

# Milk Dairy Automation using CAN Protocol

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**Abstract**— The automation industry has till today witnessed the important researches of different electronics control systems that have been developed in industry of safety, comfort, prevention of pollution and low cost. We can use automation in two ways the first one is fully automatic automation and another is controlled by human. Electronic control system causes drawback in that since there is need of reliability in communication data types. To meet the need CAN protocol is developed. Our system based on CAN protocol which is used in broad range of automation fields. It is good for shorter distance applications. For reducing the man power in our system we are using automation for flushing process of milk containers because manually operated system are time consuming. We are using CAN transceiver MCP2551 which has high noise immunity due differential bus implementation. The microcontroller that used in system is PIC18F458 which is high performance RISC CPU. For application specific work industries prefer PIC controller. In generally PLC based system is used in milk industry which is costly and noisy. Now days CAN protocol based automation is one of the beneficial system.

**Key words:** Automation, CAN Bus, CAN Protocol, Data Acquisition and Control System

## I. INTRODUCTION

For speed up the work, safety purpose as well as reduce man power automation is used in industry. for transferring large amount of data at high speed number of wires required which causes harness. To meet the reliable system BOSCH manufacturer of electrical equipment develop a communication protocol which is CAN (Controller Area Network) in 1986. CAN is widely used for its reliability and high performance. CAN is the ISO standardized serial communication protocol. The CAN protocol includes the lower layers of the basic OSI\*1 reference model which are transport, data link, and physical layer.

### A. Controller Area Network (CAN) Protocol

Controller area network was originally designed for automotive industry. The CAN protocol include the transport, data link, and physical layers of the basic OSI reference model. CAN offers 1 Mbits/sec high speed communication rate thus facilitating real time control. CAN is a twisted pair type copper wire cable. On CAN, data is segmented in several frames that can be transmitted periodically, a periodically or on demand. It may link up 112 nodes on a single network. It has error detection feature making it more trusty and adaptable to more critical environment. There are two ISO standards of CAN protocol that is ISO11519-2 and ISO11898 which has message identifiers of 11bit and 29bit respectively. These identifier are shown below:

S	11 Bit	R	I	R	D	DATA	C	A	E	I
O	Identif	T	D	O	L	Up to 8 bits	R	ACK	O	F
F		R	E	C			C		F	C

Fig. 1: Standard CAN frame format

S	11 Bit	S	I	18 Bit	R	R	R	D	0...8	C	A	E	I
O	Identif	R	D	Identif	T	1	0	L	bytes	R	C	O	F
F		R	E		R			C	DATA	C	K	F	C

Fig. 2: Extended CAN frame format

Every node in CAN allows the communication protocol to monitor the bus network in advance before transmitted message is reached. If no activity occurs in network, then each node has the equal opportunity to transmit a message. Bit-wise arbitration is used by communication protocol to solve collision problem. For successful process of arbitration, the logical states need to be explained as dominant (logic 0) or recessive (logic 1). On the basis of network configuration transmitted message send to one or many other nodes. This has many applicable consequences such as multicast, message routing and filtering, system flexibility, together with data consistency.

