Smart Real –Time Pollution Monitoring System Using FPGA and Android

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Abstract- *Now a day's real time pollution monitoring systems are very important in different industrial areas. Because in that monitoring system collect a large amount of data. This collection of data is done with the help of different sensors. In this project we create a monitoring the pollution with by using FPGA Spartan 6 and android technology.*

This smart real time pollution monitoring System is used in various industrial area .we use the modern mobile device under the android operation system. Some related works done sensing and delivering of alert message to the user over the wireless sensors networks. Instead, in this paper, we propose a real time environmental monitoring system aims at quick pollution detection. FPGA Spartan 6 devices collect the data from different sensors each value is processed by the FPGA and compared with previously defined threshold value. In that normal case, the sensed data will be sent to the android device and when the pollution threshold is exceeded, the user is notified by receiving an alert message on its mobile device user.[2] The experimental results of our project in terms of fast detection, real time response and the capacity to user notify pollution everywhere.

Keywords- Sensor, ADC4, FPGA Spartan 6, Bluetooth Controller, Android Device.

I. INTRODUCTION

Today's different industry are used different pollution monitoring system these system monitor the pollution by using different sensing technology. In that paper we present a new advanced pollution monitoring technology is smart real- time pollution monitoring system using FPGA Spartan 6 & Android.

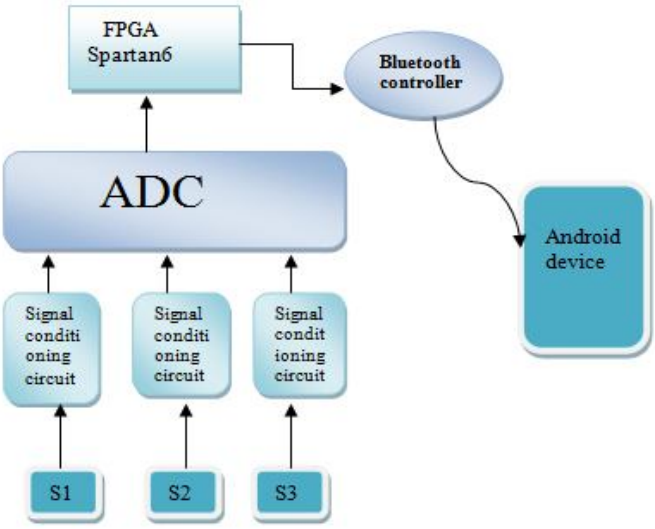

Figure 1: General scenario for Smart Real –Time Pollution Monitoring System.

Above figure shows the general scenario for Smart Real –Time Pollution Monitoring System. In that project we use .Android and FPGA Spartan 6 interfacing is done through Bluetooth module HC-05 which is electronic component. The HC-05 is TTL compatible therefore it can be directly connected to Tx & Rx pin of FPGA Spartan 6. FPGA and sensors are interface via I^2C protocol (inter integrated circuit.). For that we use ADC IC PCF8591P. It is a 4 channels IC with 8 bit output. These ADC interface with FPGA Spantan 6.The sensors are interface with FPGA through signal conditioning circuits and ADC 4 to FPGA Spantan 6.

Android device gives command to FPGA for various operations and FPGA Spantan 6 will work accordingly there function. The necessary controlling action and corrective command related to that signal will be sends to FPGA Spantan 6. For example, for monitoring temperature LM35 sensor is use which will sense the temperature and send it to android device continuously.

The function of FAGA Spantan 6 collects the data from different sensors and compared with previously defined threshold value. In that normal case, the sensor sensed data will be sent to the android device and when the pollution threshold is exceeded, the user is notified by receiving an alert message on its mobile device user.

II. RELATED WORK

In smart real –time pollution monitoring system works on different modules. This system use different sensors for sensing the signals. After sensing the signals it goes on particular signal conditioning circuit as per there sensor. Then this signal sends to the ADC IC PCF8591P this converted digital signal applied to the FPGA Spantan 6 which is high capacity device. Signals in the FPGA are passed in android device with the help of Bluetooth controller. Finally user gets the pollution information.

