Wireless Distributed Environmental Mobile Monitoring System Based On Linux

Kondapally SreeLakshmi
Department of Electronics and Communication Engineering
CVSR College Of Engineering, Hyderabad,, AP, India

M.Kiran Kumar
Department of Electronics and Communication Engineering
CVSR College Of Engineering, Hyderabad,, AP, India

Abstract- A wireless distributed Environmental mobile monitoring system based on Linux operating system been designed and tested. The proposed system consists of a Mobile Data-Acquisition Unit (Mobile-DAQ), ARM9 microcontroller board, two GSM modules. The mobile DAQ unit consists of Microcontroller (AT89S52) to which array of sensors (Temperature sensor, moisture sensor, LDR (light dependent resistor) and Gas sensor (CO, NO2 and CO2)) are connected. The mobile DAQ unit collects the data and this data is subsequently sent to the monitoring system via the GSM network. Continuous monitoring of waste gas is required in some companies where poisonous gases are released. In some companies there will be some temperature conditions, if the room temperature exceeds the limit the effects are dangerous.

Keywords – Linux, ARM9, Sensors

I. Introduction

A wireless distributed Environmental mobile monitoring system based on Linux operating system has been designed and tested. The proposed system consists of a Mobile Data-Acquisition Unit (Mobile-DAQ), ARM9 microcontroller board, two GSM modules.
The mobile DAQ unit consists of Microcontroller (AT89S52) to which array of sensors (Temperature sensor, moisture sensor, LDR (light dependent resistor) and Gas sensor (CO, NO2 and CO2)) are connected. The mobile DAQ unit collects the data and this data is subsequently sent to the monitoring system via the GSM network. Sensors are connected to microcontroller (AT89S52) board and these sensors will sense the current environmental changes (like temperature, waste gas, moisture). These values are converted to digital values and displayed on the LCD display present on microcontroller board. GSM modem is connected to microcontroller board by RS232 communication. The sensed values are sent to the receiver end ARM9 controller board by GSM message service. There is another GSM board connected to ARM9 board by RS232 communication. ARM9 board displays these values on the touch screen display. For sending the message from specified unit we enter the mobile number of the transmitted GSM board. We enter the transmitter side mobile number in hyper terminal window at receiver side and on touch screen present at the transmitter side we enter the receiver side mobile number. Continuous monitoring of waste gas is required in some companies where poisonous gases are released. In some companies there will be some temperature conditions, if the room temperature exceeds the limit the effects are dangerous.

SENSORS

The sensors used in this wireless system are LDR, GAS sensors, Temperature sensors, moisture sensors.

Temperature Sensor

Calibrated directly in ° Celsius (Centigrade)

Linear + 10.0 mV/°C scale factor

0.5°C accuracy guarantee able (at +25°C)

Rated for full -55° to +150°C range

Suitable for remote applications

Low cost due to wafer-level trimming
Operates from 4 to 30 volts
Less than 60 µA current drain
Low self-heating, 0.08°C in still air
Nonlinearity only ±¼°C typical
Low impedance output, 0.1 Ohm for 1 mA load.

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full -55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a -55° to +150°C temperature range, while the LM35C is rated for a -40° to +110°C range (-10° with improved accuracy.An analog temperature sensor is pretty easy to explain, its a chip that tells you what the ambient temperature is!These sensors use a solid-state technique to determine the temperature. That is to say, they don't use mercury (like old thermometers), bimetallic strips (like in some home thermometers or stoves), nor do they use thermistors (temperature sensitive resistors). Instead, they use the fact as temperature increases, the voltage across a diode increases at a known rate. (Technically, this is actually the voltage drop between the base and emitter - the Vbe - of a transistor. By precisely amplifying the voltage change, it is easy to generate an analog signal that is directly proportional to temperature.

