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Design And Development Of Activation And Monitoring Of Industry Automation System Via SMS Through FPGA

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Abstract:

In recent years, the world is mainly focusing on industrial development due to the massive growth in the number of industries in urban and sub-urban areas the productivity and people working in the industries are increased rapidly. At the other hand the security systems are not maintained exactly per the rules and regulations. Now a day the accidents in the industries are raising day by day but the industries are also not concentrating the safety precautions needed. In industries two factors are very hypothetical Temperature and Gas Monitoring. Always we can't guarantee a person will be monitoring all this values using PC's or some other aids. As well as microcontroller oriented security systems came but they are also not much efficient as a pure hardware IC. So, to avoid these kind problems we propose a new technique for future ASIC application using FPGA in this paper. Here we are mainly Employing GSM Communication, Temperature and Gas Sensors for Automation of the Industries.

Keywords: *FPGA, ASIC, Industrial Automation, GSM, Temperature Sensor, Gas Monitoring.*

1.Introduction

The objective of this paper is to investigate a cost effective solution that will provide controlling of Industrial appliances remotely. The motivation was to facilitate the users to automate their Industrials having universal access. The system is SMS based and uses wireless technology. This system provides ideal solution to the problems faced by Industrial owners in daily life. GSM module is a bridge responsible for enabling/ disabling of SMS capability.

The system is wireless therefore more acceptable and cost-effective. The system is capable enough to give feedback to user about the condition of the Industrial appliance according to the user's needs and requirements. The Industrial appliances monitoring and control system with an affordable cost was thought to be built that should be mobile providing remote access to the appliances. The ease of deployment is due to wireless mode of communication. GSM technology provides the benefit that the system is accessible in remote areas as well. A prototype of the controller is implemented, and the experiment results show that the FPGA can easily and flexibly control the Industrial appliances.

A processing system was microcontroller and a communication module that used GSM module or cell phone. The ease of deployment is due to wireless mode of communication. GSM technology provides the benefit that the system is accessible in remote areas as well.

The low cost remote monitoring system can be implemented using programmable logic devices (PLDs). PLDs allow fast development of prototypes and the design of complex hardware system using FPGA. The system contains low cost components easily available which cuts down the overall system cost.

The technology and processes associated with manufacturing have undergone a major change during the Last few decades: for being able to compete in today's economy; the time-to-market has to be reduced while at the same time, mass production with high quality standards is required. While these aspects are true for products in almost any domain, the notable ones are automotive and aerospace, having a high rate of production involving operations like cutting, shaping, molding, welding, polishing and assembly operations and in the large processing industries such as chemical industries, where time- or process critical and hazardous operations are involved. Thus, the demand for high-production rate coupled with strict-quality norms can be achieved with less and less direct human interaction and an increasing degree of automation.

The basic elements involved are sensing, processing, monitoring and inferring for controlling the state of the system being observed, the sensors to sense the change in the system, a medium to convey the measured parameters and finally making available the acquired information to control in real time. Automation when implemented provides for early detection of failures and correction, thus minimizes the down-time and losses while increasing productivity and profitability. This eventually also leads to reduction in wear and tear of the production system, thereby increasing its life time.

One common problem of today's settings is the static setup. The integration of further sensors to enhance the monitoring quality is very tedious and labor-intensive. Several reasons might exist why one would like to add sensors:

- To enhance the quality of production and data acquisition,
- To temporarily satisfy specific higher monitoring requirements of FPGA.

To simplify the integration of new sensors, this paper suggests the following two approaches: using wireless communication technology to reduce the required effort for physical integration and a model-driven development process to reduce the required effort for implementation.

2.Proposed Fpga Based Architecture

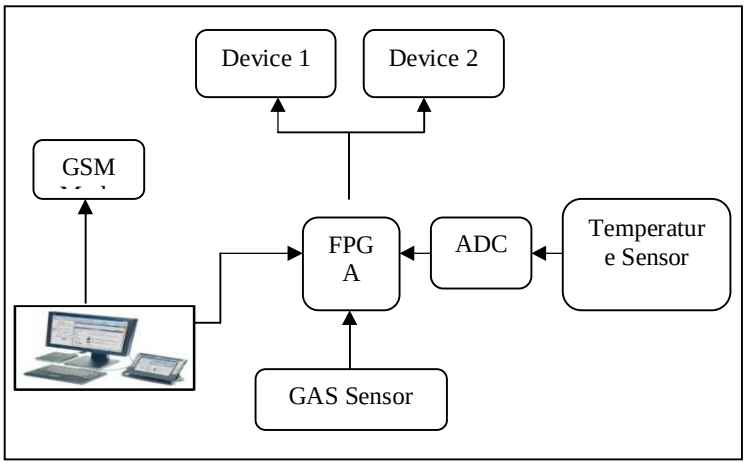

Figure 1: Block Diagram of our Proposed Design

In the block diagram we are using the temperature sensor LM35 and for the conversion of Analog values into digital values we are using ADC0809 after that we are using the Gas Sensor version as MQ-2 for the monitoring of the suspicious gases. The values of

gas and temperature are going to be continuously monitored by the FPGA. The FPGA is connected to the PC for monitoring purpose and two devices are connected to the FPGA for the purpose of controlling. The device we can change it to an Exhaust fan or a Motor pump or any device according to our needs. The implementation of this paper is done using SPARTAN 3AN FPGA XC3S50AN IC. The details of all the modules are listed one by one below.

