Implementation of CAN Protocol for Handling Industrial Parameters

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Abstract: Industrial computerization is the utilization of control frameworks, for example, PCs or robots, and data advancements for taking care of various procedures and apparatuses in an industry to supplant a person. The main aim of this project is to achieve the cost effective, production reliability, improved production control, and controlling emergency situation. This is Implemented using ARM-7 based Microcontroller (LPC1768), CAN protocol communication and send the message immediately during emergency through GSM.

Keywords: LPC1768, CAN Protocol, LM35, Flame Detector, GSM.

Introduction

In nowadays mechanization in industry is expanding quickly. For wellbeing reason and to decrease labour prerequisite mechanization is adjusted by businesses. Some robotization is completely programmed and some require human driver some control on mechanization to give computerization coordinating extensive number of sensor or gadgets part in industry plant. This is achieved by an interactive communication Network called CAN Protocol.CAN protocol was introduced in 1985 by Robert Bosch as a Multi-master and it was standardized in 1990 i.e., in ISO-11898 standard; mainly it was built for automotives but now it is used in fields where automation is necessary. It is a protocol which helps the devices to interact each other without a host computer.

The CAN (Controlled Area Network) has following features:

- CAN 2.0A → it is a Standard 11 bit Identifier
- CAN 2.0B → it is an Extended 29 bit Identifier

CAN 2.0A ISO -11898-2 provides high speed up to 1Mbps up to 40 Meters; whereas CAN 2.0B ISO-11898-3 provides low speed of 125 kbps up to 500 Meters. CAN is suited where data is needed from more than one location. Since CAN is message based and not address based; it is well suited in applications where a large number of short messages are required with high reliability in rugged environmental conditions.

Proposed System

We know that automation has become the most important factor for all industrial platforms. This matters the cost, machine efficiency, Space occupancy of the machine, and the labour charge. In this paper the microcontroller which has inbuilt CAN bus facility is been used; so that the space of the hardware can be reduced and the cost is reduced.

The Figure 1 and Figure 2 show the block diagram of Transmitter and the Receiver side of the proposed system respectively.

Block Diagram

Transmitter:

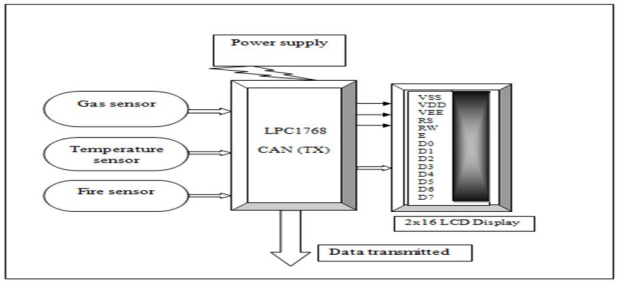

Figure 1: Transmitter Part of the System

Receiver

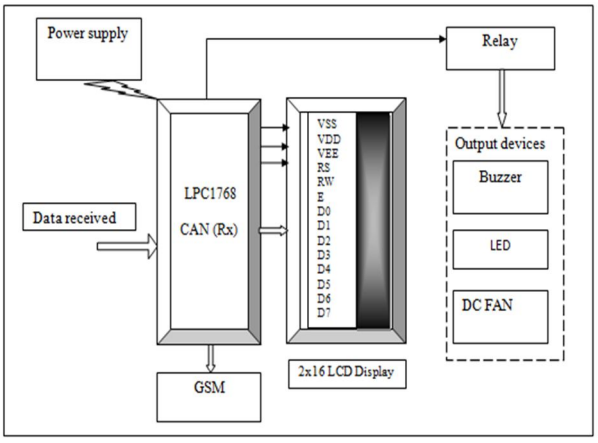

Figure 2: Receiver part of the system

LPC1768

The transmitter and receiver part consists of LPC1768 micro controller based on ARM cortex-M3; it was done for embedded applications featuring low power consumption and integration of high level, and also LPC1768 offers enhanced debug features ;

A couple highlights given by the LPC1768 are recorded beneath.