### B. Block Diagram

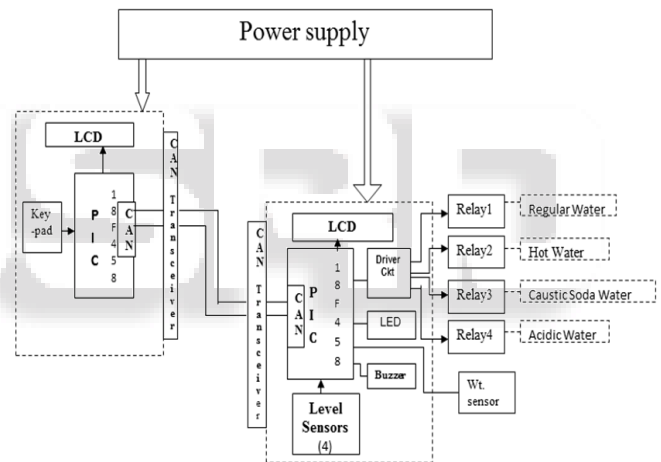


Fig. 2: Block Diagram

### C. System Operation

In our system there are two nodes, node first situated at control room and node second is at area of work. Keypad gives input to the PIC controller that tells about which real time flushing process followed by system that is either caustic soda method or acidic flushing method. LCD at node1 shows which process is selected by operator. This message is send to node2 by CAN protocol. PIC controller which is at node2 understands which process it has to do. Relay is used as a switch. Relay drivers are used to control the operation of motors and pumps. Level sensors are used for level detection of tanks. Buzzer and LED are used for indicating status of tanks. If any one of tank is empty then message displayed on LCD at node2. After flushing of milk container for weight analysis load cell weight sensor is used.

### D. Real Time Clock

Real time clock gives delay of few seconds for all types of tanks so due to that sequentially system follow the command given by control room.

The two processes for flushing are:

1) *Caustic Soda Method:*

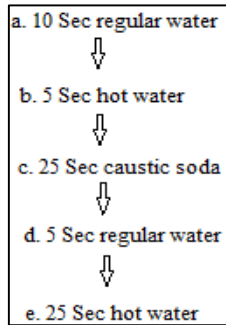


Fig. 3: CS Method

2) *Acidic Flushing Method:*

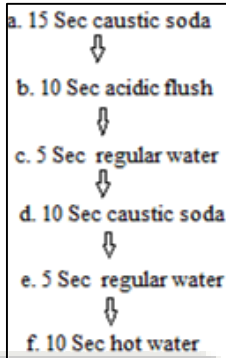


Fig. 4: AF Method

II. HARDWARE REQUIRED

A. *PIC 18F458*

Microchip develops a PIC Microcontroller. According to Microchip company PIC family is most secure in market today. We can use PIC in intended manner and under normal condition. PIC is high performance, enhanced flash magic microcontroller with CAN. It is 28/40 pin IC. PIC18F458 has high performance RISC CPU with low power consumption and low cost. It has linear program memory addressing up to 2Mbytes and linear data memory addressing up to 4kbytes. It can compile with ISO CAN conformance test with message bit rate up to 1Mbps. PIC18F458 has programmable code protection. PIC18FX58 has twice the FLASH program memory. All other features of PIC18FX58 include serial communication module.

B. *CAN Transceiver*

Digital signal generated by CAN controller is converted into suitable signal for the transmission of signal over a CAN bus. Most CAN transceivers require a 5-V power supply to reach the signal levels required by the ISO 11898 standard. CAN transceiver has electrostatic discharge (ESD) protection and it also have controlled driver output transition times.

- Receiver: For protection of CAN controller it has protective circuitry. It take the signals from bus that the CAN controller wanted.
- Transmitter: The signal received from CAN controller is converted and send onto the bus.

C. *Sensors*

For level calculation of tanks the water float sensor is used. When the level of tank goes below or above the threshold

level then the buzzer is ringing and the corresponding LED is glowing. And for weight measurement Load cell-weighing scale is used.

D. *Keypad*

Basically keypad is a user interface. For providing input to the PIC microcontroller the keypad is introduced. Unique characters, symbols or digits are given to the each key. Through software PIC get the signal which key is pressed by the user which assign the particular process.

E. *Relay*

A relay is an electrically operated switch.

Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches. Relays allow one circuit to switch a second circuit which can be completely separate from the first.

F. *Driver*

For interfacing between high voltage/current level components like relay, motor, valve, pumps, lamp, etc and low voltage/current level circuitry driver circuit is used.

G. *LCD*

The LCD is a liquid crystal display. In market different types of LCD display are available from that we are using 16X2 line LCD display.

III. RESULT

In this paper, the CAN protocol based automation and control system for milk dairy is designed for better operation. This system provides faster transmission of message from one node to another node. All notifications are displayed on LCD. The working of system is shown below



Fig. 5: Result

IV. CONCLUSION

This system is useful to overcome the limitations of currently used system because CAN protocol required less wiring and it has capacity to extend the network for modification. It can link up to 2032 devices on a single network. CAN protocol is multi-master device and it has ability to transmit data of 8 byte. This system defines how each node can respond according to operation. It gives better result for shorter distances so it is useful for milk dairy automation.

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