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RESEARCH ARTICLE OPEN

Arduino Based Smart Indoor Ambiance Monitoring and Controlling System

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ABSTRACT: With the advancement in the field regarding the internet of things which greatly facilitates the people's life and work. IoT has made very flexible and compatible in several types of equipment, which are useful in developing automatic systems. The recent changes in the climatic environment affect the changes in indoor temperature and the leakage of inflammable gases leads to the loss of lives and property. To avoid these conditions, one must continuously monitor the indoor environment. The system that monitors indoor conditions must be cost efficient and durable. As people paying are concerned about environmental quality, a set of lightweight intelligent solutions is designed for the management and controlling of indoor conditions. The system uses sensors to obtain environmental information like temperature, gas leakage, lighting conditions, noise, and humidity, through the process of controllers will make an adaptive response, such as turn on the air conditioner and alarm users. In this proposed paper, we proposed a system that can be an optimal advantage to the backwardness of present room management and make people's work and life easy.

Keywords — ARDUINO, Wi-Fi, IoT, Sensors

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I. INTRODUCTION

Current intake in buildings accounts for an important proportion of total energy consumed worldwide. Since people spend about majority of their time in buildings, it is essential that the interior environment quality is improved, and energy consumption is minimized. A design method is present in this paper is that the multi-sensors are controlled using a single system. The smart sensors are used in the proposed system is a great advantage. The development and implementation of a low-cost sensor network system that can be used to monitor important indoor parameters to achieve high indoor environmental quality. The prototype system shown in this paper has been tested in an office building. A good interior environment is associated with high flexible air quality and thermal comfort. The indoor air quality and thermal comfort drastically are significantly affected by the temperature, relative humidity, airflow sequential and other parameters in the indoor space. In order to provide a quality indoor environment, the heating, ventilation and air-conditioning systems have been rapidly increased in recent years in developed and developing countries. Although the control systems are meant to provide the required flexibility while minimizing energy consumption, many of these control systems have consistent to satisfy the occupant's comfort need and/or reduce energy consumption. This is as a result of the model being used to present the rooms in the buildings being too simple with the imagination of perfectly mixed (homogenous distribution) conditions. In practice, in indoor environments, a temperature sensor is placed adjacent to doors or heating/cooling equipment on the wall so that the measured parameter is representative of the whole room and to achieve good thermal placed comfort. Such global sensing design would not perform well for maximizing monitoring and feedback to instant building system operation or achieve optimal efficiency, as the measured parameter exhibit a local interior variation (e.g. indoor temperature variation).

Placing more sensors in the room is proposed to solve the above problem and provide more detailed monitoring or measurements; we can achieve better control of relevant parameters at multiple positions in the room. The development of such systems comprises of sensors that can be placed in multiple locations in the room to help monitor parameters that can achieve optimized control of the HVAC system in the room.

II. BACKGROUND STUDY

At present, the IoT is a buzzing topic of global concern, which provides a new moment to the detection and controlling of indoor environment intelligently. Now-a-days remote monitoring and control for indoor environment with the use of embedded technology with the combination of sensors construction of Internet of Things become the development trend and research focus in the smart home.

Szász proposed a concept of intelligent building with a combination of technology and processing that makes residents feel more comfortable, safe and efficient construction, and leads to four original intelligent building development model: residents, information, energy and adaptation.

III. PROPOSED METHODOLOGY

The proposed work includes the data collection from various sensors of environment like temperature sensor, humidity sensor, MQ6 sensor, and light sensor. The sensor signals are converted to digital from analog undergoing signal conditioning. The microcontroller used belongs to the Arduino family. It processes the data and displays the parameters on the LCD also provides it to the ESP8266 and then to an Android smartphone where data is grouped together and upload/stored in ThingSpeak using the internet. From ThingSpeak the data is retrieved using various platforms like mobile, PC etc. where server sends the data.

