IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 11, Issue 4, April 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

9940 572 462 | 6381 907 438 | ijircce@gmail.com | www.ijircce.com

International Journal of Innovative Research in Computer and Communication Engineering

ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 4, April 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1104280 |

Industrial Control using CAN Bus Communication with Embedded System

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ABSTRACT: Nowadays industrial automation systems have become popular in many of industries and play crucial role in controlling several process-related operations. Due to the implementation of wide variety of industrial networks with their geographical distribution over factory or industry, the floor data transferring and controlling capability had become more sophisticated and easy ranging from low-lever to high-level control. These industrial networks are routed through various field buses that uses various communication standards like CAN protocol, Profibus, Modbus, Device net etc. So let us look how CAN communication works for automating the industries and other automation based systems.

KEYWORDS: CAN Bus Protocol, Embedded System, Remote monitoring system

I. INTRODUCTION

Industrial automation and control consist of three levels of control is performed to automate the whole system these three levels are control and automation, process control, and higher-order control. The Control and Automation level consists of various field devices like sensors and actuators to monitor and control the process variables. Process Control Level is a central controller responsible for controlling and maintaining several controlling devices like microcontroller The Higher Order Control Level is a desired output level that manages all operations. The communication bus is the major component in industrial automation for reliable transfer of data among the controllers, computers and also from the field devices. In this project we have used CAN bus protocol for communication.

As our project is proposed that in industry there is lot of reflections to be avoided to that we connecting sensor devices to atmega328 for detecting the errors and automatically correct the error without manual work. Nowadays industrial automation system have become popular in many of the industries and play a crucial role in controlling several process-related operations. Due to the implementation of a wide variety of industrial networks with their geographical distribution over factory or industry, the floor data transferring and controlling capability has become more sophisticated and easy ranging from low-level to high-level control. These industrial networks are routed through various field buses that use various communication standards like CAN protocol.

II.LITERATURE SURVEY

In an automated industrial installation, CAN bus is most commonly used as part of a distributed control system, connecting vital systems that may be spread throughout a facility. Generally a Human Machine Interface (HMI) allows the operator to interact with the system. CAN is often found in use on production lines in manufacturing environments, allowing operators and equipment to effectively communicate at each step of the assembly process. Building automation is another area where the speed, low cost, and ease of installation have made CAN bus communication a popular choice to connect access control, security, and environmental systems.

III. DEVICE FABRICATION & COMPONENTS

- Atmega Microcontroller
- Temperature Sensor
- Gas Sensor
- LDR

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- Water level sensor
- DC motor
- Water motor
- Buzzer
- CAN bus MCP2515 transceiver

IV. FLOW CHART

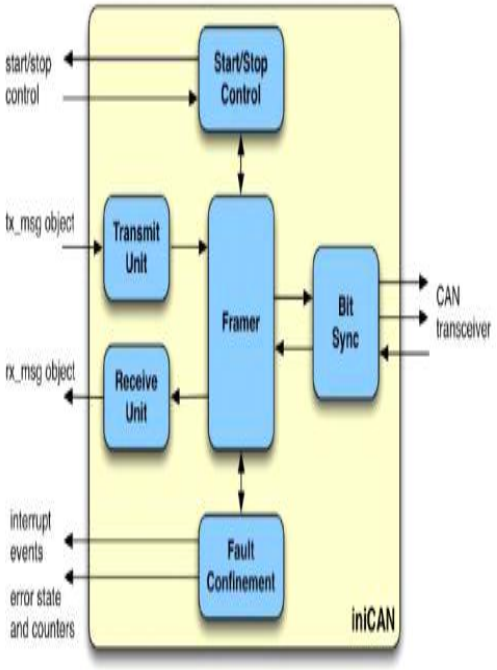

Fig 1.Flow Chart.

V. CIRCUIT DIAGRAM

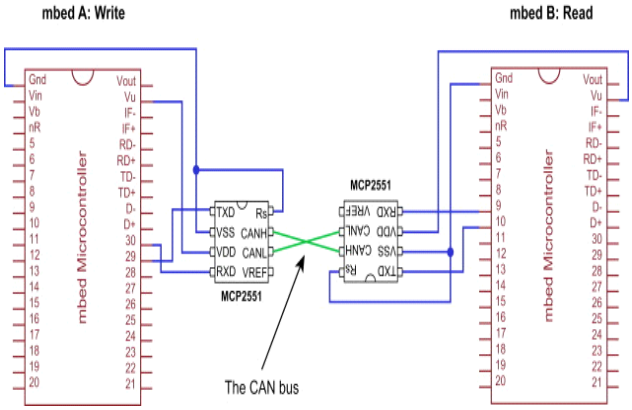

Fig 2.The circuit connection for two nodes of CAN bus communication.

