

Smart, Healthy and Natural Air Cleaner with Microcontroller using Android Application

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Abstract: Green and clean environment across the globe is very essential for the health of the nature. Unfortunately, different pollutions are affecting the quality of the environment around us. Monitoring is the first step to safety. To avoid pollution situation we need to develop an automatic toxic gas detection and alerting system using android application. Therefore, we proposed a model by using a natural plant pot, which can detect pollution, waters plant time to time. In pollution, avoiding situations high oxygen release plants plays important role. This project is mainly dealing with "Air pollution", which is a very sensitive issue in developing and developed countries and is directly affecting the human health and disturbs the biological balance of mother earth. Here our aim is to develop a system which will detect maximum air pollutants and which is highly responsive, accurate and low cost and low power consuming. Apart from this, we proposed LPG gas leakage monitoring system as this also could be a part of hazardous gas. In this system, the LPG leakage is detected through the sensor and information is sent to the user and the provider by the Short Message Service (SMS) and simultaneously alerts the customer using WIFI module.

Keywords -pollution sensor-MQ135, LPG gas sensor, Soil moisture sensor, 8051microcontroller, WIFI-IOT-Intranet,TTS, and SMS

I. INTRODUCTION

Pollution is the introduction of impurity into the natural environment that causes adverse change in the environment around us. Pollution can take the form of chemical substances such as solid particles, liquid droplets, or gas and energy such as noise, heat, light. The different kinds of pollutions are air pollution, water pollution, noise pollution or maybe soil pollution. Air pollution comes from both natural and human-made sources. However, globally human-made pollutants from ignition, construction, mining, agriculture and warfare and industrialization are increasingly significant in the air pollution equation. An air pollutant is a substance in the air that can have adverse effects on humans and the ecological community. Therefore, there is increasing demand for detection and monitoring of greenhouse gases because of rise in polluted gases. However, in this paper, our objective is to deal with the air pollution and we will concentrate on Indoor air pollution because it is major environmental risk to health. So proposed system meets all the requirements for pollution monitoring. It measures and records concentration of different polluted gases such as LPG gas, NH₃, NO_x, alcohol, benzene, smoke and CO₂ along with these gases Soil Moisture of aloe Vera plant's is also measure, as this plant give more oxygen compare to other plant so we will keep this plant in surrounding and one exhaust fan is used to take out this oxygen in environment which will maintain the quantity of oxygen. If the soil moisture is less then microcontroller will on the water pump to maintain the water level in soil. All sensor data is transferred to android app using Wi-Fi module. Therefore, that user can see the pollution level in one customized application.

II. SYSTEM OVERVIEW

The system block diagram comprises of parts as shown in figure. It consist of microcontroller, LPG gas sensor, moisture sensor, Wi-Fi module, relay, and exhaust fan, MQ135 sensor, Wife module and main AT89S52 atmega microcontroller.

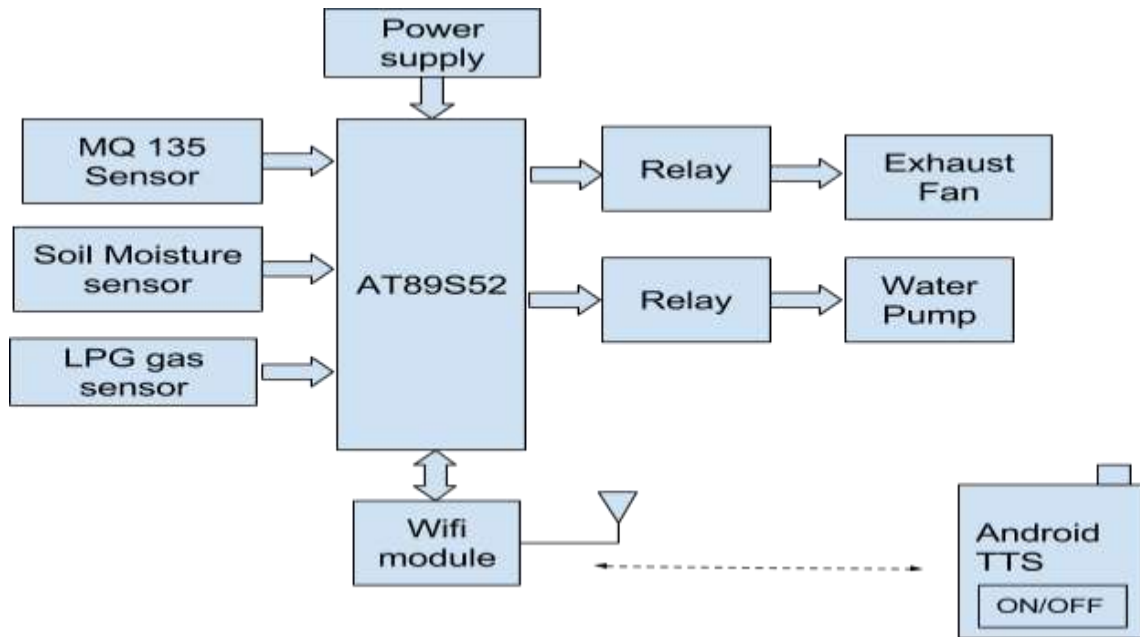


Fig1. [Block Diagram]