2.1.Temperature Sensor

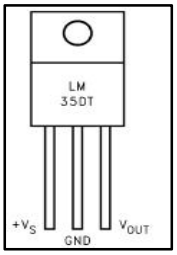

Figure 2: Temperature sensor LM35

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. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°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). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

3.GSM Communication

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaveslike a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves.

A GSM modem can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.

As mentioned in earlier sections of this SMS tutorial, computers use AT commands to control modems. Both GSM modems and dial-up modems support a common set of standard AT commands. You can use a GSM modem just like a dial-up modem.

In addition to the standard AT commands, GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards. With the extended AT commands, you can do things like:

- Reading, writing and deleting SMS messages.
- Sending SMS messages.
- Monitoring the signal strength.
- Monitoring the charging status and charge level of the battery.
- Reading, writing and searching phone book entries.

The number of SMS messages that can be processed by a GSM modem per minute is very low -- only about six to ten SMS messages per minute.

4.Gas Sensor

A Gas sensor is a device which detects the presence of various gases within an area, usually as part of a safety system. This type of equipment is used to detect a gas leak and interface with a control system so a process can be automatically shut down. A gas detector can also sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave the area. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals.

Gas detectors can be used to detect combustible, flammable and toxic gases, and oxygen depletion. This type of device is used widely in industry and can be found in a variety of

locations such as on oil rigs, to monitor manufacture processes and emerging technologies such as photovoltaic. They may also be used in firefighting.

The MQ6 is a simple-to-use Liquefied Petroleum Gas (LPG) sensor. It can be used in gas leakage detecting equipment in consumer and industry applications, this sensor is suitable for detecting LPG, iso-butane, propane, LNG. Avoid the noise of alcohol, cooking fumes and cigarette smoke. The sensitivity can be adjusted by the potentiometer. They are used in gas leakage detecting equipment's 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.

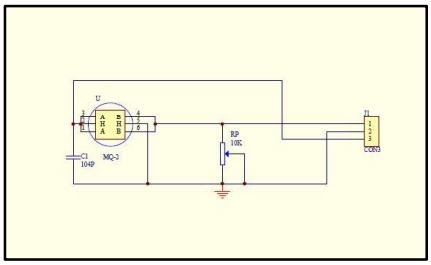

Figure 3: Schematic of GAS Sensor

One smoke detector is not enough! There should be smoke detectors on every level of your Industry and near sensitive areas. This means the basement and the attic, too, if it is used as a living space. If you work with the industry door closed, be sure to install a detector inside your industry, too, as smoke and poisonous gases are blocked by a closed door. A smoke detector needs to be installed in a smoker's industry, whether the occupant works with the door open or not.

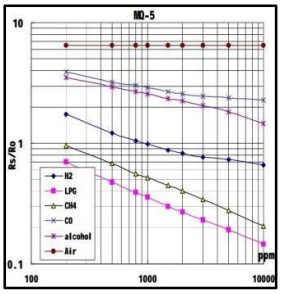

Figure 4: Sensitivity Characteristics of MQ5

In their: Temp: 20℃、Humidity: 65%、O2 concentration 21% RL=20kΩ Ro: sensor resistance at 1000ppm of H2 in the clean air.Rs: sensor resistance at various concentrations of gases.

5.ASM Chart

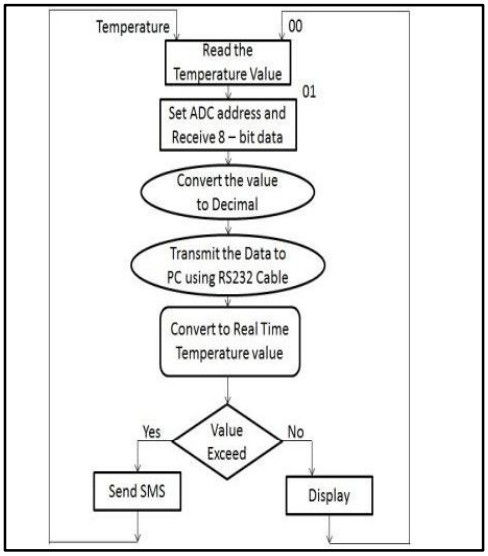

Figure 5: ASM Chart

6.Simulation Results

In our work we have used Xilinx Simulator of the proposed Industry Automation System and the result is shown below.