Measuring temperature

To convert the voltage to temperature, simply use the basic formula:

Temp in °C = [(Vout in mV) - 500] / 10

So for example, if the voltage out is 1V that means that the temperature is ((1000 mV - 500) / 10) = 50 °C

If you're using a LM35 or similar, use line 'a' in the image above and the formula:

Temp in °C = (Vout in mV) / 10

Moisture Sensor

Moisture sensors measure the water content in soil. A soil moisture probe is made up of multiple soil moisture sensors. One common type of soil moisture sensors in commercial use includes the Frequency domain sensor such as the capacitance sensor.Measuring soil moisture is important in agriculture to help farmers manage their irrigation systems more efficiently. Not only are farmers able to generally use less water to grow a crop, they are able to increase yields and the quality of the crop by better management of soil moisture during critical plant growth stages.Besides agriculture, there are many other disciplines using soil moisture sensors. Golf courses are now using sensors to increase the efficiencies of their irrigation systems to prevent over watering and leaching of fertilizers and other chemicals offsite.In urban areas, landscapes and residential lawns are using soil moisture sensors to interface with an irrigation controller. Connecting a soil moisture sensor to a simple irrigation clock will convert it into a "smart" irrigation controller that prevents an irrigation cycle when the soil is wet.Moisture Sensor usage in urban landscape irrigation will only increase over the next decade. Cities and states have begun rebate programs for the installation of moisture sensors on new properties as well as retrofitting installed sprinkler and irrigation systems. In addition, cities and counties are introducing local legislation requiring the installation of soil moisture sensors.Cities and States with rebates, exemptions and ordinances: Dallas, Texas; Collin County, Texas; Tampa, Florida; Pasco county, Florida; California; Utah; Colorado; Oregon;

GAS Sensor:

A CO gas sensor according to the present invention includes a gas collecting container for collecting a measured gas therein; a detecting section provided within the gas collecting container and having at least a pair of electrodes positioned through electrolyte; and a voltage applying apparatus for applying voltage to the detecting section. One of the electrodes of the detecting section is a detection electrode having the capability of adsorbing at least one of hydrogenous gas and CO gas when a voltage is applied and then oxidizing it.

By introducing a measured gas into a gas collecting container of the CO gas sensor and carrying out electrolysis according to a potential sweep method or a pulse method with the measured gas being in contact with the detecting section, a CO gas concentration in the measured gas can be measured based on an electrical current value obtained at the detecting section and changes of the electrical current with elapse of time. According to the CO gas sensor of the present invention, it is possible to accurately carry out detection and measurement of the concentration of CO gas when CO gas is to be detected or measured even in a gaseous atmosphere containing a relatively large amount of hydrogen gas and CO2 gas.

The present invention relates to a CO gas sensor for measuring the concentration of CO gas contained in a gaseous phase and to a method of measuring the concentration of CO, in particular relates to a CO gas sensor for measuring the concentration of CO gas in a gaseous atmosphere containing relatively high concentrations of hydrogen gas and CO2, a fuel cell power generating apparatus equipped with such CO sensor, a method of measuringconcentrationCOgas.

In many cases, hydrogen gas is used as a fuel gas for fuel cells. As such hydrogen gas, a hydrogen gas rich reforming gas which is obtained by reforming methanol or the like is used. When manufacturing such a reforming gas, a tiny amount of carbon monoxide (CO), namely several tens ppm to several hundred ppm, is present as impurities. For this reason, when such a reforming gas is used as a fuel gas for a fuel cell, the CO gas is adsorbed on the surface of the platinum catalyst of the fuel cell electrodes, thus hindering ionization of the hydrogen gas and lowering the output of the fuel cell. In order to take appropriate measures to counter such a problem caused by the CO gas, it is necessary to continuously monitor the concentration of CO gas in the reforming gas used in the fuel cell. Conventionally, as for the most commonly used CO gas sensor, there are known a controlled potential analysis type CO gas sensor and a semiconductor type CO gas sensor. However, for the reasons given below, neither of these CO gas sensors is appropriate for detecting CO gas in a reforming gas.

Namely, the reforming gas contains hydrogen gas used as a fuel in the fuel cell for the amount of about 75% thereof. In comparison with this, the reforming gas contains a relatively tiny amount of CO gas as described above. Therefore, it becomes necessary to detect or measure CO gas in a hydrogen gas atmosphere containing a relatively large amount of hydrogen gas. However, in the case where the concentration of CO gas is measured in such a hydrogen gas rich atmosphere using these CO gas sensors, there is a problem that it is difficult to accurately detect (qualitative analysis) or measure (quantitative analysis) such CO gas with either type of CO gas sensor due to influence of the hydrogen gas rich atmosphere in which interference by hydrogen gas occurs.

