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Sfi CAN based Fault-Injection Infrastructure for IMM by µCOS-II

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Abstract— The dependability requirements of distributed embedded control systems(1) demand appropriate evaluation techniques. Requirements of embedded systems are often tested by means of fault injection. However, for the controller area network (CAN),(2) the potential of this technique has not been fully exploited. Moreover, sfi CAN allows the remote and flexible configuration of fault injection(3) and the retrieval of accurate information about the subsequent behaviour of the nodes. The proposed system consider the Fault Injection of Injection molding machine automation(4) industries and time alarm for real time demo with sensors with real time operation system(µ COS-ii)(5).

Keywords— Embedded control systems, Controller area network, Fault injection, machine automation, µ Cos-ii .

I. INTRODUCTION

It is the first injector that is able to test the behaviour under inconsistency scenarios of arbitrary software for CAN nodes and the first that makes it possible to inject faults that may lead to integrity errors without requiring any modifications to the nodes' software or CAN controllers.

I-1 INJECTION MOULDING MACHINE

An Injection molding machine, also known as an injection press, is a machine for manufacturing plastic products by the injection molding process. It consists of two main parts, an injection unit and a clamping unit. Injection molding is a manufacturing process for producing parts by injecting material into a mold. Injection molding can be performed with a host of materials, including metals, glasses, elastometers, confections, and most commonly thermoplastic and thermosetting polymers. Material for the part is fed into a heated barrel, mixed, and forced into a mold cavity where it cools and hardens to the configuration of the cavity.

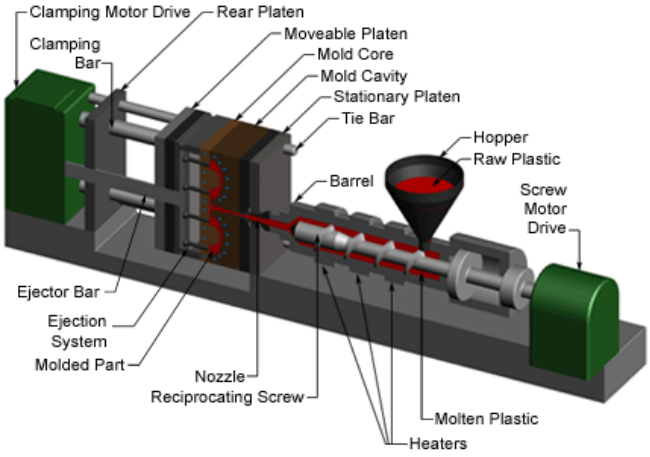


Figure 1- Injection molding machine

I-2 WORKING OF IMM

In Injection Molding Process also automation involves in wide range for the development of the product in high quality. An Injection molding machine, also known as an injection press, is a machine for manufacturing plastic products by the injection molding process. It consists of two main parts, an injection unit and a clamping unit. At present, the control mode of injection molding machines is mainly stand-alone control, which cannot provide the network control function for injection molding machines .The maintenance and the management for the machines are also limited to on-site management level. This kind of operation and management mode is not only unable to meet the requirements of automation and scale production, but also it is harm to the operator's health because they are long time working in the environments that is full of machine noise and plastic smell.

I-3 FLEX-RAY CONSORTIUM

A significant reason for the success of Flex-Ray was the foundation of the Flex-Ray Consortium, under whose guidance under the two automotive OE Ms Daimler Chrysler and BMW joined together with the two chip producers Motorola and Philips in the year 2000.

Figure 2- Flex-Ray Module

II-SYSTEM DESIGN OVERVIEW

II-1 EXISTING SYSTEM

CAN Bus is used to control the existing system but it creates a real time problem during transmission of data .Speed of the transmission is low because the data rate of the CAN bus is 1Mbits/sec. In CAN network several nodes are connected and share the bus commonly so that it can cause several delays in transmission. The control mode of injection moulding machines is mainly stand-alone control, which cannot provide the network control function for injection moulding machines. The maintenance and the management for the machines are also limited to on-site management level.

