Volume 4 || Special Issue 4 || ICCEME 2019-2020 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH
AND ENGINEERING TRENDS

INDUSTRIAL AUTOMATION BY USING CAN PROTOCOL WITH LABVIEW

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Abstract-: When we consider an industry of large area the monitoring, controlling of each section involved in the industry is a big task. It involves a large amount of man power and time consumption. To overcome these above factors we developed this technology to make single person for monitoring and controlling the entire network. This can be achieved using controller area network (CAN) bus network, Arduino Uno and LABVIEW software. Industrial automation 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.

Keywords- *Arduino Uno, CAN protocol, LABVIEW, etc.*

I INTRODUCTION

Industrial automation improves productivity and quality while reducing error and wastage of material. It also increases safety and adds flexibility to the manufacturing process. The CAN bus provides an ideal platform for interconnecting modules and LABVIEW software provides good monitoring of system.

CAN 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. Using CAN protocol we can send data from one node to other node.

Here we are having two nodes. In first node we are interfacing temperature and ultrasonic sensors with Arduino Uno, in second node heater and motor are interfacing with Arduino Uno. Node 1 will measure the water level and temperature and send these values to node 2 through CAN bus. This node 2 will control the motor and heater according to the data it received. All the system will be monitored through the LABVIEW. LABVIEW provides single view status of the system. Data like temperature and water level, on/off state of pump and heater, change in range of parameters are displayed on LABVIEW.

We use MCP2515 CAN module. The MCP2515 CAN Bus Controller Module is very helpful. The MCP2515 CAN Bus Controller is a simple Module that supports CAN Protocol version 2.0B and can be used for communication at 1Mbps. In order to setup a complete communication system, we will need two CAN Bus Module. This particular module is based on MCP2515 CAN Controller IC and TJA1050 CAN Transceiver IC. The MCP2515 IC is a standalone CAN Controller and has integrated SPI Interface for communication with microcontrollers coming to the TJA1050 IC, it acts as an interface between the MCP2515 CAN Controller IC and the Physical CAN Bus. MCP2515 IC is the main controller that internally consists of three main subcomponents: The CAN Module, the Control Logic and the SPI Block. CAN Module is responsible for transmitting and receiving messages on the CAN Bus. Control Logic handles the setup and operation of the MCP2515 by interfacing all the blocks. The SPI Block is responsible for the SPI Communication interface. Coming to the TJA1050 IC, since it acts as an interface between MCP2515 CAN Controller and the physical CAN Bus, this IC

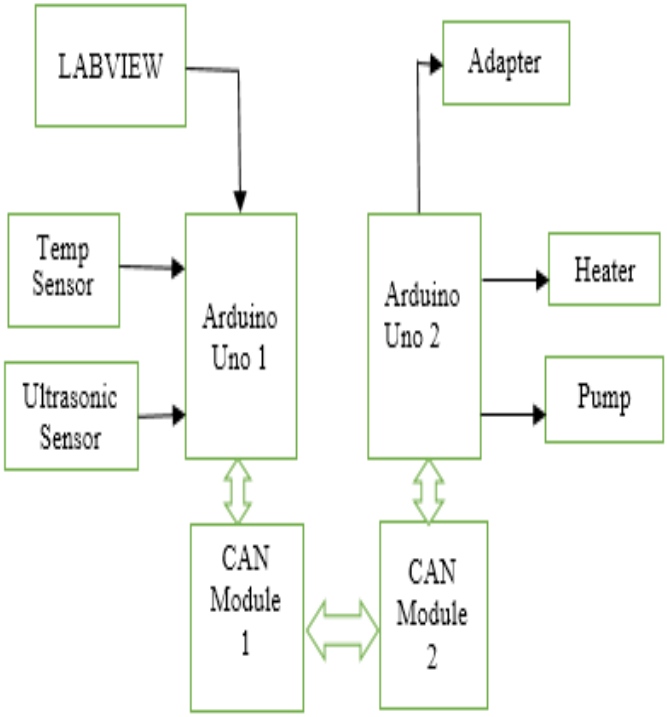
is responsible for taking the data from the controller and relaying it on to the bus. CAN is message-based communication, we need to send a message anywhere between 0 and 8 bytes.

The name LabVIEW is a shortened form of its description: Laboratory Virtual Instrument Engineering Workbench. LabVIEW is a visual programming language: it is a system-design platform and development environment that was aimed at enabling all forms of system to be developed. LabVIEW was developed by National Instruments as a workbench for controlling test instrumentation. LabVIEW was first launched 1986 as a tool for scientists and engineers to facilitate automated measurements. In our case we use it as system monitoring purpose. LabVIEW uses a graphic interface that enables different elements to be joined together to provide the required flow. LabVIEW is essentially an environment that enables programming in G – this is a graphical programming language created by National Instruments.

II EXITING SYSTEM

The system in which CAN protocol is used to monitor and control 3 different devices by single microcontroller called as master and another 3 microcontrollers called as slave. Monitoring of the system through LabVIEW is not involved. So remote monitoring is not possible.[1] Industrial automation using LabVIEW and ZigBee based Wireless Network. The ZigBee has low transmission rate. It cannot be used as outdoor wireless communication system due to it's short coverage. Replacement to ZigBee compliant appliances can be costly.[2] An industrial automation system was implemented using Raspberry Pi. The system was able to monitor and control all the parameters used in the industries. Zigbee module is used. The Raspberry Pi controller is costlier than Arduino. Along with this ZigBee has many disadvantages also.[3] An industrial automation system was implemented using GSM. The GSM network helps in controlling the system from a distant area. The microcontroller used helps in interfacing many input/output devices at a time.[4] Whenever there is a weak signal the system will not work properly. Also they can not monitor the system.