In view of the problem mentioned above, it is an object of the present invention to provide a CO gas sensor which can accurately carry out detection (qualitative analysis) and measurement (quantitative analysis) of the concentration of CO gas when CO gas is detected or measured in a gaseous atmosphere containing a relatively large amount of hydrogen gas and carbon dioxide gas, a fuel cell power generating apparatus equipped with such a CO gas sensor, and a method of measuring the concentration of CO gas.

II. Proposed Algorithm

The main aim of the project is to design a system that continuously monitors the environmental changes like waste gases, Temperature, humidity and moisture in environment. The proposed system contains gas sensors, temperature sensors, moisture sensors, 2GSMmodules, Microcontroller (AT89S52) Board, ARM9 board, Touch screen display. Continuous monitoring of waste gas is required in some companies where poisonous gases are released.In some companies there will be some temperature conditions, if the room temperature exceeds the limit the effects are dangerous. So here temperature sensors are needed. Data sending and receiving is done through the GSM boards. In GSM board we are using the SIM300 module .

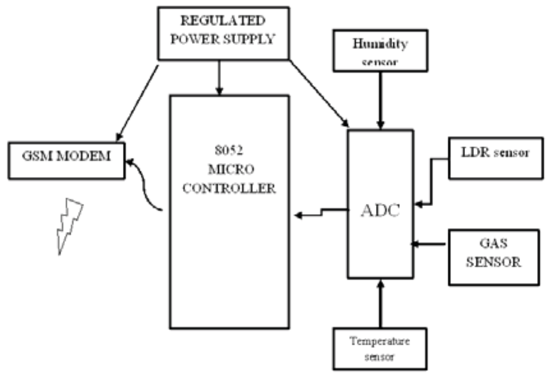


Fig 2.1 Block Diagram of Transmitter end

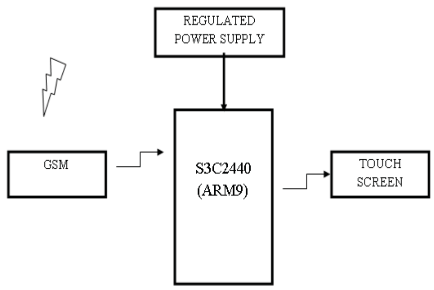


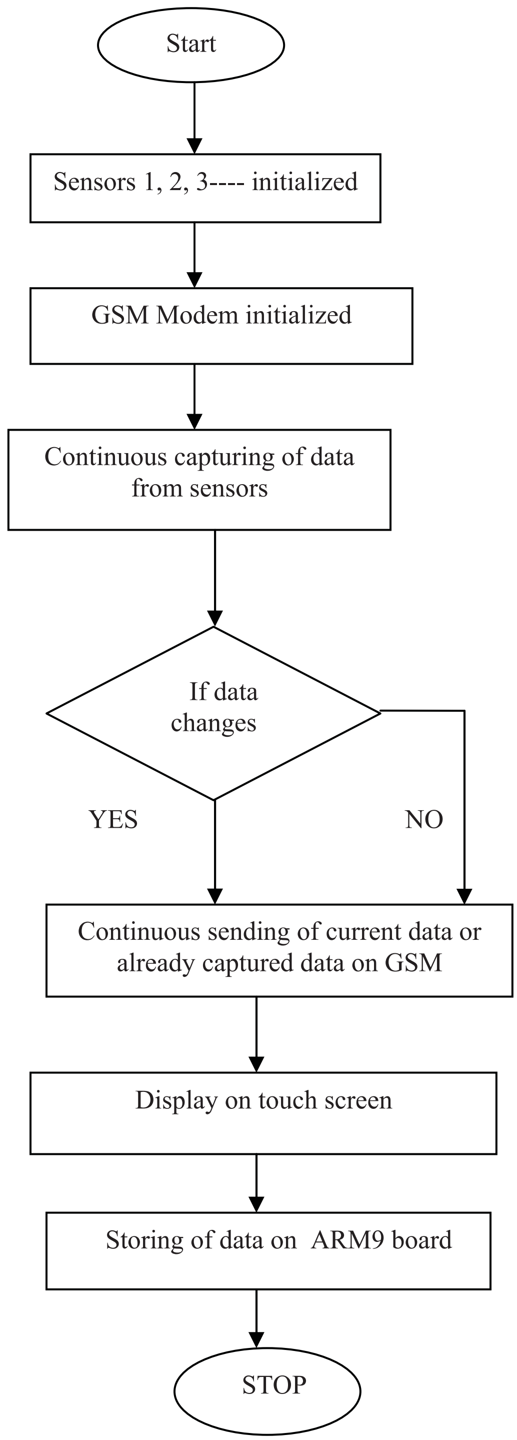
Fig 2.2 Block diagram of Receiver end

ALGORITHM

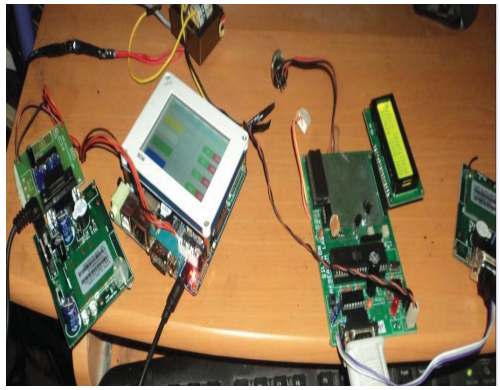
The working of the project can be explained in the following steps:

1. Initially Sensors 1, 2, 3---- initialized
2. GSM Modem initialized
3. Continuous capturing of data from sensors
4. Continuous sending of captured data on GSM
5. Continuous capture of data on GSM
6. If data is unchanged the same data is displayed on touch screen
7. Display on touch screen
8. Storing of data on ARM9 board

FLOW CHART



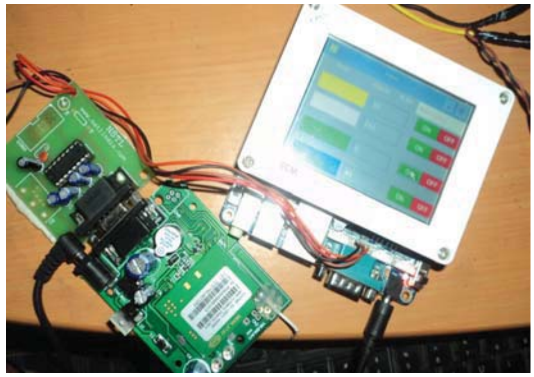
1. Connect all the modules as per the project requirements.



2. Insert the SIM in the GSM Module.

