ARM Based RTOS Multitasking and Time Scheduling for Industrial Safety System

MD KHAJAMOINUDDIN
PG Scholar,
VBIT , College

MrMansoor M.TECH
Asst. Professor,
VBIT

Dr.B. Brahma Reddy[3],M.tech,Ph.d
Head of the department
VBIT Engg.college

Abstract- **RTOS is an operating system which is used to perform a task with in a particular time interval ie, with in the specific allocated time. It is a real time operating system. A real-time OS that can usually or generally meet a deadline is a soft real-time OS, but if it can meet a deadline deterministically it is a hard real-time OS. Compared with OS and RTOS, RTOS only supports the multitasking operations and time scheduling tasks. Real-time OS is the level of its consistency concerning the amount of time it takes to accept and complete an application's task. If we are implementing any task without RTOS, it is less accuracy and time delay of the specified time and normally it can possible to perform only one task at a time. So in normal operations systems perform a task one by one. So we are implementing our project using real time operating system**.

The multitasking is a process to perform a more than one application or task at concurrently, it means possible to perform a so many operations at the same time. in the normal operating systems are not supported this type of multitasking. so in this project we are implementing RTOS concepts. a The main advantage of RTOS is multitasking and time scheduling and rescheduling etc. In RTOS due to the internal minimum time delay of the time scheduling process it will give the output within the specified time.

Keywords- ARM, LCD display, LED, Motors, Sensors, Keypad, Seven Segment, Interrupt, Glcd ,

I .INTRODUCTION

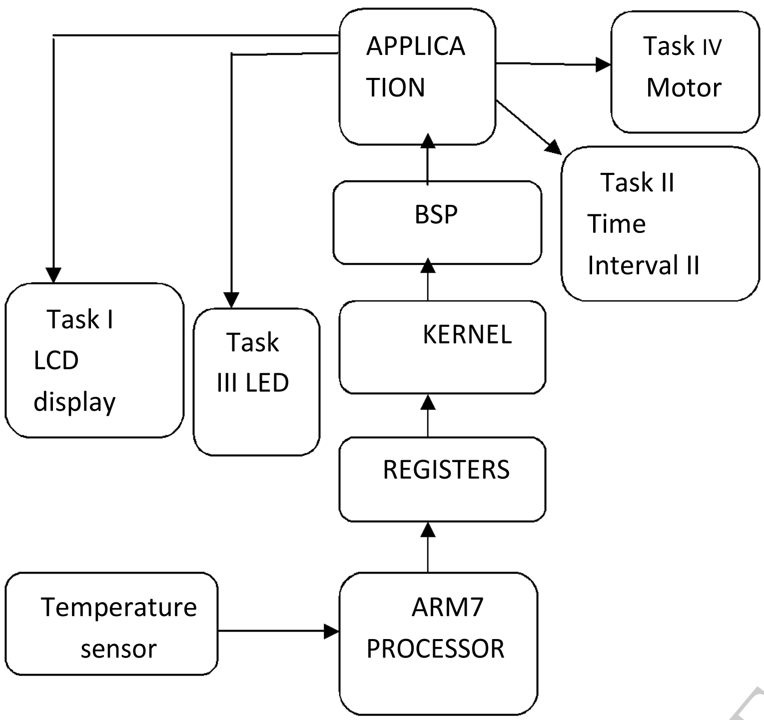
The main advantage of RTOS is multitasking and time scheduling and rescheduling etc. In RTOS due to the internal minimum time delay of the time scheduling process it will give the output within the specified time.

However, due to the lack of uniform programming model and system components for these different teams, the migrations costs of a function model from software to hardware are high. But these actions are necessary in the hardware-software partitioning of embedded systems, especially in the prototype designs. To cope with this problem, we adopt a uniform multi-task model and implement UCOS II RTOS (Real- Time Operating System).