II-2 PROBLEM IDENTIFIED

- *Accuracy & Automation is not achieved.*
- *More Time Consuming to monitor and rectify.*
- *Harm to the worker's health.*
- *Data Transmission rate is less.*

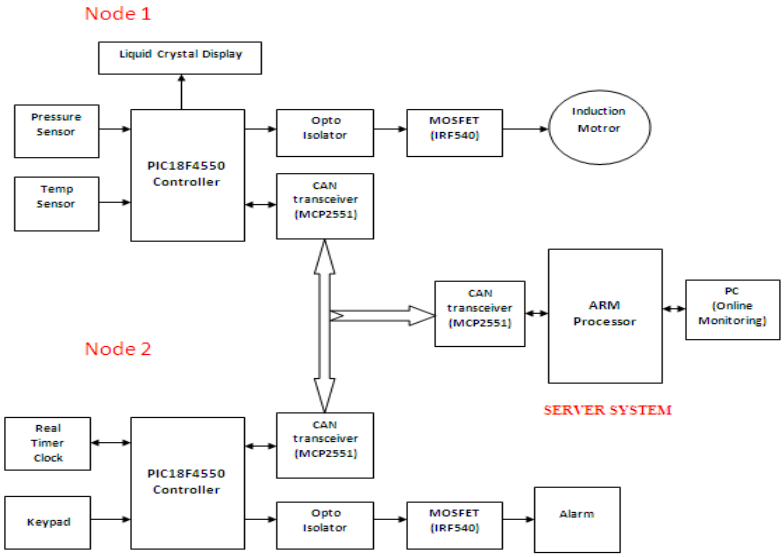
II-3 PROPOSED SYSTEM

A new distributed intelligent control system of Injection molding machine is proposed. This system utilizes Flex-ray field bus for connecting ARM controllers from different Injection Molding Machine locations to the host computer and the transmission of data occur at high rate with very high speed at 10 Mbps and supports up to maximum 64 node connections. Distributed Artificial intelligence method used to store the modification of values for future purpose. Number of injection molding machine monitoring is increased.In regard to this, a new distributed intelligent control system based on ARM and Flex-ray field bus was designed. This control system can realize the distributed intelligent control and the on-site monitoring of the injection molding machine.

II-4 COMPONENTS OF IMM

- *Flex-ray Transceiver.*
- *ARM Controller.*
- *Pressure Sensors.*
- *Temperature Sensors.*
- *Accelerometer.*
- *RS 232.*
- *Liquid Crystal Display.*
- *Host Computer.*
- *Keil compiler.*

II-5 BLOCK DIAGRAM



II-6 BLOCK DESCRIPTION

The ARM-based distributed intelligent control system mainly consists of the host computer, Flex-ray transceiver field-bus, ARM controller as the master and slave and other accessories, as shown in Fig.2. The control center of the system, host Computer, together with Flex-ray transceiver field-bus, connects all ARM controllers scattered in different working locations, realizing the distributed intelligent control for the injection molding machines. The Flex-ray network is selected as a bus due to the high requirements of the system for the real-time and reliability performance, and industrial computer is used as the host computer, where the data transmission occurs with the help of RS-232.Sensors are used to sense the various values of temperature, pressure of the product to be molded. Temperature sensor, pressure sensor, and accelerometer used for the position correction of the product.

III-DESIGN OF FLEXRAY TECHNOLOGY

III-1 FLEX-RAY TOPOLOGY

A Flex-Ray communication system (Flex-Ray Cluster) is made up of a number of Flex-Ray nodes and a physical transmission medium (Flex-Ray Bus) interconnecting all of the Flex-Ray nodes. Since Flex-Ray communication is not restricted to any specific physical topology, a Flex-Ray cluster may be based on any of a number of different physical topologies. A point-to-point connection is as feasible as a line topology, passive star topology or active star topology. To attain its high transmission speeds Flex-ray uses an Active Star configuration. The active star consists of a node containing multiple bus drivers linked by a high speed back plane, the active star, as its name suggests is a powered device, it has 3 key states indicated by levels.

