above proposed work and adding features to make a reliable smart home system.

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