1. Work at frequencies up to 100 MHz
2. On-chip flash programming memory up to 512 KB.
3. High-speed operation with zero wait state is enabled by Enhanced flash memory accelerator.
4. Serial interfaces: USB 2.0 full speed device, four UARTs, CAN 2.0B, SPI controller, Two I^2C-bus
5. 12 bit ADC with conversion rates up to 1MHz.
6. 10 bit DAC with DMA support
7. Power on reset
8. Crystal oscillator with an operating frequency range of 1MHz to 25 MHz
9. Power management unit (PMU) adjusts automatically internal regulators to minimize power consumption during sleep, Deep sleep, Power-down, and Deep-power-down modes.
10. It has single 3.3 V Power supply
11. PORT0 includes all four external interrupt inputs configurable as edge/level sensitive.
12. PORT2 can also be used as an edge sensitive interrupt sources.

LCD Interface with LPC1768

2x16 LCD consists of 8 bit data bus named from D0 to D7. We can send the data/command in bytes as it is an 8 bit data bus. When there is limited number of GPIO lines on the microcontroller data/command can be sent in the chunks of 4-bit.

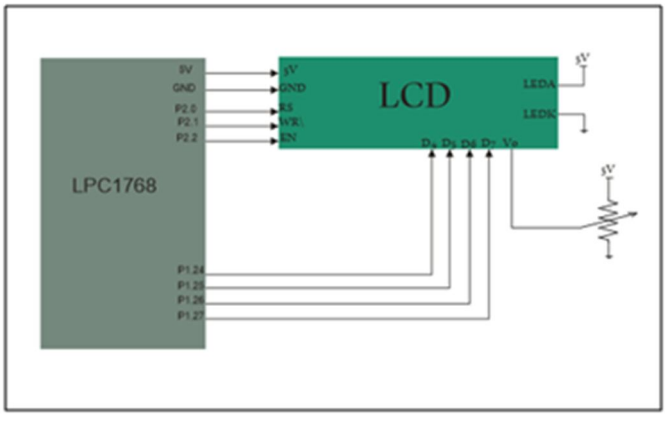

Figure 3: LCD interface with LPC1768

LCD consists of two registers namely Data register and Command register. Any data that we need to display on to the LCD should be written in to the Data register of the LCD. By writing command to the Command register of the LCD, command can be issued to the LCD. If the RS signal is LOW; the LCD interprets the 8-bit information as Command and writes it in Command register and performs the action as per the command. If the RS signal is HIGH; the LCD interprets the 8-bit information as data and copies it to data register. After this the LCD decodes the data and generates the 5x7 patterns and finally display on the LCD.

LM35 Interface

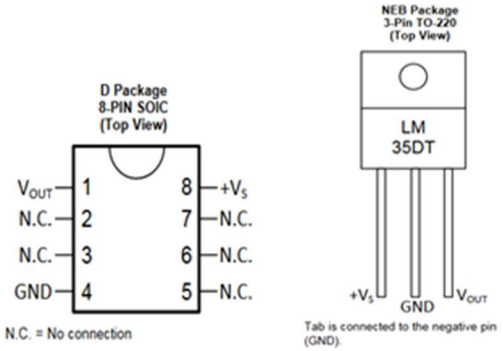

Figure 4: Pin Diagram of LM35

The Pin +Vs are associated with 3.3v power stick given in the microcontroller, and GND to the ground pin in the transmitter part. The Vout pin is connected to the ADC channel to calculate the temperature in real time i.e. in degree centigrade. When the temperature is sensed by the sensor, the sensed data is been displayed on the LCD and when there is high temperature a message is sent through GSM to mobile number, as well as the temperature is been controlled through switching the cooling fan automatically in the receiver part.

Flame Detector

A flame detector is a sensor designed to detect and respond to the presence of a flame or fire. Responses to a detected flame depend on the installation, but can include sounding an alarm and activating a fire suppression system.

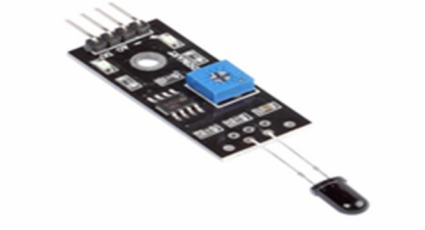

Figure 5: Flame Sensor

Highlights:

- Detection angle is about 60 degrees; it is sensitive to the flame spectrum.
- Accuracy is adjustable
- Operating voltage 3.3V-5V
- Power indicator (red) and digital switch output indicator (green)
- Flame detection distance, lighter fire test can be triggered within 0.8m, if the force of fire is high, the detection distance will be increased.

