

Petrochemical Level Indicator and Controller for Automation Industries Using UTLP Kit

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ABSTRACT: Petrochemical scarcity is one of the major problems in cotton process industries. This paper is designed to monitor and control the level of a tank using ARM based microcontroller. Reed sensors are used to detect the level of the content. An AC motor is operated based on the level of the content. In spinning mills Petrochemical based cleaning solutions are used for cleaning of raw cotton. This petrochemical liquid is pumped from tank to the process container by using an AC motor. The process container is the capacity of 2000 litres. The motor takes more than one hour to fill the process container. An operator has to pay attention to the container to switch off the motor to avoid overflow of petrochemical by using ARM 8 processor from Texas and Spartan6 FPGA. During the process 39⁰C temperature has to be maintained. This can also be implemented in Unified Technology Learning Platform (UTLP) kit which has the two major platforms to go beyond the experiments and to develop products and to solve real life problems.

KEYWORDS: ARM, Magnetic Sensors, LCD, Unified Technology Learning Platform (UTLP).

I. INTRODUCTION

If a system is developed for automation of pump for filling the container, no operator is required for supervising the system. Automatic water level controllers are already available in the market. But these controllers are not suitable for this application, as the electrodes are having direct contact with the content. As it is petrochemical based liquid, direct contact with electrodes is not acceptable. The construction and working of a liquid/water level indicator. Such an indicator is used in tanks to indicate the level of liquids and alert us when the tank is full. So by this circuit we can monitor the various levels of the tank and can avoid spillage of water and also we can configure our supplies according to the various levels of tank. Such module or circuit can be installed in big buildings where manual monitor of tanks is difficult and its indicator can be placed at some centralised place.

The sensors are fixed at specified locations on the container. A floating magnet floats on the liquid and triggers the magnetic sensors one-by-one based on the liquid level. Microcontroller monitors the liquid level and the level displayed on LCD. If the maximum level is reached, the microcontroller switches off the motor. If the liquid reaches the lower level, the controller drives the driver circuit and switches on the motor. A thermistor is used as temperature sensor.

This paper is specially designed for spinning / cotton process Industries. Direct contact of level probes with the content liquid is completely avoided in this paper. Magnetic sensors, Reed switches are used as level sensors. Thermistor is used as temperature sensor. The level of the content and its temperature is monitored by the microcontroller and displayed on LCD.

K.S.S. Prasad [1] proposed a system in that provides uniform and required level of water for the agricultural farm and it avoids water wastage. These paper have real time sensing and control of an irrigation system. When the condition of water in the agricultural farm is abnormal then the system automatically switches ON the motor. When the water level reaches normal level the motor automatically switch OFF. Also interfacing microcontroller through

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temperature sensor, humidity sensor and also interfacing to GSM through MAX 232. In this we set specified values of temperature, humidity and the conditioned is uniformly monitored by VB.NET.

Muhd Asran Bin Abdullah [2] described that Water level in tank control using level sensor and PID controller system is an implementation of PID controller application into designing an intelligent and automatic level control of water/liquids/solids. While people especially in engineering fields have difficulties to measure and control the desired level in smooth transitions, this system provides the features which allow people to control and maintain water level in tanks as accurately and as steady with smooth transition process. This system is able to continuously maintain and doing necessary processes non-stop day and night.

Osueke, G.O. Nnanna, I. and Ononogbo, R.C [3] described that the design of the fuel tank measuring system using a computer interface. The level sensor is Capacitance-based and was used to measure through variations in dielectric constant despite the varying fuel viscosity or tank conditions. Equipped it with a digital indicator to display process values and powering of the sensor with a 12volts battery. Capacitance level sensors are rugged and easy to use without any moving parts. They were used in constricted places due to its compact size. At the end of the design and fabrication, the project was confirmed to be effective for use in any underground storage fuel tank.

Ayob Johari, Mohd Helmy Abd Wahab [4] presents that the development of water level monitoring system with an integration of GSM module to alert the person-in-charge through Short Message Service (SMS). The water level is monitored and its data sent through SMS to the intended technician mobile's phone upon reaching the critical level. It is used to reduce the risk of unexpected shortage of water supply.

