International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Articles available online http://www.ijoer.in; editorijoer@gmail.com

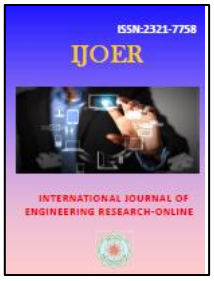
Vol.5., Issue.2, 2017
March-April

RESEARCH ARTICLE

ISSN: 2321-7758

Motor Parameter Monitoring System Using PIC Microcontroller and CAN Bus

R.VISHNU VARDHAN[1],G.PAVITHRA DEVI[2], K.AISHWARYA[3]
[1,2,3]Assistant Professor
P.A College of Engineering and Technology,Pollachi,Coimbatore,India
guganvishnu@gmail.com[1], pavithradevip4@gmail.com[2], aishwaryapacet@gmail.com[3]



ABSTRACT
The system describes how to monitor the parameters of DC motor using can protocol implementation. In industries parameters of motor can be monitored by huge man power for safety purpose single man can control entire motor by using can bus. Using this method usage wire complexity can be reduced. Controller area network CAN is a serial, asynchronous, multi master communication protocol which is mostly used in Automobiles and industrial applications. In this system motor parameter are sensed by different sensors and these parameters are transmitted to the master node and if any fault recognized slave node will automatically turn off. In wired technology, PIC microcontroller and CAN protocol are main objective. By Comparing with other wireless system CAN protocol provides a error free data transmission and data reception. So that, the system gives higher data transmission rate. This application can be achieved at a very low cost and also user friendly.
Keywords:PIC18F458, Microcontroller,CAN(Controller Area Network), Protocol, DC Motor, CAN Transceiver MCP2551, Current Sensor ACS712, LM358,Temperature Sensor LM35, LCD (Liquid Crystal Display).

I. INTRODUCTION

In the existing practice, the interconnections of systems in industries are complex and moreover the fault detection is also difficult [6] .In case of Network consisting of huge number of systems, maintenance is difficult due to congestion of wires. Remote monitoring and control requires separate wire to control each parameter thereby increasing the complexity of the network. In order to overcome all these difficulties CAN (Controller Area Network) is used [7].

The CAN bus is a two wired serial bus with multi-master capability. This means that multiple devices sitting on a single two wired bus can talk to one another. In our project, the prototype of motor monitoring system is developed. Here one motor is taken into consideration and the four parameters are monitored using CAN Bus and PIC Microcontroller[8][10]. The master node is used as an interface between the nodes and the LCD Display by which remote monitoring and controlling is possible. The data's from the slave node reach the display through the master node.

The data's from slave node such as temperature, voltage, speed, current are sent to master controlling unit. If there is any overload or some disturbance takes place, which is indicated by master node through LCD Display.

II. EXISTING TECHNIQUE

There are various systems are used for monitor and control the motor parameters. In the existing system the speed of the DC motor can be

controlled by monitoring the parameter of temperature changes in the motor using CAN protocol implementation. Here the temperature of the motor is monitored by the LM35 series which are the precision integrated circuit temperature sensors. The speed of the motor is regulated using PWM (Pulse Width Modulation) technique.

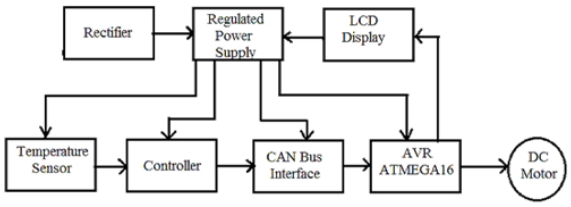


Fig 1: Block Diagram of Existing Method

III. PROPOSED TECHNIQUE

The proposed method is very useful for industrial automation. It is used for monitoring and controlling the motors without the help of host computer. Here, the PIC Microcontroller and CAN Protocol participates the major role in monitoring parameters of motor. The CAN (Controller Area Network) Protocol is used for communication between the master node and slave node. The parameters of motor such as current, temperature and voltage are sensed by ACS712 Current sensor, LM-35 and OP-AMP 358 respectively. Here, the PIC Microcontroller 18F458 is used which is an inbuilt CAN module controller.

In transmitter side, 12V supply is given to the voltage regulator and it gives the regulated voltage as 5V,It is used to run the PIC microcontroller. Pin 1 of the controller is connected to high supply voltage in order to clear the controller. Every time, when we start it will clear the microcontroller. Colpitts oscillator is used in micro controller in order to maintain the constant frequency. A 10k ohm resister is connected to pin 1 in transmitter side and it acts as a pull up resistor. 22µF is used in the controller to reduce the spikes in the transmitter side.