III PROPOSED SYSTEM



The temperature sensor LM35 and ultrasonic sensor Hc-sr04 are interfaced with Arduino Uno 1. Lm35 senses the temperature and Hc-sr04 senses the level of water in tank. After sensing data these sensors send data to Arduino Uno 1. Arduino Uno 1 transfer the data to Arduino Uno 2 through CAN module 1 and CAN module 2.

Arduino 2 process all the data and compare the sensor values with given threshold values. Heater and pump are connected to Arduino 2. According to threshold values heater and pump will go in ON and OFF state.

If temperature value of system is below the threshold value the heater is in ON state. When temperature value of system is above the threshold value the heater is in OFF state. Ultrasonic sensor checks the water level in tank, if level of water is above the threshold value then pump will be in ON state and if it is below the threshold value then pump remains in OFF state.

All the system will be monitored through the LABVIEW. LabVIEW provides single view status of the system. Data like temperature and water level, on/off state of pump and heater, change in range of parameters are displayed on LabVIEW.

- Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

- Temperature Sensor (LM35)

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device has an advantage 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 device 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.

- Ultrasonic sensor (Hc-sr04)

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

(1) Using IO trigger for at least 10us high level signal.

(2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.

(3) IF the signal back, through high level, time of high output IO duration is the time from sending ultrasonic to returning. Test distance = (high level time) × velocity of sound (340M/S) / 2.

IV SELECTION METHODOLOGY

- For CAN (Controller area network)
- CAN= A Controller Area Network is a robust vehicle bus standard designed to allow microcontrollers and devices to communicate with each other's applications without a host computers.
- SPI=Serial Peripheral Interface (SPI) is an interface bus commonly used to send data between microcontrollers and small peripherals such as shift registers, sensors, and SD cards. It uses separate clock and data lines, along with a select line to choose the device you wish to talk to.
- I2C=I2C is serial protocol for two-wire interface to connect low-speed devices like microcontrollers, EEPROMs, A/D and D/A converters, I/O interfaces and other similar peripherals in embedded systems. It was invented by Philips and now it is used by almost all major IC manufactures.
- CAN= A Controller Area Network is a robust vehicle bus standard designed to allow microcontrollers and devices to communicate with each other's applications without a host computers.
- Modbus= Modbus is a communication protocol developed by Modicon systems. In simple terms, it is a method used for transmitting information over serial lines between electronic devices. The device requesting the information is called the Modbus Master and the devices supplying information are Modbus Slaves.
- BACnet= BACnet is "a data communication protocol for building automation and control networks." A data communication protocol is a set of rules governing the exchange of data over a computer network that covers everything from what kind of cable to use to how to form a particular request or command in a standard way.

Parameter	**SPI**	**I2C**	**CAN**
Speed	3Mbps to 10Mbps	Standard: 100Kbps	10KBps to 1MBps Also depends upon length of wire used
		Fast: 400 Kbps	
		Highspeed:3.4Mbps	
Type	Synchronous	Synchronous	Asynchronous
Number of Wires	3+ (MISO, MOSI, SCK, SS1, SS2…SS(n))	2 wires (SDA, SCL)	2 wires (CAN_H, CAN_L)
Duplex	Full Duplex	Half Duplex	Half Duplex

Parameters	**CAN**	**Modbus**	**BACnet**	**LonWorks**
Network Interface	Wiring	LAN	Ethernet	U10/U20 USB Network Interface
Cost	Low	Low	Low	High
Advantages	Wiring is less. Multi master protocol	Scalability between size, cost and system performance.	Easy to deploy and maintain.	Web based tool saves time and cost.
Disadvantages	Half duplex protocol	Limited the number of field devices that can connect to a master station except Ethernet TCP/IP	Great amount of configuration and programming required	Hardware specific, and requires the Neuron chip for network movement of the protocol.

Application Areas	Boiler, Pick and place robot.	Boiler Control, Tank Level Measurements	Tasks such as request temperature reading, send status alarm, or fan schedule	Security, lighting systems, HVAC, machine control, manufacturing, metering

Arduino uno= *Arduino Uno* is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button.

Raspberrry pi= The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote teaching of basic computer science in schools and in developing countries.

V SCOPE

Automation enables a set of technologies that result in operations of machines and system without human intervention and achieve performance superior to the manual activities. These automation solutions are essential for most modern industries everywhere in India as well as in the world. This modern control technologies evolving with the different solutions that providing the perfect customized control solution.

Automation industries attain efficient production and manufacturing processes by eliminating issues related to their production with the help of every day changing technologies.

VI CONCLUSION

From the study we have concluded that, CAN protocol is not an address based protocol that is it does not focus on address of devices for communication rather the CAN is message based protocol i.e. message broadcasting is used to carry out the communication. To avoid the collision CAN uses priority based message broadcasting.

While implementation of system we use this characteristic of CAN protocol to control and monitor two different devices i.e. DC motor, temperature sensor, ultrasonic sensor, heater. For implementation we uses. Arduino Uno bored which have ATmega328 microcontroller and for monitoring purpose we use LabVIEW software which gives single view status of the system. Data like temperature and water level, on/off state of pump and heater, change in range of parameters are displayed on LABVIEW.

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