Usama Abdullah, Ayesha Ali [5] described that GSM based water level and temperature monitoring system (WLTMS). To detect the water level of the tank which is connected to the industry. Also monitor the temperature of the tank. By using LM35 sensor which defines the parameters of the temperature sensor. Analogue output of LM35 is amplified through a process of signal conditioning, where OP-741 is used to amplify the signal. Amplified signal is fed into an ADC for the sake of digital data. This digital data is transferred to an LCD for displaying result. PIC microcontroller is used for this procedure. Modem is also connected to this controller for the wireless communication of the data through GSM technology by receiving an alert through SMS.

S.M. Khaled Reza, Shah Ahsanuzzaman Md. [6] described that the notion of water level monitoring and management within the context of electrical conductivity of the water. This management of water level approach would help in reducing the home power consumption and as well as water overflow. It can be used to indicate the amount of water in the tank that can support Global Water types including cellular data loggers, satellite data transmission systems for remote water monitoring system. The cellular phones with relative high computation power and high quality graphical user interface became available recently. The web and cellular based monitoring service protocol would determine and sense water level globally.

J.Ramoji Guptha G.S.R Satyanarayana and P.S ambaiah [7] presents that in industrial application can be developed around such microcontroller like ARM (advanced RISC machine) to optimize the system performance. This paper includes description about the real time application using ARM Cortex M3 and GUI. Most of the industrial application results are in digital values only. By using GUI we can view the values graphically like bar charts.

Neena Mani, Sudheesh T.P [8] Presents that a programmed microcontroller is the basic component for the water level indicator. ATmega 32A microcontroller helps to indicate the level of water or any other conducting liquid. With the help of an lcd display we can see all the level of the water contained in a tank or in any other vessels. A liquid level sensor (transistor circuit) detects the present level of the liquid in the tank in terms of the voltage across transistor and feeds it to the microcontroller and the microcontroller generates corresponding output text which is then displayed in the LCD. If the water level is full, then the circuit beeps through the buzzer notifying that the water level is full.

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II. BLOCK DIAGRAM

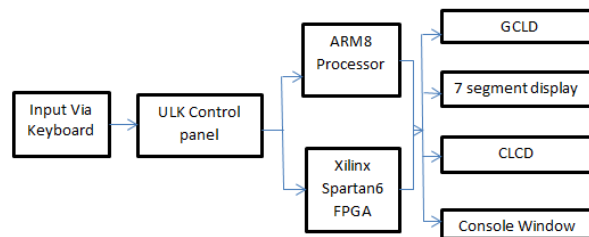


Fig.1. Block diagram of petrochemical indicator and controller

A. Description

The block diagram of interface system is shown in figure 1. The program is coded and compiled using eclipse software. After compilation, the ULK control panel is interfaced to the UTLP kit. The code is loaded in control panel to run the system. It is processed by using two devices. They are ARM 8 processor and Xilinx spartan6 FPGA. According to the given input, the output is displayed in console window, Character Liquid Crystal Display, Graphical Liquid Crystal Display and via audio output.

B. Eclipse

Eclipse is multi-language software which is developed by development environment tool including an integrated development environment (IDE) and an extensible plug-in-system. It is written mostly in Java. It can be used to develop the applications in Java program and, by means of various plug-in systems, other programming languages including Ada, C, C++, COBOL, FORTRAN, Haskell, Perl, PHP, Python etc. Eclipse IDE tool is a tool which is used for developing applications based on C language for UTLP.

C. ULK control panel

The ULK (Unified Learning Kit) control panel is an application program and it is developed using ubuntu development personal computer which facilitates the communication between the Ubuntu Host personal computer and the Unified Technology Learning Platform (UTLP). It also enables downloading and executing the UTLP program in usual mode. Fig 2, shows the host and client interface.