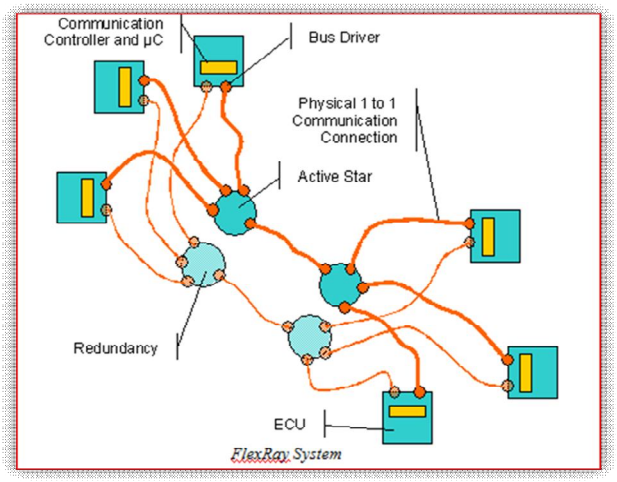


Figure 4 Flex-ray Active Star System

III-2 MODES OF FLEX-RAY NODE

Normal mode: BD is able to send and receive data streams via the bus.
Standby mode: BD is in a low power mode such that it is not able to send or receive data via the bus.
Sleep mode: only the wake up detector is activated to monitor wake up patterns via the bus.

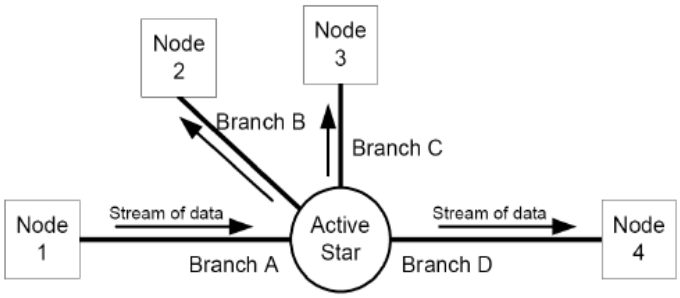


Figure 5-Modes of Flex-Ray

IV-HARDWARE DESCRIPTION

IV-1 ARM PROCESSOR

The LPC2148 micro controllers are based on a 32/16 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the micro controller with embedded high speed flash memory ranging from 32 kb to 512 kb. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30% with minimal performance penalty. Due to their tiny size and low power consumption, LPC2148 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale.

IV-2 HARDWARE COMPONENTS

A)MICRO CONTROLLER
PIC-PIC18F4550
ARM LPC2129

B)SENSORS
Temp Sensor LM35
Press Sensor MP3V5050
C)REAL TIME CLOCK -DS1307
D)MOSFET – IRF540
E)OPTO ISOLATOR – MOC3021

IV-3 ADVANTAGES

Consumes less power and generates less heat.
Saves lot of space compared picture tubes due to LCD flatness.
Due to less weight and flatness LCD are highly portable.
No flicker and fewer screens glare in LCD to reduce eye strain.

V- SOFTWARE DESCRIPTION

V-1 KEIL-µ-VISION-3

µ-Vision, the popular IDE from Keil Software, combines Project management, Source Code Editing, Program Debugging, and Flash Programming in a single, powerful environment. Editor facilities for creating, modifying, and correcting programs and target Debugging or CPU peripheral Simulation. For experienced users, µVision3 adds new features such as Source Outlining, Function Navigation, Editor templates, Configuration Wizard, Logic Analyzer, and I C Simulation, Flash Programming and JTAG Debugging.

V-2 SOFTWARE COMPONENTS

a)IDE for Microcontroller
MPLAB IDE for PIC
Keil µ vision for ARM
b)Programming Language - Embedded C
c)Data base - Visual basic

VI-CONCLUSION

In the process of plastic molding, the setting and control of the process parameters of the machines are critical. The experiments have showed that FLEX-RAY based distributed intelligent control system of the injection molding machine can improve the control capability and the management level by optimizing the process parameters, dynamically tracking and controlling the molding process, and establishing and updating the processing knowledge base.

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