We use the different sensors this control system used for read the temperature, smoke gas and light in the environment. The current variable is sensed by the sensor. We can control these parameters using different programming technique. It is converted in particular format by signal conditioner and ADC which transferred to FPGA to android system.

SENSORS-

- LM35

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.

- MQ-6 Gas Sensor

High sensitivity to LPG, iso-butane, propane small sensitivity to alcohol, smoke. Fast response and stable and long life .Simple drive circuit. They are used in gas leakage detecting equipments in family and industry, are suitable for detecting of LPG, iso-butane, propane, LNG, avoid the noise of alcohol and cooking fumes and cigarette smoke.

- IR Sensor

An IR sensor is a device which detects IR radiation falling on it. There are numerous types of IR sensors that are built and can be built depending on the application. Proximity sensors (Used in Touch Screen phones and Edge Avoiding Robots), contrast sensors (Used in Line Following Robots) and obstruction counters/sensors (Used for counting goods and in Burglar Alarms) are some examples, which use IR sensors.

Every sensor in this world has three terminals:

Vcc – to power up the sensor

GND – to provide a fixed negative reference

Output – analog output of the sensor (in some sensors, there may be more than one output terminals)

The following block diagram demonstrates it.

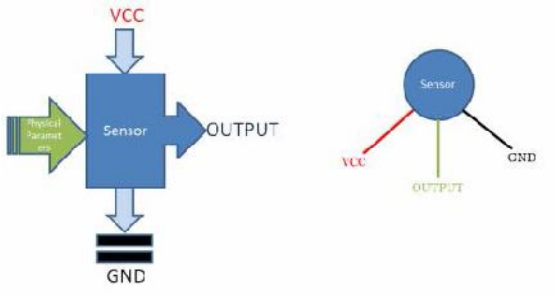

Figure 2: Working of Sensor.

- Smoke

It is a device which is use that to senses smoke, typically indicator of fire. Commercially it use as security devices issue a signal to a fire alarm control panel as part of a fire alarm system, while household detectors, known as smoke alarms.[1]

Signal Conditioning & ADC Circuit

This circuit contains unity gain amplifier & analog to digital converter (ADC). The output of sensor is analog in nature & of low value .Output of sensor is given to ADC through unity gain amplifier .ADC converts that analog into corresponding digital signal, which is given to FPGA.

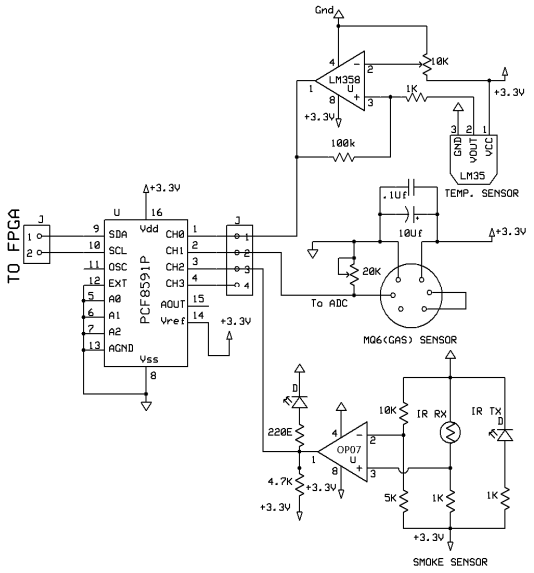

Figure 3: Working of ADC

The LM358 series consists of two independent, high gain internally frequency compensated operational amplifier which is designed specially to operate from a single power supply over wide range of voltages. Operation from split power supply is also possible.

The unity gain cross frequency is temperature compensated. The input bias current is also temperature compensated.

FPGA Spartan6

FPGAs are programmable digital logic chips. We can program them to do almost any digital function. You use a computer to describe the "logic function" that We want(schematic, or a text file describing the function). Perform the functional simulation on your computer, using software provided by the FPGA vendor. Although problems with the size or timing of the hardware may still crop up later, the designer can at least be sure that his logic is functionally correct before going on to the next stage of development.[2]

Spartan-6 LX FPGAs are optimized applications that require the absolute lowest cost. They support up to 147K logic cell density, 4.8Mb memory, integrated memory controllers, DSP slices, ease-of-use, and high-performance Hard IP with an innovative open standards-based configuration. The Atlys board combines a high-capacity Spartan-6 FPGA with the circuits and devices needed to create today's most demanding digital systems.