The advantage of RTOS multitasking and time scheduling is get better accuracy and with high operating speed and processing time is less. In this project the devices will processed by multitasking. using this RTOS architecture ARM processor give the signals to all devices, it will operated my multitasking and time scheduling. So we get the output for all devices with in the specified time interval.

BLOCK DIAGRAM :

RTOS STRUCTURE

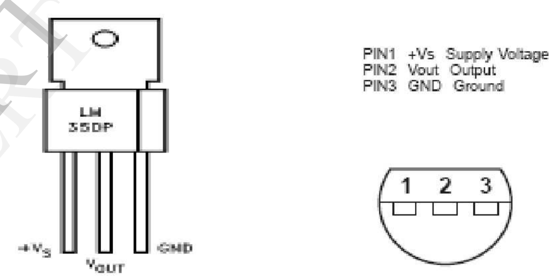


II. Temperature Sensors

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.

Features

- 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 ±1⁄4°C typical
- Low impedance output, 0.1 Ω for 1 mA load



III. LCD MODULE

Dot matrix LCD modules is used for display the parameters and fault condition.16 characters 2 lines display is used. It has controller which interface data's and LCD panel. Liquid crystal displays (LCD's) have materials, which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal. An LCD consists of two glass panels, with the liquid crystal material sandwiched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal molecules to maintain a defined orientation angle.

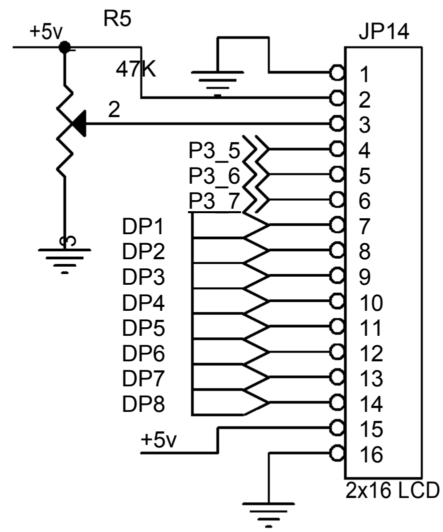
One each polarizer's are pasted outside the two glass panels. These polarizer's would rotate the light rays passing through them to a definite angle, in a particular direction When the LCD is in the off state, light rays are rotated by the two polarizes and the liquid crystal, such that the light rays come out of the LCD without any orientation, and hence the LCD appears transparent.

When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned on a specific direction. The light rays passing through the LCD would be rotated by the polarizes, which would result in activating/highlighting the desired characters.

Figure 7 – LCD Diagram

The LCD's are lightweight with only a few millimeters thickness. since the LCD's consume less power, they are compatible with low power electronic circuits, and can be powered for long durations .The LCD's don't generate light is needed to read the display. By using backlighting, reading is possible in the dark .The LCD's have long life and a wide operating temperature range.

One of the most popular output devices for embedded electronics is LCD. The LCD interface has become very simple. This is due to the availability modules for LCDs. The LCD along with necessary controller (LCD Controller) and mounting facility is made available in the module itself. The LCD controller takes care of everything necessary for the LCD. We communicate with the LCD controller with the help of a command set provided by the manufacturer.



This circuit consists of a Microcontroller and a LCD. This LCD is operating with an 8-bit data bus. So totally 11 data lines are required (8 Data lines and 3 control lines). The 8 bit data lines are connected to the Port1 and the 3 control lines to the Port3.5-Port3.7. The EN line is called "Enable." This control line indicates to the LCD that we are sending it data. To send data to the LCD, the EN should be low (0) and then set the other two control lines and/or put data on the data bus. When the other lines are completely ready, bring EN high (1) and wait for the minimum amount of time required by the LCD datasheet (this varies from LCD to LCD), and end by bringing it low (0) again.