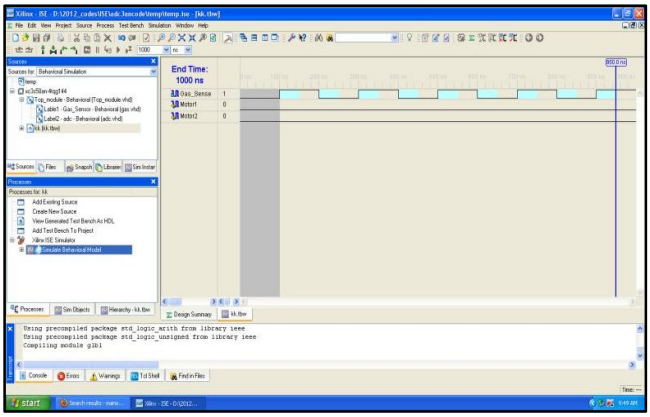

Figure 6: Input of Gas Sensor

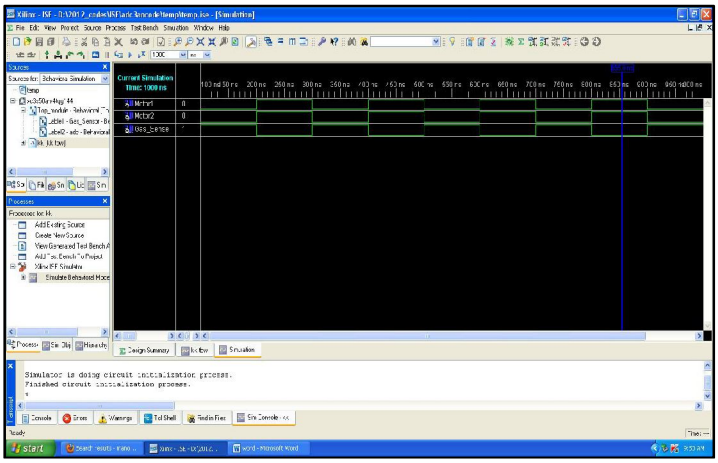

Figure 7: Output of Gas Sensor

The graph represents LM35 Temperature Sensor series is 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 -40 to +110°C temperature range. Low cost is assured by trimming and calibration at the wafer level.

Figure 8: Output of Temperature Sensor

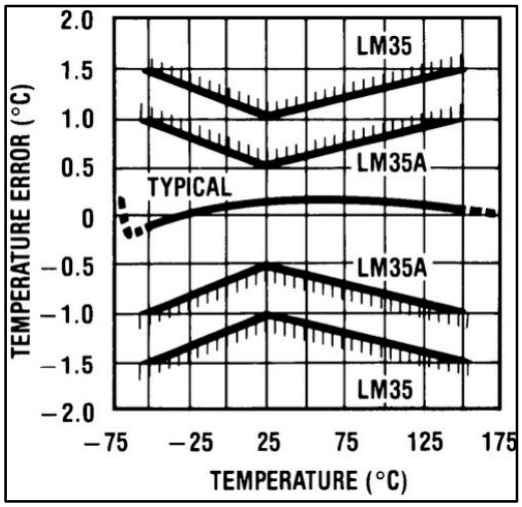

Figure 9: Temperature Sensor Graph

Symbol	Parameter Name	Technical Condition	Remarks
V_C	Circuit Voltage	5V±0.1	AC or DC
V_H	Heating Voltage	5V±0.1	AC or DC
P_L	Load Resistance	20KΩ	
R_H	Heater Resistance	31±10%	Room Temperature
P_H	Heating Consumption	Less than 800mw	

Table 1: Standard Work Condition for LM35

10.Conclusion

In this time, model biotelemetry system is being implemented into working solution. Nevertheless, there is Space for improvements in both concept and implementation details of this system. Model biotelemetry system is currently designed for indoor use by one patient only. More nearby instances of inner part of model bio telemetric system managed by single outer part of system are possible, but there exists one to one mapping between patient and ZigBee network. Future improvements may include support for outdoor operation with communication implemented using 3G mobile technology and patient's tracking by GPS system. With advancements in low-power high-density FPGA solutions, FPGA programmable system on chip technology seems to be promising for purpose of this bio telemetric system.

11.Future Scope

Future improvements may include support for outdoor operation with communication implemented using 3G mobile technology and patient's tracking by GPS system. With advancements in low-power high-density FPGA solutions, FPGA programmable system on chip (SoC) technology seems to be promising for purpose of these biotelemetry systems.

Improve designer productivity through enhancing conciseness, simplifying common occurrences of code, and improving capture of intent. Facilitate modelling of functionality that is currently difficult or impossible.

The VHDL designer and vendor community are actively working on revisions to both VHDL and the packages that support the language. These revisions are integrating the newest features of verification languages and assertion languages as well as adding features such as a programming language interface (VHPI) and a simulation control interface. In addition, changes are being made to improve performance and ease of use.

“In this we are attaching GSM modem to get sms alerts to the authorized person”.

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