CAN Bus is a message-based protocol, designed specifically for automotive applications. The CAN Network is a Peer-to-Peer Network which consists of different nodes. The different parameters can be monitored by these nodes and these parameters are updated to the Central Control Unit. The values are displayed by interfacing ofLiquid Crystal Display (LCD) in master node and each slave node.

IV. PROPOSED METHOD ARCHITECTURE

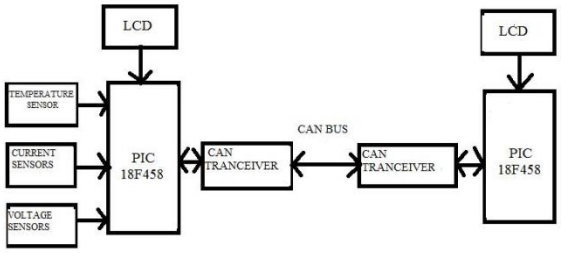


Fig 2: Proposed Method Block Diagram

The basic block diagram of the system is shown in figure 2.The following essential blocks are present in this block diagram.

A. Power Supply
B. PIC18F458 Microcontroller
C. LCD Display
D. CAN Protocol
E. DC Motor with Encoder
F. CAN Transceiver
G. Current Sensor ACS712
H. OP-AMP LM358
I. Temperature Sensor LM35

A. Power Supply:A power supply circuit supplies electric energy to the system. To obtain 5V as a output, regulator is used. The basic building block of power supply are

1) Step down transformer
2) Rectifier
3) Regulator
4) Capacitor

B.PIC18F458 Microcontroller:The PIC18F458 is a high performance RISC CPU with low power microcontroller. It is a 40 pin microcontroller which controls main function of the entire system.

Fig 3:PIC18F458 Microcontroller

Features:

- Program memory : 32 k bytes

- Data Memory: 16384 bytes
- Operating Frequency: DC- 40 MHz
- Data EEPROM Memory: 1536 bytes
- Interrupt Sources : 21
- I/O Ports : Ports A – E
- Timers : 4
- PWM Modules : 1
- Serial Communications : MSSP, CAN Addressable USART
- 10-bit Analog-to-Digital Module : 8 input channels
- Instruction Set : 75 Instructions
- Packages : 40-pin PDIP, 44-pin PLCC, 44-pin TQFP

C. LCD Display:LCD (Liquid Crystal Display)screen is an electronic display module and find a wide range of applications. A 16×2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LED's. A 16×2 LCD means it can display 16 characters per line and there are 2 such line. In this LCD each character is displayed in 5×7 pixel matrix. This LCD has two registers namely, Command and Data.

D. CAN Protocol: The CAN (Controller Area Network) or CAN-bus is an ISO standard computer network protocol and bus standard, designed for microcontrollers and devices to communicate with each other without a host computer [2]. Designed earlier for industrial networking but recently more adopted to automotive applications, CAN have gained widespread popularity for embedded control in the areas like industrial automation, auto motives, mobile machines, medical, military and other harsh environment network applications.

Features:

- Message bit rates up to 1 Mbps
- Conforms to CAN 2.0B ACTIVE Spec with: - 29-bit Identifier Fields - 8-byte message length
- 3 Transmit Message Buffers with prioritization
- 2 Receive Message Buffers
- 6 full 29-bit Acceptance Filters
- Prioritization of Acceptance Filters
- Multiple Receive Buffers for High Priority Messages to prevent loss due to overflow
- Advanced Error Management Features

E. DC MOTOR: DC motors are widely used, inexpensive, small and powerful for their size. Reduction gearboxes are often required to reduce the speed and increase the torque output of the motor. Unfortunately more sophisticated control algorithms are required to achieve accurate control over the axial rotation of these motors. Several characteristics are important when selecting DC motors and these can be Split into two specific categories. The first category is associated with the input ratings of the motor and specifies its electrical requirements, like operating voltage and current. The second category is related to the motor's output characteristics and specifies the physical limitations of the motor in terms of speed, torque and power.

