ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Industrial Automation and Control System Using Can Protocol

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ABSTRACT:

Industrial automation and process control greatly reduces the need for human sensory and mental requirements as well. Most complex industrial automation processes and systems can be automated. A major advantage of industrial automation and process control is the increased emphasis on flexibility and convertibility in the manufacturing process. The main aim of this project is to provide more safety to industry machines by avoiding operating from over temperatures and also provide constant lighting by controlling artificial lights depends upon the ambient light intensity. This will be implemented using advanced CAN protocol and ARM7 based LPC2148 32 micro controller.

Index-terms:

ARM processor, sensors, Embedded C, CAN transceiver, Relay, Loads.

I.INTRODUCTION:

The CAN bus provides an ideal platform for interconnecting modules and allows each module to communicate with any other module. A networked system which requires fast and robust communication and where data should maintain high integrity, CAN can be used. The CAN protocol is robust and uses sophisticated error checking and handling, which allows errors and failures to occur without shutting the entire system down which is useful in the motor control node. Using CAN protocol we can send data from one node to other node. Here we are having two nodes, each node contains ARM7 based LPC2148 micro controller, MCP2515 (CAN CONTROLLER), MCP2551 (CAN TRANSRECEVER). In first node we are interfacing temperature and light sensors, in second node contains loads and lights.

Node 1 will measure the light intensity and temperature and send these values to node 2 through CAN bus. This node 2 will control the machines and lights according to the data it received. The Can protocol is implemented using SPI lines of ARM7. The NXP (founded by Philips) LPC2148 is an ARM7TDMI-S based high-performance 32-bit RISC Microcontroller, 512KB on-chip Flash ROM, 32KB RAM, Two 10bit ADCs with 14 channels, Two SPI serial interfaces Two 32-bit timers, Watchdog Timer, PWM unit, Real Time Clock with optional battery backup, Brown out detect circuit General purpose I/O pins.

II. IMPLEMENTATION OF PROJECT:

2.1 BLOCK DIAGRAM:

Transmitter:

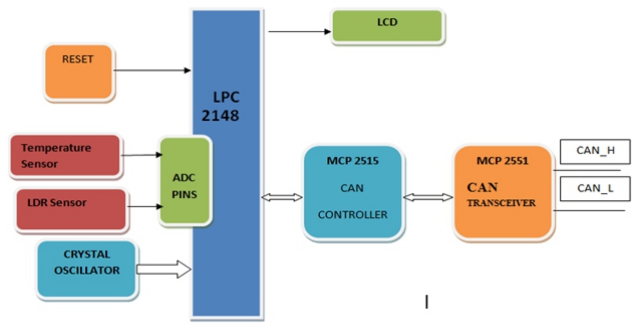

Figure-1: Transmitter of the project

Receiver:

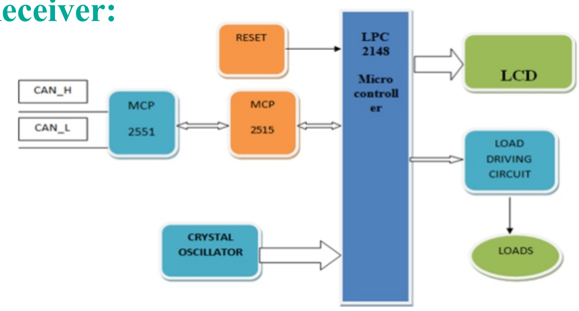

Figure-2: Receiver of the project

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2.2 ARM PROCESSOR:

The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the in¬struction set and related decode mechanism are much simpler than those of micro programmed Complex Instruc¬tion Set Computers (CISC). This simplicity results in a high instruction throughput and impressive real-time inter¬rupt response from a small and cost-effective processor core. Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory. The ARM7TDMI-S processor also employs a unique architectural strategy known as Thumb, which makes it ideally suited to high-volume ap-plications with memory restrictions, or applications where code density is an issue. The key idea behind Thumb is that of a super-reduced instruction set.