Experimental Results

The images shown below represent the experimental results obtained.

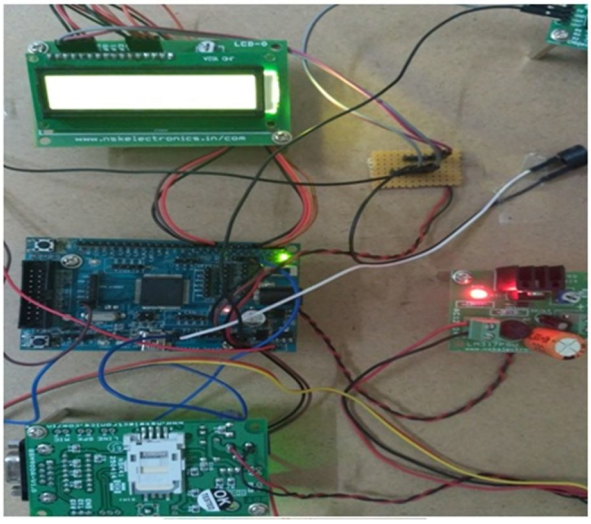

Figure 6: Transmitter part Hardware

Figure 6 shows the message displayed on the LCD when temperature in increased in the work field.

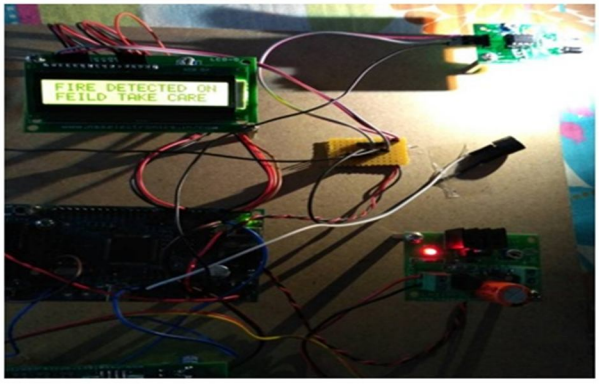

Figure 7: Fire detected and displayed on LCD

When fire is detected message is displayed in LCD, buzzer is on and message is sent through GSM to handle the situation in the field.

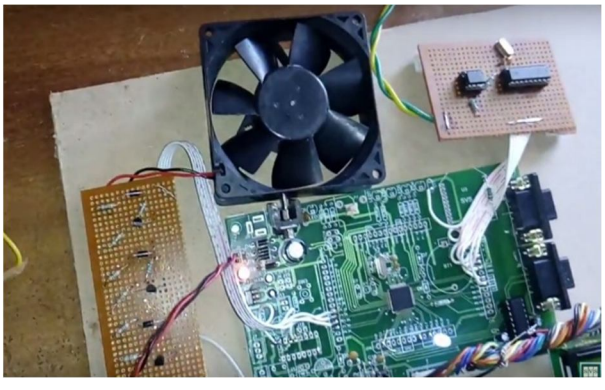

Figure 8: Receiver part Hardware

The fan automatically switches on when there is increase in temperature and message is been delivered through GSM as shown in figure 9 below

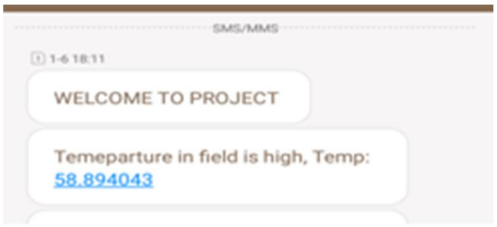

Figure 9: Alert message sent by the GSM

Reference review

Reference [1] paper analyses an architecture of control system and deals with its application using the CAN protocol. This prototype system hardware circuits mainly consist of LPC2129 32-bit Microcontroller, MCP 2551 CAN standalone Controller, MCP 2515 Transceiver. In Ref. [2] the author speaks about implementing CAN Protocol on Xenomai RTOS on ARM Platform which aims about the robust real time distributed embedded system control.

Conclusion

The proposed paper enhances the implementation of low cost system for monitoring and maintaining the industrial parameter based on device to device communication. The data information is sent effectively from transmitter to the receiver by CAN serial communication using LPC1768 Cortex-M3. The data is been displayed in LCD and alert message is sent through GSM.

Acknowledgement

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