A. Block diagram Description

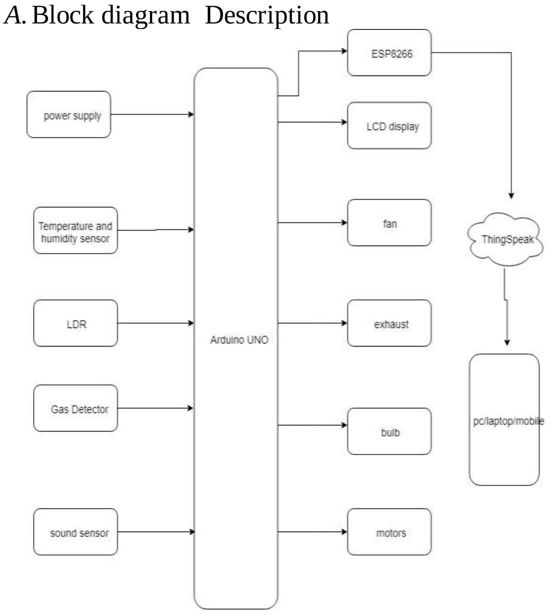

Figure 1: Block Diagram of Proposed Model

The proposed model is divided into two parts. The first part consists of data collection from different sensors like DHT11 temperature and humidity sensor, MQ6 gas sensor, LDR sensor, sound sensor etc. These sensors are placed at a different desired location in room to measures the parameters and gives to ThingSpeak. We compare sensor values with predefined values in the program. If the reading of sensors is greater than the predefined, then the controlling of parameters is done by turning the actuators i.e. ON/OFF. Figure 1 represents block diagram of the proposed system.

B. Hardware Description**:**

The proposed block diagram consists of different sensors, Arduino Uno [MCU], ESP8266, LCD display and power supply.

i. Arduino Uno:

Arduino Uno is a microcontroller with ATmega328P processor. It consists of 14 digital input/output pins of which 6 can be used as PWM outputs, 6 analog inputs, 16 MHz crystal oscillator. It contains everything needed to support the microcontroller.

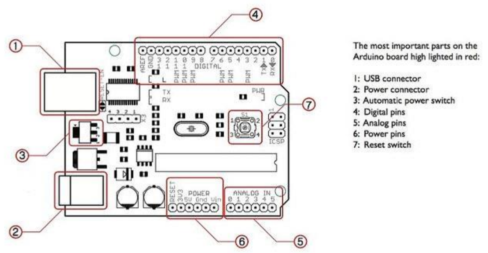

Figure 2: Microcontroller board of Arduino Uno

The ATmega328 has 32 KB flash ROM, 2 KB of SRAM and 1 KB of EEPROM The ATmega328 provides UART serial communication. It can be programmed with the help of Arduino software.

ii. Temperature and Humidity Sensor:

DHT11 digital temperature and humidity sensor in figure 3 is a composite Sensor contains a calibrated digital signal output of the temperature and humidity. The sensor consists a resistive components temperature measurement device. It has an accuracy of ±5% RH at 25˚C for humidity and has a response time of 10 sec at 25˚C.

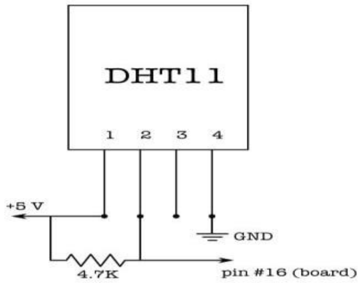

Figure 3: Temperature and Humidity sensor layout

iii. MQ-6 Gas Sensor:

Gas sensor is used to detect leakage of gases in homes and detects LPG, iso-butane and propane. MQ-6 has six pins, of which four are signal pins, 2 pins provide heating current. The sensor gives resistance value depending on LPG and butane gas concentration.

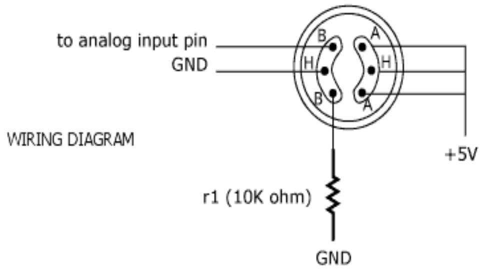

Figure 4: Gas sensor

iv. LDR:

LDR stands for Light Dependent Resistor. LDR in figure 5 is a photoelectric device which converts light energy into an electrical (electrons) signal. A Light Sensor generates a signal representing the light intensity.

