International Journal of Science Engineering and Advance Technology

Kernel based Design on Industrial Automation

Dileep Kumar Dake[1], V.L.Prasanna Dhulipudi[2]
M.Tech Scholar, Asst.Prof in Dept of ECE, Kakinada Institute of Engineering & Technology-II,
dileepkumar494@yahoo.com[1],,prasannadhulipudi14@gmail.com[2]

Abstract: In this paper presented an Industrial based automation with real-time approach by using kernel objects. ARM7 processor chip was used for real-time scheduling purpose. In this an embedded resistance-temperature characteristic measurement system for automotive temperature sensor is designed, which uses ARM7 chip as kernel and preemptive real-time embedded operating system µC/OS-Ⅱ as software platform. The system has the capability of multi-tasking, real-time scheduling and completely meets the need of real time and reliability. Irrevocably it was highly efficient, accurate and reliable automatic measurement system. It was composed with Wireless-Sensor-Network based industry appliances monitoring system for efficient behavior in functionality assessment through various sensing units.

***Keywords*- ARM7, RTOS, WSN.**

I. Introduction

A thermistor is a type of resistor whose resistance varies significantly with temperature, more so than in standard resistors. Thermistors are widely used as inrush current limiter, temperature sensors (NTC type typically), self-resetting overcurrent protectors, and self-regulating heating elements. Thermistors differ from resistance temperature detectors (RTDs) in that the material used in a thermistor is generally a ceramic or polymer, while RTDs use pure metals. The temperature response is also different; RTDs are useful over larger temperature ranges, while thermistors typically achieve a higher precision within a limited temperature range, typically −90 °C to 130 °C.

ARM7 generation introduced the Thumb 16-bit instruction set providing improved code density compared to previous designs. The most widely used ARM7 designs implement the ARMv4T architecture. All these designs use Von Neumann architecture. It is a versatile processor designed for mobile devices and other low power electronics. This processor architecture is capable of up to 130 MIPS on a typical 0.13 µm process.

II. Modules

Ultrasonic Sensor: Ultrasonic transducers are transducers that convert ultrasound waves to electrical signals or vice versa. Those that both transmit and receive may also be called ultrasound transceivers; many ultrasound sensors besides being sensors are indeed transceivers because they can both sense and transmit. These devices work on a principle similar to that of transducers used in radar and sonar systems, which evaluate attributes of a target by interpreting the echoes from radio or sound waves, respectively.

Fig. 1 Ultrasonic Sensor

Active ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions, convert it to an electrical signal, and report it to a computer.

Relay Circuit: The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Hence a CB amplifier is used to achieve the current rating of the relay.

Transistors and ICs must be protected from the brief high voltage produced when a relay coil is switched off. The diagram shows how a signal diode (e.g. 1N4148) is connected 'backwards' across the relay coil to provide this protection. Current flowing through a relay coil creates a magnetic field which collapses suddenly when the current is switched off.

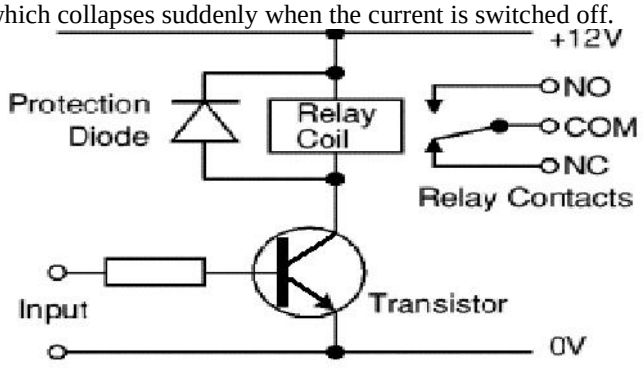

Fig. 2 Relay Circuit

The sudden collapse of the magnetic field induces a brief high voltage across the relay coil which is very likely to damage transistors and ICs. The protection diode allows the induced voltage to drive a brief current through the coil (and diode) so the magnetic field dies away quickly rather than instantly. This prevents the induced voltage becoming high enough to cause damage to transistors and ICs.

GLCD: The goal of this project is select a low-cost graphical LCD and design a driver that would allow such experiments and demonstrations to be designed around it. In most of the

ISSN 2321-6905

experiments used a 16x2 Crystal font Alphanumeric LCD is used as the major user output and represents the user interface. Alphanumeric LCDs display characters in pre-designated blocks and the LCD screen and this limits their use to simple number and character displays and crude images drawn from numbers or characters (a bouncing ball using the character 'o' or other such graphical techniques using text). While this is suitable for many applications, there are some which would benefit greatly from an easy to use graphical LCD. Most graphical LCDs are not supported by standard C libraries as are simple alphanumeric displays so it becomes much more time consuming to use them in projects. This can be especially prohibitive during regular laboratory experiments because they are often designed to prove a specific instructive idea, and generating a driver for a graphical LCD cannot be done during the allotted time. This paper and project outline the design of a graphical LCD driver for the Crystal font CFAG12864B series (128 x 64 pixel) graphical display which can be easily modified to drive any Samsung KS0108 based graphical LCD.