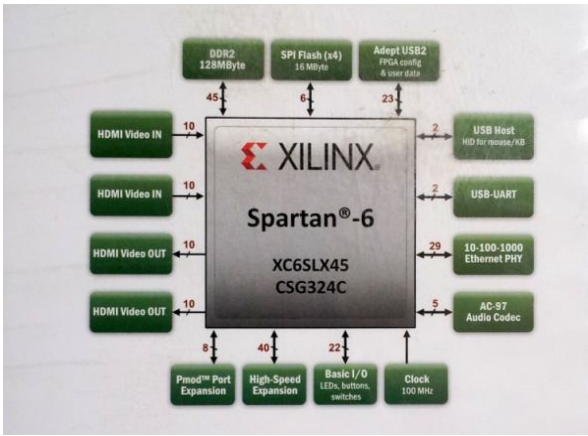

Figure 4: Spartan 6 Chip

Message Transmission FPGA to Android Device

After the sensing the signal by using sensor then message is send from FPGA to android device .The actual message sending process are display in below flowchart. First it checks the status of control pins whether it is temperature, smoke and MQ6. According to their status it sends message to the android mobile device. In this way user know the information of pollution.

The designs can run much faster than if you were to design a board with discrete components, since everything runs within the FPGA. FPGAs lose their functionality when the power goes away (like RAM in a computer that loses its content). We have to re-download them when power goes back up to restore the functionality.

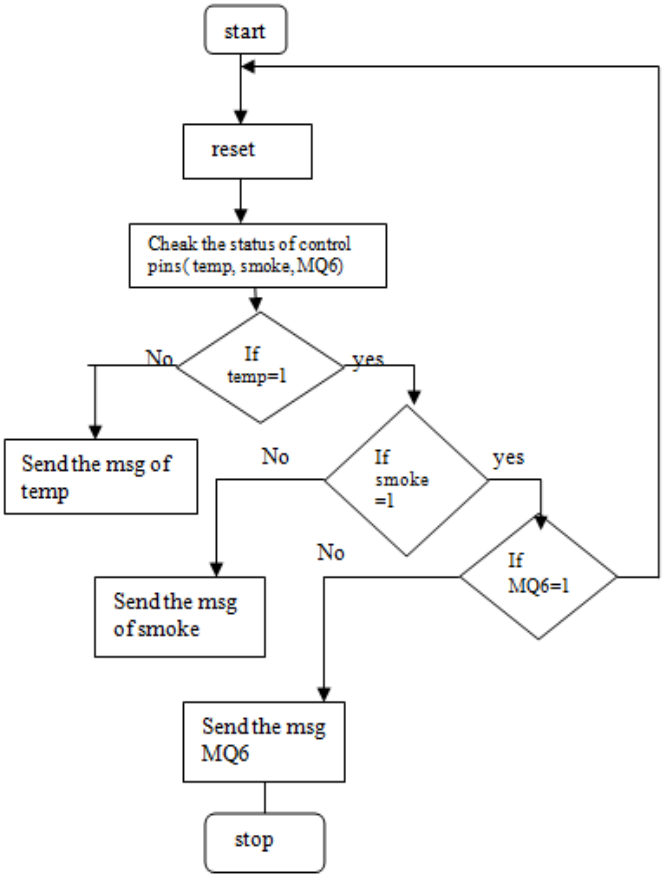

Figure 5: Flow Chart Message transmission

IV. FUTURE WORK

These proposed systems can be enhanced further. In future in this system we may add different sensors such as humidity, level, speed, flow etc. It also used in Process monitoring for maintenance and troubleshooting applications in different industry for sensing water pollution , sound pollution etc.

V. CONCLUSION

This project we create real –time pollution monitoring system application which helps to monitor the air pollution. Here we use new advanced FPGA Spartan 6 technology whose capacity is very high as compare to other devices such

as AVR, Embedded Ethernet, and ARM 7 etc. Using this application user get pollution information on his android mobile hence it is easy to detect the pollution in air.

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