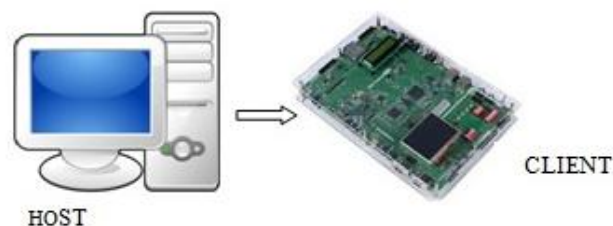


Fig.2. Host and Client Interface

D. ARM 8 processor

The ULK (Unified Learning Kit) is based on Texas Instruments ARM 8 application processor and Spartan-6 FPGA. The Texas Instrument ARM 8 processor is a high performance processor which is based on ARM architecture. It is used to support high-speed devices and number of thread processing application. The ARM 8 processor supports TI OMAP 3530 SOC, ARM Cortex A8 600MHz CPU, DM64X+ 430MHz DSP, Xilinx Spartan-6 LX25T FPGA, 128MB CPU RAM –mDDR, 64MB FPGA RAM-DDR2, 128MB NAND FLASH, PowerVRSGX Graphics, Video OUT-VGA, LCD-local/external, AV Support, TV Out, Video IN-Camera, Audio in, audio out, stereo out, Boot Loader, Xloader, Uboot, Operating Systems, LinuxX11(Graphics), Eclipse IDE & XILINX ISE Web Pack, Peripherals 3.5" TFT LCD with Touch screen, Seven Segments LED, Dual line character LCD, ADC, DAC & Flexible IOs, External-Bluetooth, Wi-Fi, GPS*, DIP switches, Onboard RTC, Connectivity UART, I2C, McSPI, McBSP, USB 2.0 OTG, Ethernet (10/100Mbps), JTAG support for CPU and FPGA, API Support for debug & ULK Control panel.

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Spartan-6 FPGA

Spartan 6 FPGA has 2 mega-byte of SPI PROM from Atmel. Then, it has 10 bit ADC with parallel interface and 12 bit DAC with parallel interface. It contains JTAG interface, 7-segment LED's, 20 pin header and 70 pin I/O expansion connector, DIP switches and Status LED's.

E. UTLP- Interfaces

UTLP has different devices and interfaces which can be accessed both in the normal mode and in the lab mode. ULK by default comes with 3.5 inch Graphics LCD with touch interface. ULK has the option to connect external bigger LCD's through Photo Frame add on board. ULK supports 7" Graphics LCD + Touch panel for photo frame or HMI applications. Images stored in SD Card / USB Memory stick can be displayed in external 7" Graphics LCD. This can also be used as an alternative to on-board 3.5" LCD display. GSM/ GPRS Add-On Board consist of a GSM module and a SIM slot. One can access the GSM network and also get connectivity through GPRS. Since GSM/ GPRS Add-On Board gives access wide GSM/GPRS network, several innovative projects can be implemented. The projects may include applications involving webserver, internet connectivity, transfer of messages, commands over GSM network etc. Bluetooth Interface Board consists of a Bluetooth module and required interfaces to connect with ULK.

API stands for Application Programming Interface. APIs are the functions provided by interface libraries. By using these library calls in the programs for an interface functionally. At the linking time, the API library binaries to make an executable program. In the UTLP normal mode, there are interface libraries provided for different devices and functionality.

Reads a string from the control panel input window-

Void ulk_scanf_string(char*user_string)

Outputs a string on the serial port-

Uin8 ulk_printf(const char*fmt...)

Prints a string in the control panel output window-

void ulk_cpanel_printf(const char*fmt...)

Reads a hex value from the control panel input window-

void ulk_scanf_hex(unsigned long*hex_variable)

F. Character LCD

A 16x2 LCD shows to display 16 characters per line and has 2 lines. Each character is displayed in 5x7 pixel matrix. Character LCD interface is shown as Fig.3. The 16x2 character LCD is connected through the I2C interface.

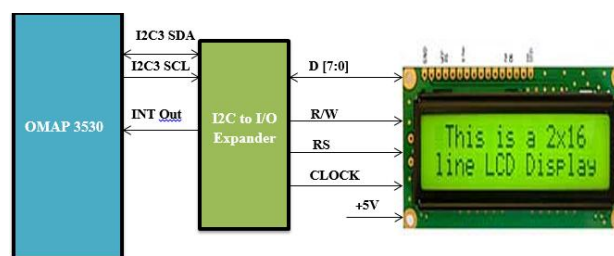


Fig.3. Character LCD

G. 7 SEGMENT LED DISPLAY

The Seven segment LED is used to display the characters. The 7 Segment LED have many applications such as digital clocks, electronic meters, basic calculators and other electronic devices that display numerical information etc., Fig.4. Shows the 7 Segment LED display.