LDR Sensor: A photoresistor or light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity. A photoresistor is made of a high resistance semiconductor.

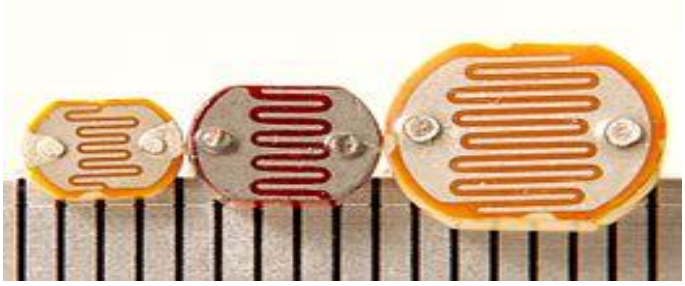

Fig. 3 LDR Sensor

In the dark, a photoresistor can have a resistance as high as a few megohms (MΩ), while in the light, a photoresistor can have a resistance as low as a few hundred ohms. If incident light on a photoresistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons conduct electricity, thereby lowering resistance.

Humidity Sensor: Humidity is the presence of water in air. The amount of water vapor in air can affect human comfort as well as many manufacturing processes in industries. The presence of water vapor also influences various physical, chemical, and biological processes.

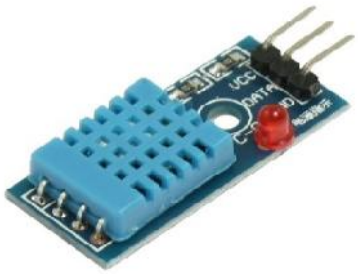

Fig. 4 Humidity Sensor

Humidity measurement in industries is critical because it may affect the business cost of the product and the health and safety of the personnel. Hence, humidity sensing is very important, especially in the control systems for industrial processes and human comfort.

GSM: GSM (Global System for Mobile Communications, originally Groupe Spécial Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second-generation (2G) digital cellular networks used by mobile phones.

Fig. 5 GSM Module

GSM was designed with a moderate level of service security. The system was designed to authenticate the subscriber using a pre-shared key and challenge-response. Communications between the subscriber and the base station can be encrypted. The development of UMTS introduces an optional Universal Subscriber Identity Module (USIM), that uses a longer authentication key to give greater security, as well as mutually authenticating the network and the user, whereas GSM only authenticates the user to the network (and not vice versa). The security model therefore offers confidentiality and authentication, but limited authorization capabilities, and no non-repudiation.

GPIO: General-purpose input/output (GPIO) is a generic pin on an integrated circuit whose behavior, including whether it is an input or output pin, can be controlled by the user at run time. GPIO pins have no special purpose defined, and go unused by default. The idea is that sometimes the system integrator building a full system that uses the chip might find it useful to have a handful of additional digital control lines, and having these available from the chip can avoid the effort of having to arrange additional circuitry to provide them.

UART: A UART is usually an individual (or part of an) integrated circuit used for serial communications over a computer or peripheral device serial port. UARTs are now commonly included in microcontrollers. A dual UART, or DUART, combines two UARTs into a single chip.

The universal asynchronous receiver/transmitter (UART) takes bytes of data and transmits the individual bits in a sequential fashion. At the destination, a second UART re-assembles the bits into complete bytes. Each UART contains a shift register, which is the fundamental method of conversion between serial and parallel forms. Serial transmission of digital information (bits) through a single wire or other medium is less costly than parallel transmission through multiple wires.

ISSN 2321-6905

ADC: An analog-to-digital converter (ADC, A/D, or A to D) is a device that converts a continuous physical quantity (usually voltage) to a digital number that represents the quantity's amplitude.

The conversion involves quantization of the input, so it necessarily introduces a small amount of error. Instead of doing a single conversion, an ADC often performs the conversions ("samples" the input) periodically. The result is a sequence of digital values that have been converted from a continuous-time and continuous-amplitude analog signal to a discrete-time and discrete-amplitude digital signal.

III. Designing of Industrial Automation

The hardware for the rangefinder can be broken down into three functional units, the transmitting circuit, the receiving circuit and the MCU circuit. The receiver and transmitter circuits can work independently of the MCU, which made testing with a signal generator quite useful.

This allowed one of us to work on the hardware while the other worked on the software independently and not require one to be dependent on the other for testing.