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VI. SYSTEM DESIGN

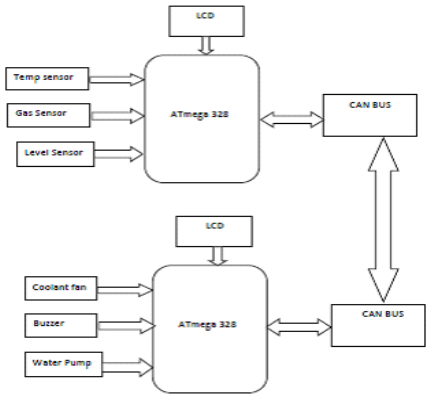

Fig 3.Block diagram of Industrial control using CAN bus with Embedded System.

This project is implemented to control different parameters in industry based on temperature variation, water level, hazardous gas leakage detection. So this project achieves this with the use of CAN protocol which is highly efficient and reliable low-cost communication. Two microcontrollers are used in this project, one for acquiring temperature data, water level and any gas leakage and other for controlling actuators for coolant(fan in our case) water pump , and alert system if any gas leakage. CAN Controller MCP2515 and CAN transceiver MCP2551 are connected to both microcontrollers to implement CAN communication for exchanging the data. Transmitting side microcontroller continuously monitors the temperatures with the use of LM35 temperature sensor by converting analog values to digital with ADC attached to it. These values are compared with the set values programmed in the microcontroller, and these values are violated when the microcontroller sends or transmits the data to the receiver side microcontroller by CAN controller and transceiver units.

The receiving side CAN communication receives the data and transfers it to the microcontroller that further processes the data and controls the DC motor of coolant by a motor-driver IC. It is also possible to change the direction of the motor with the driver IC controlled by the microcontroller. Similarly water pump is ON or OFF if water level is below or above set value and if any gas leakage is detected alarm system is activated. Thus the CAN protocol enables the peer-to-peer communication by connecting different nodes in industrial environment.

VII. HARDWARE DESIGN

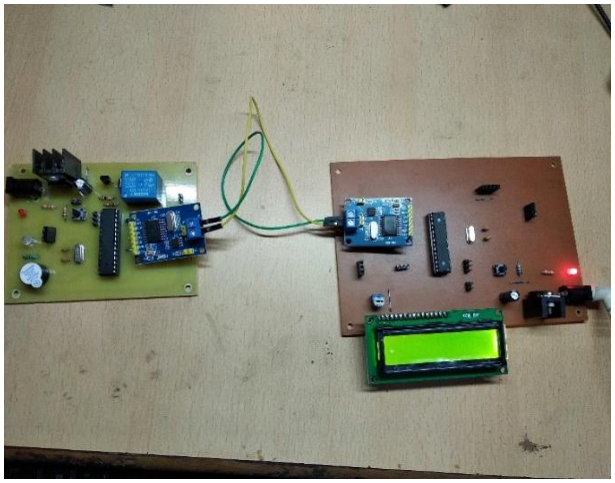

Fig 4.Hardware.

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Two nodes of pair MCP2551 transceiver and embedded system designed with Atmega328 microcontroller one as receiver and one as transmitter. At receiver side different parameters such as temperature, light intensity, leakage of any hazardous gas, water level are detected and these signals are transmitted via CAN bus in real time to transmitter to control corresponding parameters. RTOS library is used for real time implementation system has two nodes namely receiver and transmitter, receiver four different sensors and transmitter has display, indicator, and actuators to control corresponding parameters in this system a coolant fan is used to control temperature, a buzzer is used to indicate leakage of any hazardous gas, similarly other parameters are displayed on LCD screen.

VIII. ADVANTAGES

- As the area of industrial floor is very large and therefore different units are placed at quite apart CAN bus is fast enough to made peer to peer communication between controller nodes.
- We can add many nodes as per our requirements.
- Multi master and multicast features can be applied.
- High speed data rate.

XI. DISADVANTAGES

- Limited number of nodes (up to 64 nodes).
- High cost for software development and maintenance.

X .CONCLUSION

In this application CAN used multiple nodes to acquire data from sensors and transmit the data in packets over a CAN bus. Each node consist of pair of Atmega 328 microcontroller and CAN transceiver MCP2551. The system works at a high speed up to 1Mbps. One can develop its own network application using the above system such as home automation using CAN bus, light control network using CAN.

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Impact Factor: 8.165

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ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

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