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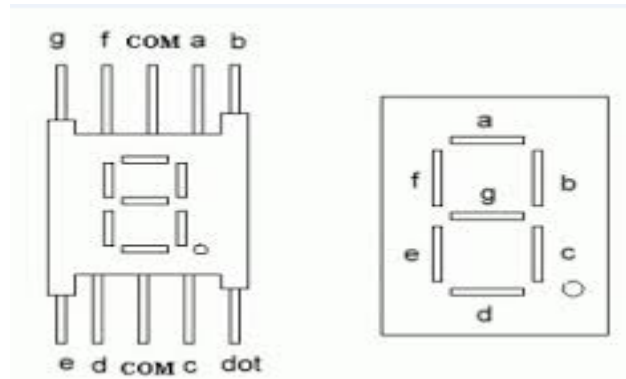


Fig.4. 7 Segment Display

H. Touch panel

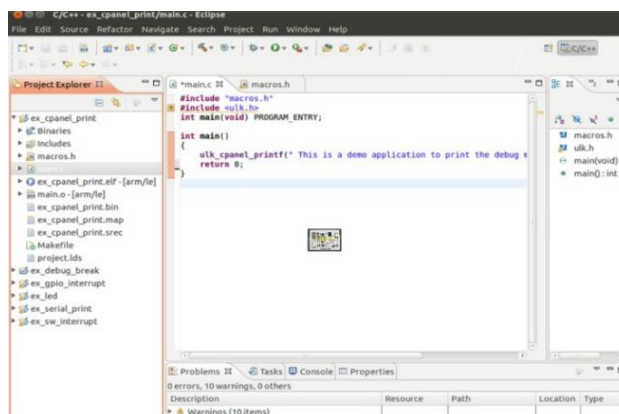
The touch screen analog signals from the external LCD will be interfaced with touch screen controller through 4 pin 2.54mm pitch header. The touch screen analog signals from the 3.5inch LCD will be interfaced with touch screen controller through the 54pin LCD connector itself. The 4-wire, 12bit resolution, low voltage touch screen controller TSC2046IPWR from TI is used.

I. Implementation

The ARM-8 Cortex processor, based on the ARMv7 architecture, has the ability to scale in speed from 600MHz to greater than 1GHz. The Cortex-A8 processor can meet the requirements for power-optimized mobile devices needing operation in less than 300mW. The program has been implemented in Unified Technology Learning Platform kit display. An output can be displayed on CLCD and GLCD with the help of Application Programming Interface (API) which is coded using Eclipse software.

III. EXPERIMENTAL RESULTS

The program written in Embedded C was executed using the Eclipse software. C application program window is shown in the figure 6a. After successful execution, it is interfaced with the UTLP kit through ULK control panel. Fig.6b shows the execution window of the ULK panel where the program was interfaced with the kit. ULK load and execution operation was done in the ULK panel, it was shown in the fig.6c. The output was displayed in the console window shown in the fig.6d, as well as in the Character Liquid Crystal Display (CLCD) as Petrochemical indication and controller system as shown in fig.6e. As fig.6e, depicts the 7 segment display for range of chemical present in the tank.

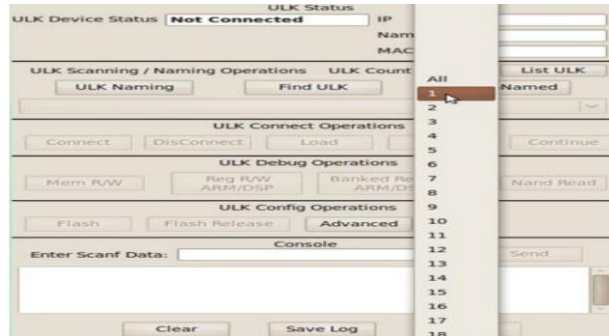


(a)

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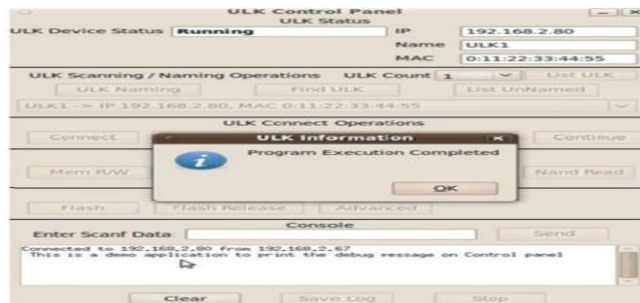
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(b)