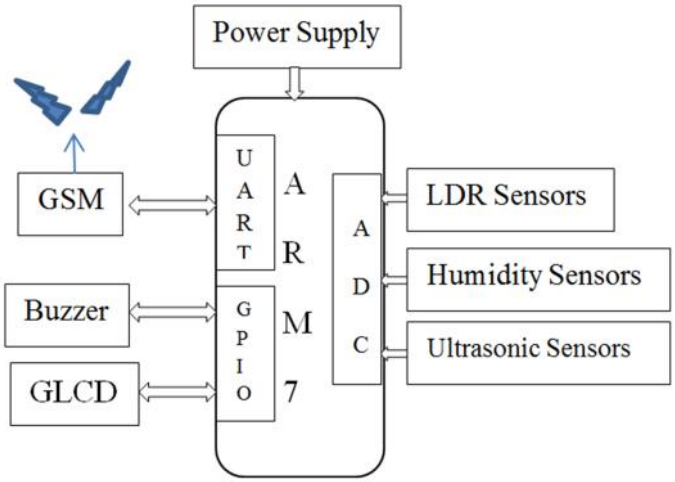

Fig. 6 Block Diagram Automation System

In the transmitter session, we can sense the Light in dark and high level through the LDR Sensor. The Humidity sensor sense the amount of water vapor in air can affect human comfort as well as many manufacturing processes in industries. Through the Active Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object.

At the heart of the receiver circuit is one of the ultrasonic transducers. The transducer converts an incoming sound wave and converts it into a voltage signal. This signal needs to be cleaned of noise, amplified, and turned into a TTL-type signal for the MCU. The signal from the transducer is fed through a capacitor to filter out noise and then through a voltage divider to center the signal at 2.5 volts. From here, the signal needs to be amplified to guarantee true TTL levels. Initially, this was attempted using an LM358 op-amp. However, the LM358 could not switch fast enough and was unable to create a clean square wave. We tried using a 74HC04 high speed CMOS inverter as a high gain linear amplifier. Initially, we used resistor values of 1 M? and 100 k? to achieve a gain of 10. This created voltage levels well beyond +5 volts and resulted in a clipped signal at the output. This, however, is actually desired because the output now represented a more of a square wave than a sine wave. The output of the inverter was then fed into a (CD4069) Schmitt trigger to convert it into a true TTL square wave. The input of the Schmitt trigger was connected to ground using a 22 pF capacitor to clean the signal from noise. The output of the Schmitt trigger can now be fed into the MCU as the received pulse.

During testing, however, we noticed that this did not quite create a nice clean square wave and was influenced greatly by noise. To combat this, we changed the gain of the inverter amplifier by replacing the 100 k? resistor with a 10 k? resistor for a gain of 100. We then fed the signal through three cascaded Schmitt triggers to clean up the signal much more than previously. There is a single 22 pF capacitor on the input of the last Schmitt trigger to ground.

Here the Buzzer sound was enabled for the significance of alarm to alert the workers in the Industry. All the sensing related things are clearly displayed through the GLCD and through the GSM via SMS. In the Real-time scheduling all are perfectly scheduled by the ARM7 Processor.

Conclusion

ARM7 Processor has managed with the RTOS and the allocation of Wireless Sensor Network based industry monitoring system for elderly activity behavior involves functional assessment of daily activities. We reported a mechanism of sensing related things are clearly displayed through the GLCD and through the GSM via SMS for regular and live monitoring.

References

[1] WirelessHART standard, HART Communication Foundation. www.hartcomm.org

[2] ISA100 standard, International Society of Automation. www.isa.org/isa100

[3] WIA-PA standard, Chinese Industrial Wireless Alliance. www.industrialwireless.cn/en/

[4] Akerberg, J.; Gidlund, M.; Bjorkman, M. Future research challenges in wireless sensor and actuator networks targeting industrial automation. *IEEE Int. Con. on Industrial Informatics (INDIN), 2011*, 410-415.

[5] Xiuming Zhu; Song Han; Mok, A.; Deji Chen; Nixon, M.. Hardware challenges and their resolution in advancing WirelessHART. *IEEE Int. Con. on Industrial Informatics (INDIN), 2011*, 416-421.

[6] Edmonds, N.; Stark, D.; Davis, J. "MASS: modular architecture for sensor systems". *Int. Sym. Information Processing in Sensor Networks (IPSN)*, 2005. 393-397.

[7] Utz Roedig, Sarah Rutlidge, James Brown, Andrew Scott, "Towards Multiprocessor Sensor Nodes". *ACM Workshop on Hot Topics in Embedded Networked Sensors (HotEmNets '10)*, 2010.

[8] Chen, Deji, Nixon, Mark, Mok, Aloysius, *WirelessHART™: Real-Time Operating Systems.*