2.1. Flow of project:

- Pollution sensor MQ 135 sensor attach to 8051 controller to check pollution of environment i.e. it will detect the harmful gases present in surrounding. It will detect the gases like NH₃, NO_x, alcohol, benzene, smoke and CO₂.
- Digital pin of Soil moisture sensor connect with 8051. 8051 will check the value of sensor and compare it; if the Soil moisture is low below than predefined, value then microcontroller will on the water pump via relay for watering purpose.
- Digital pin of LPG gas sensor connected with microcontroller It will monitor the LPG gas continuously.
- The exhaust fan will remain on continuously near the plant, for providing fresh air from plant to surrounding.
- There is Wi-Fi module interfaced with controller for data sending on Android app. Microcontroller will send all the sensor data to android app using Wi-Fi module. There is Customized android app at user side.
- Here we are using intranet facility. Intranet means mobile and controlled connected to the same network.
- All sensor values and controlling status will get display on android app side
- If condition of sensor is not proper (i.e. value sensor below or above than predefined value) then notification will come on android in speech as well as text format using TTS.
Manually also user can on/off water pump or exhaust fan through mobile app.

III. COMPONENT DETAILS

3.1. AT89S52 Microcontroller-

The AT89S52 is a low power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller, which provides a highly flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

It has Features:

- Compatible with MCS-51 Products
- 4K Bytes of In-System Reprogrammable Flash Memory Endurance: 1,000 Write/Erase Cycles

- Fully Static Operation: 0 Hz to 24 MHz
- Three-level Program Memory Lock
- 128 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Two 16-bit Timer/Counters
- Six Interrupt Sources
- Programmable Serial Channel

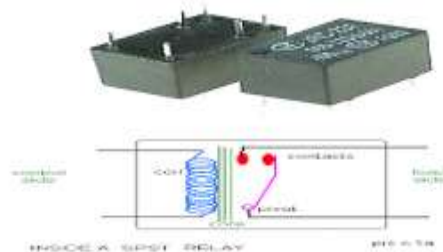


Fig2. [Microcontroller]

3.2.Relay-

A relay is an electrical switch that uses an electromagnet to move the switch from the off to on position instead of a person moving the switch. It takes a relatively small amount of power to turn on a relay but the relay can control something that draws much more power. A relay is used to control the air conditioner in your home. The AC unit probably runs off 220VAC at around 30A. That is 6600 Watts! The coil that controls the relay may only need a few watts to pull the contacts together. A relay switch can be divided into two parts: input and output. The input section has a coil, which generates magnetic field when a small voltage from an electronic circuit is applied to it. This voltage is called the operating voltage. Commonly used relays are available in different configuration of operating voltages like 6V, 9V, 12V, 24V etc. The output section consists of contactors, which connect or disconnect mechanically. In a basic relay, there are three contactors: normally open (NO), normally closed (NC) and common (COM). At no input state, the COM is connected to NC. When the operating voltage is applied, the relay coil is energized and the COM changes contact to NO. Different relay configurations are available like SPST, SPDT, and DPDT etc., which have different number of changeover contacts. By using proper combination of contactors, the electrical circuit can be switched on and off.



Fig3. [Relay]

3.3. Soil Moisture-

Most soil moisture sensors are designed to estimate soil volumetric water content based on the dielectric constant (soil bulk permittivity) of the soil. The dielectric constant can be thought of as the soil's ability to transmit electricity. The dielectric constant of soil increases as the water content of the soil increases. This response is because the dielectric constant of water is much larger than the other soil components, including air. Thus, measurement of the dielectric constant gives a predictable estimation of water content.



Fig4. [Soil Moisture Sensor]

3.4. ESP8266 Wi-Fi module-

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community. This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces; it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts. There is an almost limitless fountain of information available for the ESP8266, all of which has been provided by amazing community support. In the *Documents* section below you will find many resources to aid you in using the ESP8266, even instructions on how to transforming this module into an IoT (Internet of Things) solution!