Fig 4: DC Motor

F. CAN Transceiver: The MCP2551 is a high speed CAN,fault tolerant device that serves as the interface between a CAN protocol controller and the physical bus.the MCP2551device provides differential transmit and receive capability for the CAN protocol controller,and it is fully compatible with the ISO-11898 standard,including 24V requirements.It will operate at speed of up to 1 Mbps.Each node in a CAN system must have a device to convert the digital signals generated by a CAN controller to signals suitable for transmission over the bus cabling(differential output).It also provides a buffer between the CAN controller and the high voltagespikes that can be generated on the CAN bus by outside sources.

Fig 5: CAN Transceiver MCP2551

G. Current Sensor ACS712: The Analog Current Sensor ACS712 is used measure the current value of the motor[5]. The device consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which the Hall IC converts into a proportional voltage. The output of the device has a positive slope (>VIOUT (Q)) when an increasing current flows through the primary copper conduction path (from pins 1 and 2, to pins 3 and 4), which is the path used for current sampling. The internal resistance of this conductive path is 1.2 mΩ.

Fig 6:Current Sensor ACS712

Features:

- Low-noise analog signal path
- 80 kHz bandwidth
- Total output error 1.5% at TA = 25°C
- Small footprint, low-profile SOIC8 package
- 1.2 mΩ internal conductor resistance
- 2.1 kV RMS minimum isolation voltage from pins 1-4 to pins 5-8
- 5.0 V, single supply operation
- 66 to 185 mV/A output sensitivity
- Extremely stable output offset voltage
- Nearly zero magnetic hysteresis

H. OP-AMP LM358: Voltage of the DC motor can be monitored by using LM358. These devices consist of two independent, high-gain frequency-compensated operational amplifiers designed to operate from a single supply over a wide range of voltages. Operation from split supplies also is possible if the difference between the two supplies is 3 V to 32 V and VCC is at least 1.5 V more positive than the input common-mode voltage. The low supply-current drain is independent of the magnitude of the supply voltage.

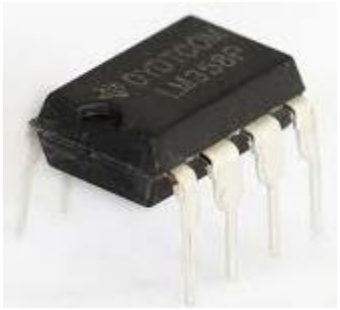


Fig 7: LM 358

Features:

- Wide Supply Ranges.
- Low Supply-Current Drain, Independent of Supply Voltage: 0.7 mA Typical.
- Wide Unity Gain Bandwidth: 0.7 MHz.
- Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage: 32 V.
- Open-Loop Differential Voltage Gain: 100 dB Typical.
- Internal Frequency Compensation.

G. Temperature Sensor LM35: The LM35 series are precision integrated-circuit, temperature sensors, with an output voltage linearly proportional to the centigrade temperature. Thus the LM35 has an advantages over linear temperature sensors calibrated in °Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient centigrade scaling. The LM35 does not require any External calibration or trimming to provide typical accuracies of±¼°C at room temperature and ±¾ °C over a full -55°C to +150°C temperature range. Low cast is assured by trimming and calibration at the wafer level. The low output impedance , linear output, and precise inherent calibration of LM35make interfacing to readout or control circuitry especially easy[3][4].

V. WORKING

In our system different sensors like current sensor, voltage sensor, Temperature sensor are connected to the PIC MICROCONTROLLER which acts as a slave node. Sensors sense the various industrial parameters like temperature, current, voltage and speed.

Our system has following two sections,

1) Transmitting section
2) Receiving section

In the transmitting section, the variable parameters are sensed by the slave nodes are sent to the master controller through CAN Bus and CAN Controller using the can protocol. The master controller is programmed in such a way that the parameters are sensed periodically and transmitted. To achieve higher data rate the CAN protocol are effectively used. The master controller controls the sensor to come below the cut-off point if the value of any sensor is above the cut-off point.

In the receiving section, the measured parameter values are shown over the LCD Display. If anything is going abnormal, the motor will automatically turn off.

VI. SIMULATION

The system uses PIC18F458 microcontroller which is programmed using Embedded C Language. The program and model was tested using Proteus Software. The output is checked by connecting the LCD Display.