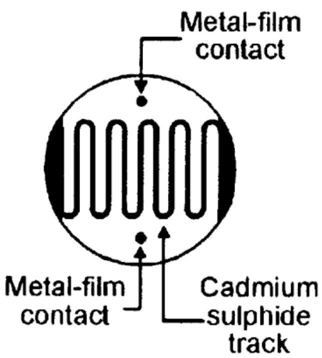

Figure 5: LDR Layout Diagram

v. ESP8266:

ESP8266 is a Wi-Fi microchip controller with AI thinker, providing internet facility for microcontrollers using TCP/IP connections using Hayes-Style commands. It has 32-bit RISC microprocessor with 32KB RAM and 16MB ROM.

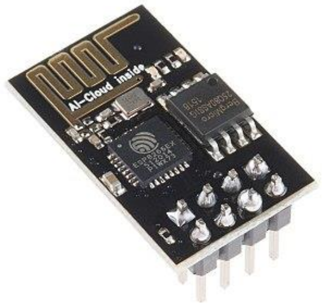

Figure 6: ESP8266 module

vi. Sound Sensor:

A Sound Sensor in figure 7 is a device that detects sound. It has a microphone, LM836 amplifier with some processing circuit. The sensitivity of the sensor is adjusted by the potentiometer.

Figure 7: Sound Sensor

The sensitivity is of 52dB, has frequency range of 50Hz to 20 KHz. It has both analog and digital outputs.

C. Software Description:

ARDUINO 1.8.3 SOFTWARE

Arduino IDE is an open source program for designing digital devices and interactive subjects
that can sense and control objects in the real world. Variety of microprocessors and controllers are used to design Arduino boards.

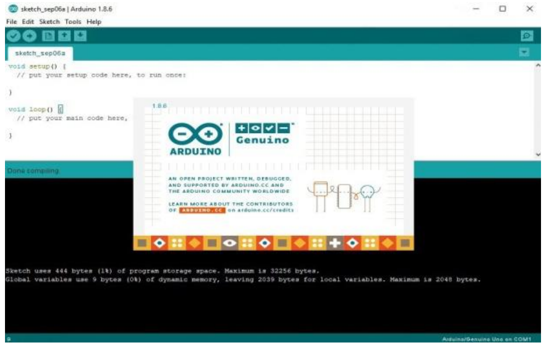

Figure 7: Arduino IDE software

The boards are interfaced with other shields and kits with the set of digital and analog input/output pins. USB is fixed to board for providing communication and to dump the code into it. The language used for programming of Arduino is either C or C++. The Arduino project provides an Integrated Development Environment (IDE) based on the Processing language project.

IV. RESULT

In this work, the sensors are successfully implemented and interfaced with Arduino Uno. The data from the sensors are displayed on 16x2 LCD display, also the controlling of devices are done depending on sensor data. sensor data is updated in the cloud for remote monitoring. The snapshots and figures show the optimized results.

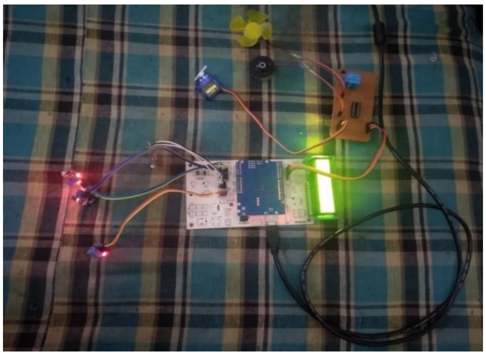

Figure 9: Proposed Model

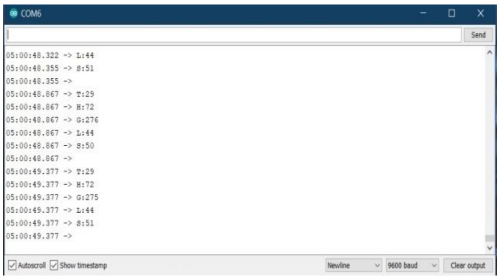

Figure 10: Output of Sensors

V. CONCLUSION AND FUTURE SCOPE

The sensor-based automation system can collect sensor data intelligently. It was designed based on Arduino. It is very suitable for real-time and effective requirements in data acquisition system in indoor environment. Different types of sensors can be used as long as they are connected to the system.

As the number of inputs to the microcontroller is limited, we can use the PLC controller for higher inputs/outputs. We can attach a GSM for getting abnormal condition alerts.

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