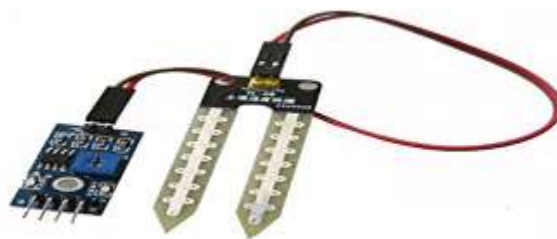


Fig5. [Wi-Fi Module]

IV. CIRCUIT DIAGRAM

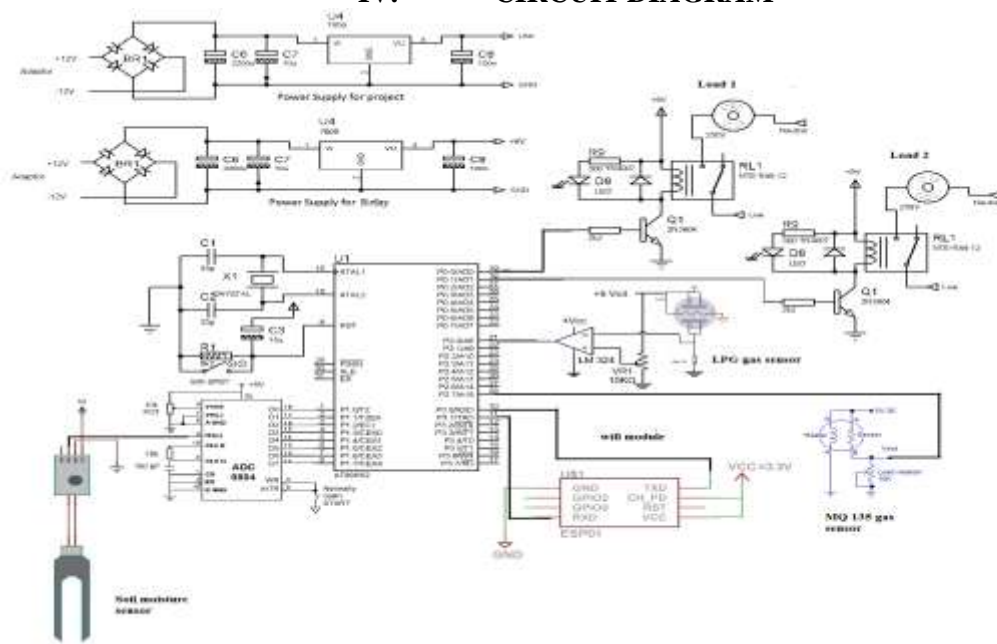


Fig6. [Circuit Diagram]

4.1. Circuit Diagram Explanation-

4.1.1. Power supply-

- The input to the system is 12V ac supply from adaptor, the power supply unit comprises of bridge rectifier, which rectifies the voltage input.
- 2200µF capacitor is used for filtering of the input accompanied by 10µF capacitor.
- LM7805 is the regulator in the circuit; output filtering is done using 100µF.
- At the output, we get the output voltage as per the value of regulator, i.e. if regulator used is LM7805 then 5V.

4.1.2. AT89S52 Circuit-

- Power coming from the supply is further regulated using LM7805 for the microcontroller as it acts on 5V.
- Crystal of 11.0592 MHz along with a pair of 33pF is used as oscillator input at 18 and 19 pin of microcontroller.
- Soil moisture sensor's analog data pin is connected to data pin of ADC, as the soil moisture sensor is analog sensor we need to convert it into digital using 8 bit ADC, ad's output pins are connected to port 1.
- On port 2, LPG gas and MQ 135 gas sensor are interfaced at p2.0 and P2.7 respectively. Both sensor's digital pin is interfaced.
- Serial port of microcontroller is connected with Wi-Fi module. The Wi-Fi module's pin is connected with TX pin of microcontroller and TX pin is connected with Rx pin of microcontroller. Pins P3.0 - Rx and P3.1 - Tx are serial ports.

V. ADVANTAGES

1. Easy to Install.
2. Eco friendly model.
3. Updates on Smartphone directly using Android app.
4. Accurate Pollution monitoring.
5. Plant monitoring and moisture control.

VI. APPLICATIONS

1. Pollution cleaning and monitoring in any area like cities, industrial area etc.
2. Plant health monitoring.
3. Maintain the pollution level.
4. Home automation.

VII. FUTURE SCOPE

- a. Further enhancements to this project that can be done is to log the sensed data into server, which can be used for research and analysis work of the soil conditions and predicting the future atmosphere and soil health.
- b. In the next phase, we can use different sensor to check condition of soil and environment. For example temperature sensor.
- c. In the future, we can implement this project in agricultural field for irrigation and good yielding product.

VIII. CONCLUSION

A Wireless network was successfully implemented for controlling agricultural environmental parameters and was tested for real time. The sensed data is transmitted to the receiver i.e. android app through via Wi-Fi-by-Wi-Fi module. From receiving side, we control the operations and check the status.

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