(c)



(d)



(e)

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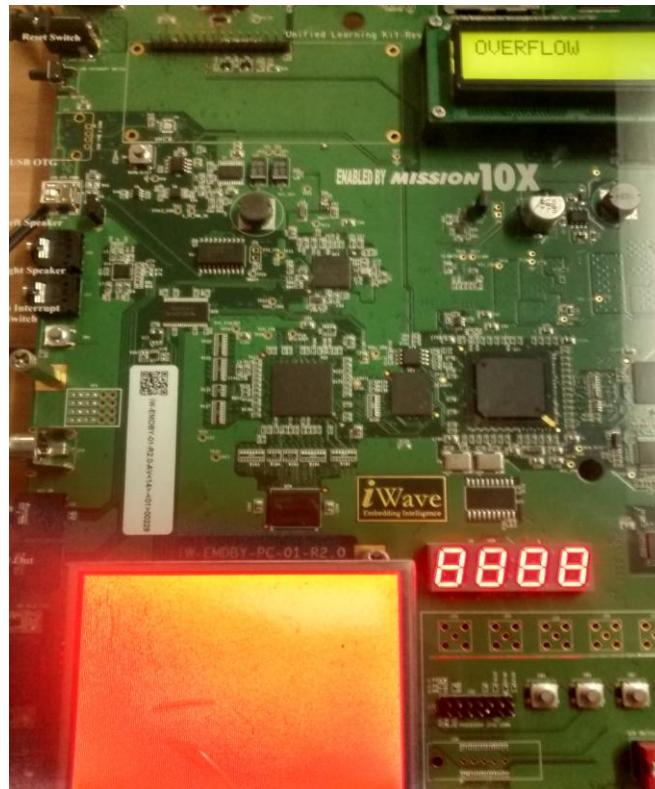


Fig.6. (a) Eclipse Software program window, (b) ULK Control panel, (c) ULK Load operation, (d) Character LCD Output, (e) Unified Technology Learning Platform (UTLP) kit

IV. CONCLUSION

This paper improves the indication and control of petrochemical in Cotton process industries, Spinning mills and petrochemical industries with the available resources. The parameter considered for monitoring the petrochemical level as temperature. This has been synthesized using eclipse and it is implemented in Unified Technology Learning Platform (UTLP) kit.

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REFERENCES

- [1].K.S.S. Prasad, Nitesh Kumar, Nitish Kumar Sinha and Palash Kumar Saha "Water-Saving Irrigation System Based on Automatic Control by Using GSM Technology Middle-East Journal of Scientific Research ISSN 1990-9233,vol 12, no 12, pp 1824-1827,2012.
- [2]. Muhd asran bin, Abdullah,"water level in tank using level sensor and pid controller "universiti malaysia pahang November 2008.
- [3]. Osueke, g. O. Nnanna, i. And ononogbo, r .c "Design and production of a fuel tank measuring system using computer interface "an international journal of advanced computer technology, 2 (9), 2013 .
- [4]. Ayob Johari, Mohd Helmy Abd Wahab, Nur Suryani Abdul Latif, M. Erdi Ayob, M. Izwan Ayob, M. Afif Ayob, Mohd Norzali Haji Mohd "Tank Water Level Monitoring System using GSM Network", (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 2 (3) , pp 1114-1120,2011.
- [5].Usama Abdullah, Ayesha Ali, "GSM Based Water level and Temperature Monitoring System International Journal of Recent Development in Engineering and Technology" ISSN 2347-6435Volume 3, Issue 2, August 2014.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 6, May 2015

- [6]. S. M. Khaled Reza, Microcontroller Based Automated Water Level Sensing and Controlling: Design and Implementation Issue Proceedings of the World Congress on Engineering and Computer Science Vol I, 2010.
- [7] J. Ramoji Gupta¹, G.S.R Satyanarayana and P.Sambaiah² " *Gui Based Liquid Indicator Using Cortex M3 For Industry Monitoring System*" International Journal of Application or Innovation in Engineering & Management (IAIEM) ISSN 2319 – 4847, vol 2, no 6, 2013.
- [8]. Neena Mani¹, Sudheesh T.P², Design and Implementation of a Fully Automated Water Level Indicator International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering ISSN 2320 – 3765, 2013.