3.8052 board connected to Transmitter end GSM board
4.By using HyperTerminal enter the receiver end mobile number.
5.The sensors on the 8052 board continuously sense the temperature, light, moisture and waste gas values.
6.Sensed values will send to receiver (ARM9) board.

7.Connect the ARM9 board and receiver end GSM board.
8.Enter the transmitter mobile number on ARM9 board.
9.On the screen we see the current values of temperature, light, moisture and waste gas received from the transmitter board.
10.The communication between the transmitter and receiver is done by the GSM.



11.Outputs on ARM9 board.

IV.CONCLUSION

The project "**WIRELESS DISTRIBUTED ENVIRONMENTAL MOBILE MONITORING SYSTEM BASED ON LINUX"** has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit.

Secondly, using highly advanced ARM9 board and with the help of growing technology the project has been successfully implemented. This is a soft real time monitoring system. The main aim of the project is to design a system that continuously monitors the environmental changes like waste gases, Temperature, humidity and moisture in environment. The system can be used for alerting the people whenever there is threat by Environmental changes like fire and poisons gas. Ex. Coal mines and pharmaceutical Companies.

More work is required to commercialize the system by using GPRS, latest sensors and GPS can be used for finding the location of pollution. By using GPS we can find the location, time and date. We can also use the system with Ph sensors by replacing the gas sensors for monitoring the water pollution.

V.FUTURE SCOPE

More work is required to commercialize the system by using latest sensors, GPRS and GPS can be used for finding the location of pollution. By using GPS we can find the location, time and date. We can add Ph sensors in the system for monitoring the water pollution. These sensors are used for finding the percentage of oxygen in sea for survival of fishes

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