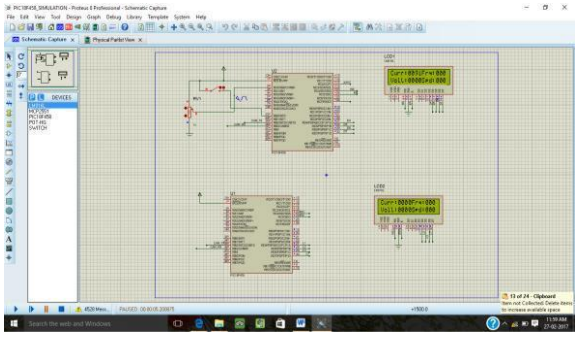


Fig 8.Simulated output

VII. EXPERIMENTAL RESULT

Figure 9 shows the transmitter circuit of Parameter monitoring system. The transmitter sense the parameter values of motor by using various sensors and transmitted to the master node by the help of CAN Bus.

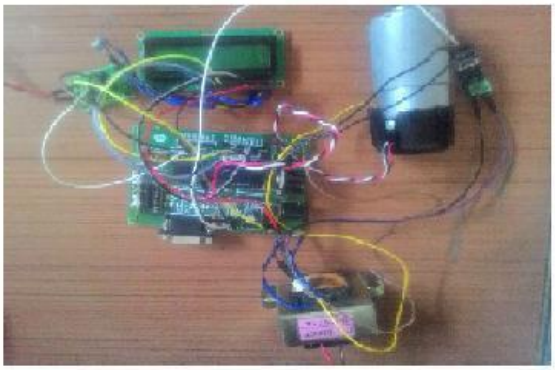


Fig 9.Transmitter Side

Figure 10 shows the receiver circuit of the system. The CAN Transceiver is used to receive the parameter values of motor and displays the values in the LCD display. If the received value is above the cut-off point the motor will automatically turn off.

Fig 10.Receiver Side

ADVANTAGES

- The system provides a complete security to transmission of data.
- Monitoring and controlling the industrial parameters by huge man power work can be reduced by single man can control the entire motor by CAN bus.
- To protect the motor against the fault such as over current, over heating in winding and under/over voltage.

VIII. CONCLUSION

This system is concerned with the implementation of low cost effective control of industry with less man power. This is very useful in many industries to avoid any malfunction and monitoring all the parameters in the factory. Transmission process of information from one node to another node is done in efficient manner by CAN serial communication protocol. Normal and abnormal conditions are viewed in the LCD.

REFERENCES

[1]. Aruna Y. Jagtap and Prof.D.S Bhosale" Industrial Parameter Monitoring System using CAN Bus" International Journal of Emerging Research in Management &Technology, ISSN: 2278-9359 (Volume-3, Issue-9) ,September 2014.

[2]. R.Bayindir and S.vadi "Real –Time Monitoring and Control of the Parameter of an Induction

Motor" ELEKTRONIKAIRELEKTROTE CHNIKA, ISSN 1392-1215,Vol 19,NO 10,2013.

[3]. Jon Bickel and Franck GRUFFAZ "Increasing the reliability of induction motors with power monitoring system",20th International conference on Electricity Distribution, June 2009.

[4]. JariwalaHiren, Patel Chintan, Prasad Kuldip, Shukla Ankur, Chaudhary Sarawar Ali and PatilHemant " Ac drive synchronization using can protocol", International Journal of Engineering and Techniques, Volume 2 Issue 2,March- April 2016.

[5]. Mohini Reddy and Vidya Sawant" Remote Monitoring and Control System for DC Motor using Zigbee Protocol" Innovation in Engineering and Management (IJAIIEM), Volume 3,Issue 4, April 2014.

[6]. Shaohua Lu And FaridBoussaid," Microcontroller Based Industrial Automation And Control System Using Can Protocol" IEEE Transactions on Power Electronics, Vol 30 No 10, Octomber.

[7]. SumitNarwade, Prasad Kulkarni and C.Y.Patil"fault Detection of Induction Motor using Current and Vibration Monitoring" International Journal ofAdvanced Computer Research , ISSN: 2249-7277, Volume 3,Number 4 Issue 13, December 2013.

[8]. Dr.R.Udhayakumar and Dr.V.Khanaa "Health monitoring system for Induction motors"International Journal of Engineering andComputerscience ISSN:2319-7242,Volume 2 Issue 4 Apiral,2013 Page No.1117-1122.

[9]. Vijay.S and Kesavan. S.P "Design of Modern Industry Automation using pic and can protocol"IJARIIE-ISSN(O)-2395-4396,Vol-2 Issue-2 2016.

[10]. Wilson Wang, Senior Member, IEEE, "AnIntelligent System for Machinery Condition Monitoring" IEEE TRANSACTIONS ON FUZZYSYSTEMS, VOL. 16, NO. 1, FEBRUARY 2008.