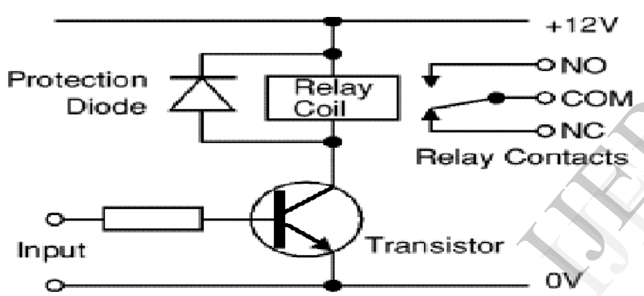
The RS line is the "Register Select" line. When RS is low (0), the data is to be treated as a command or special instruction (such as clear screen, position cursor, etc.). When RS is high (1), the data being sent is text data, which should be displayed on the screen. For example, to display the letter "T" on the screen we would set RS high.

The RW line is the "Read/Write" control line. When RW is low (0), the information on the data bus is being written to the LCD. When RW is high (1), the program is effectively querying (or reading) the LCD. Only one instruction ("Get LCD status") is a read command. All others are written commands so RW will almost always be low.

IV.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. 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.



V.LIGHT EMMITING DIODES

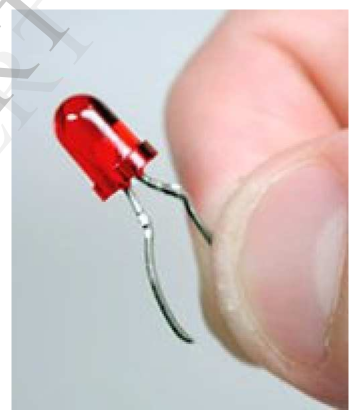
Light Emitting Diodes commonly called LEDs, are real unsung heroes in the electronics world.

A light emitting diode (LED) is a semiconductor device that emits incoherent narrow spectrum light when electrically biased in the forward direction. This effect is a form of Electro-Luminescence.

The color of the emitted light depends on the chemical composition of the semiconductor material used, and can be near-ultra violet, visible or infrared. Rubin Braun stein(born 1922),of the Radio corporation of America, was the first to report on infrared emission from GaAs (gallium Arsenide) and other semiconductor alloys in 1955.Nick Holonyak Jr.(born 1928),of the general Electric company, developed the first practical Visible spectrum LED in 1962.

They do dozens of different jobs and are found in all kinds of devices. Among other things, they form the numbers on digital clocks, transmit information from remote controls, light up watches and tell you when your appliances are turned on. Collected together, they can form images on a jumbo television screen or illuminate a traffic light.

Basically, LEDs are just tiny light bulbs that fit easily into an electrical circuit. But unlike ordinary incandescent bulbs, they don't have a filament that will burn out, and they don't get especially hot. They are illuminated solely by the movement of electrons in a semiconductor material, and they last just as long as a standard transistor.



LED TECHNOLOGY:

An LED is a special type of semiconductor diode like a normal diode; it consists of a chip of semiconductor material doped with impurities to create a structure called a p-n junction. As in other diodes, current flows easily from the p-side or anode to the n-side or cathode, but not in the reverse direction. Charge carriers –electrons and holes flow into the junction from electrodes with different voltages.

When electron meets a hole, it falls into a lower energy level, and releases energy in the form of a photon as it does so, the wavelength of the light emitted, and therefore its color, depends on the band gap energy of the materials forming the p-n junction. In silicon or Germanium diodes, the electrons and holes recombine by a non radiating transition which produces no optical emission, because these are indirect band gap materials. The materials used for an LED have a direct band gap with energies corresponding to near Infrared, visible or near ultraviolet.

LED development began with infrared and red devices made with GaAs.Advances in materials science have made possible the production of devices with ever shorter wavelengths, producing light in a variety of colors.

Conventional LED's are made from a variety of inorganic semiconductor materials, producing the following colors.