2.3 CAN TRANSCEIVER:

The MCP2551 is the interface between the Controller Area Network (CAN) protocol controller and the physical bus. It is primarily intended for high speed applications, up to 1 Mbps, in passenger cars. The device provides differential transmit capability to the bus and differential receive capability to the CAN controller. CANSPI Board is a CAN development tool for microcontrollers with SPI interface. The Board includes MCP2515 CAN controller and MCP2551 transceiver. It is capable of transmitting and receiving both standard and extended data and remote frames. The CAN controller also has two acceptance masks and six acceptance filters that are used to filter out unwanted messages, thus reducing the host MCUs overhead.

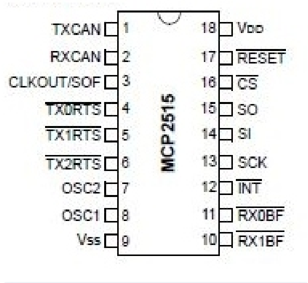

Figure-3: CAN diagram

III. SENSORS:

3.1 TEMPERATURE SENSOR:

LM35 series sensors are precision integrated-circuit temperature sensors whose output voltage is linearly proportional to the Celsius temperature. The LM35 requires no external calibration since it is internally calibrated. . 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. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to read-out or control circuitry especially easy. It can be used with single power supplies, or with plus and minus sup-plies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air.

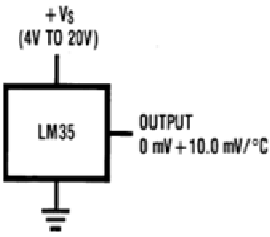

Figure-4: Temperature sensor

3.2 LIGHT DEPENDENT RESISTOR:

LDRs or Light Dependent Resistors are very useful es¬pecially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1,000,000 ohms, but when they are illuminated with light, the resistance drops dramatically. Thus in this project, LDR plays an important role in switching on the lights in the room based on the intensity of light i.e., if the intensity of light is more (during daytime) the lights will be in off condition. And if the intensity of light is less (during nights), the lights will be switched on.

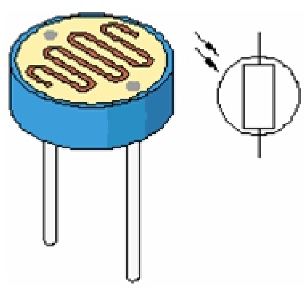

Figure-5: LDR sensor

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IV. RESULTS:

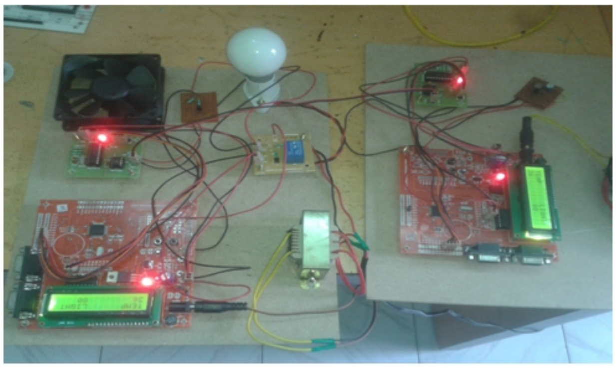

Figure-6: Hardware Implementation

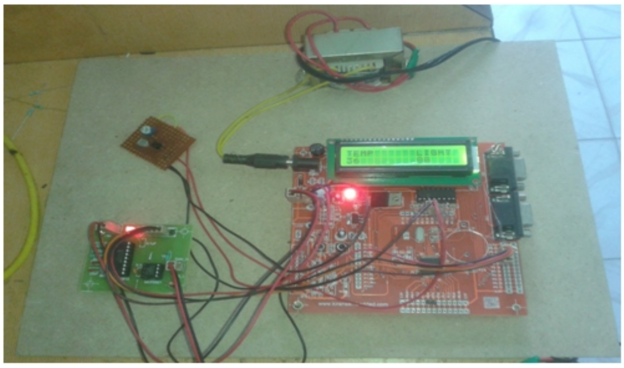

Figure-7: Hardware implementation of transmitter

V. CONCLUSION:

This paper is concerned about implementation of low cost system for monitoring parameters of an industrial based on multiprocessor communication. The monitoring parameters are temperature and light sensors. Transmission of process information sent from transmitter to receiver efficient manner by CAN serial communication protocol. Instantaneous values of process parameter are showed in LCD. Normal and abnormal conditions are viewed in the LCD. Control elements are activated and deactivated as per the program logic.

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