- Aluminum Gallium Arsenide (AlGaAs)-red and infrared.
- Aluminum Gallium phosphide (AlGaP)-green
- Aluminum Gallium Indium phosphide (AlGaInP)-high brightness orange-red, orange, yellow and green.
- Gallium Arsenide phosphide (GaAsP)-red, orange-red, orange and yellow.
- Gallium phosphide (GaP)-red, yellow and green.
- Gallium nitride (GaN)-green, pure green (or emerald green) and blue.
- Indium Gallium Nitride (InGaN)-near ultraviolet, bluish-green and blue.
- Silicon (Si) as substrate-blue (under development).
- Sapphire (Al203) as substrate-blue.
- Zinc selenide (ZnSe)-blue.
- Diamond(C)-ultraviolet

OPERATION PARAMETERSAND EFFICIENCY

Most typical LED's are designed to operate with no more than 30-60 mw of electrical power. Around 1999, commercial LED's capable of continuous use at one watt of input. As well, the semiconductor diodes were mounted to metal slugs to allow for heat removal from the LED diode. In 2002, 5W LED's were available with efficiencies of 18-22 Lumens per watt. It is projected that by 2005, 10watt units will be available with efficiencies of 60 Lumens per watt. These devices will produce about as common 50 watt Incandescent bulb, and will facilitate use of LED's for general illumination needs.

FEATURES

- High sensitivity
- Long reception distance
- Low voltage and low power consumption
- High protection

ADVANTAGES

- LED's are capable of emitting light of an intended color without the use of color filters that traditional lighting methods require.
- The shape of the LED package allows light to be focused. Incandescent and fluorescent sources often require an external reflector to collect and direct it in a useable manner.
- LEDs are insensitive to vibration and shocks, unlike incandescent and discharge sources.
- LEDs are built inside solid cases that protect them, making them hard to break and extremely durable.
- LEDs have an extremely long life span: typically ten years, twice as long as the best fluorescent bulbs and twenty times longer than the best incandescent bulbs.
- LEDs give off less heat than incandescent light bulbs with similar light output.

DISADVANTAGES

LEDs are currently more expensive than more conventional lighting technologies. The additional expense partially stems from the relatively low lumen output (requiring more light sources) and drive circuitry/power Supplies needed. A good measure to compare lighting technologies is lumen/dollar.

LED performance largely depends on the ambient temperature of the operating environment." Driving" an LED 'hard' in high ambient temperatures may result in overheating of the LED package, eventually to device failure. Adequate heat-sinking is required to maintain long life.

This is especially important when considering automotive/military applications where the device must operate over a large range of temperatures, with government-regulated output.

LIST OF APPLICATIONS

- LEDs are used as informative indicators in various types of embedded systems.
- Status indicators.
- Optical switch
- Thin, light weight message
- Displays at airports and railway stations and as destination displays for trains and buses.
- Red or yellow LEDs are used in indicator and alphanumeric displays in environments where night vision must be retained: aircraft cockpits, submarines and ship bridges.
- To transmit digital information.
- Remote controls for TVs, VCRs etc, using infrared LEDs.
- In optical fiber communications.
- In dot matrix arrangements for displaying messages.
- In traffic signals, LED clusters are replacing colored incandescent bulbs.
- Movement sensors, for example, in optical computer mouse.

VI.Conclusion

In this paper we proposed a resistance-temperature characteristic measurement system for automotive temperature sensor. The hardware circuit and software platform of the system are introduced in detail here. The control kernel of the hardware circuit is an ARM7 microprocessor LPC2214. The external circuit contains resistance / voltage conversion circuit and temperature /current / voltage / Thermodynamics / Celsius temperature measurement and conversion circuit. The embedded real-time operating system μC/OS-II is chosen as the software platform, which manages and schedules multiple tasks of the system. Results of practical application indicate that the proposed system has high performance, safety and reliability, and can fully meet the inspection process requirements for automotive temperature sensor. In further study, we can cut, expand and optimize the system, in order to make it more powerful.

IX.References

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