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Local Interconnect Network Bus Application In Vehicle

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Abstract

Local Interconnect Network bus was particularly designed for low-cost communication between smart sensors in automotive applications. It is used when high bitrates communications as CAN bus are not needed. The LIN master initiates communication by sending the "Header". The "Data fields" are send by LIN master or a LIN slave. Only one slave will respond to a given header. An airbag is part of a vehicle's safety system, a flexible envelope designed for rapid inflation in an automobile collision, to prevent vehicle occupants from striking hard interior objects such as steering wheels. It is considered a "passive" safety component not requiring any input or action from the user, rather than an "active" component such as a seat belt, which requires fastening. The purpose of this project is to control airbag control unit, temperature cooling and obstacle detection by using LIN protocol. To control the airbag we are using ACCELEROMETER, LM35 for temperature cooling and IR sensor for detection of obstacle. LIN is a serial communication protocol designed to support automotive network. Which efficiently supports the control of mechatronics nodes in distributed automotive applications. The Final test of our prototype with real sensors validate our proposed system design, which could replace the existing system through further industrial validation.

Keywords:*Microcontroller (PIC), LIN transreceiver, accelerometer, sensors*

Introduction

A LIN network consists of a LIN master and one or several LIN slaves. Usually in automotive application, the LIN bus is connected between smart sensors and an Electronic Control Unit (ECU) which is often a gateway with CAN bus. You may find several LIN busse interconnected between them as shown in the figure below. This is a major difference with other low-cost busses as K-line which was intended to link all the ECUs to an external analyse tool for diagnosis purpose

The design consist of a central "Airbag control unit"(ACU) (a specific type of ECU) monitors a number of related sensors within the vehicle, including accelerometers, impact sensors, wheel speed sensors, gyroscopes, brake pressure sensors, and seat occupancy sensors. When the requisite 'threshold' has been reached or exceeded, the airbag control unit will trigger the ignition of a gas generator propellant to rapidly inflate a nylon fabric bag. The inflated airbag reduces the deceleration experienced by the passenger during the crash through the process of venting gas out of small vent holes in a controlled manner absorbing the energy of the occupant impacting the bag. The airbag's volume and the size of the vents in the bag are tailored to each vehicle type, to dissipate the occupant's energy over time and distribute the deceleration forces across a larger portion of the occupant's body (compared to a seat belt alone). The LIN allows to implement a serial communication in state-machine, small microcontrollers. LIN is an asynchronous bus with a single communication wire, used especially for controlling the events which are not critical. It is implemented through the common UART/ SCI interfaces found on almost any microcontroller. The LIN communication is based on message frames in a fixed format of selectable length. Every message frame contains 2, 4 or 8 bytes data and 3 bytes control and security data. The bus communication is controlled by a single master.

A LIN bus length is limited to 40 meters and up to 16 ECUs could be connected.

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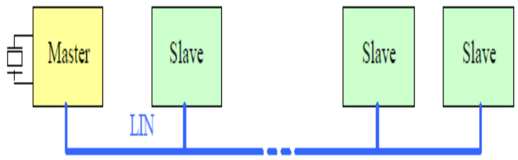

Fig.1 LIN consisting of one master and several slave

Block diagram

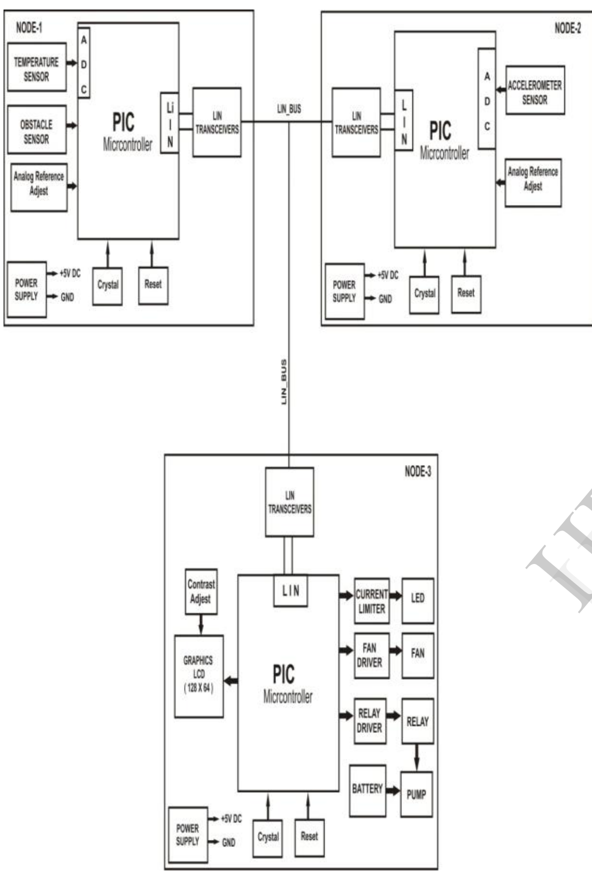

Fig.2 Block diagram of LIN application

Description

In this there are two Slaves and one master. The one slave node is connected to the accelerometer & obstacle sensor and other node is connected to the temperature sensor for measurement of temperature. The PIC microcontroller would be used for the Node 1 and Node 2. The MCP2022 transceiver would be used as LIN transceiver. All the nodes would be connected through LIN single wire network. On the Node 1 the accelerometer sensor would be connected it will sense the acceleration. This signal from the sensor would be analog and further given to the microcontroller. The Internal ADC in the PIC will be used and further processed to pass the data on the LIN bus. According to the set point set in the relay would be toggle and pump will be controlled at same node obstacle sensor is present which detect the obstacle & gives the information to user for changing its direction. The second slave Node 2 would contain the LM35. This is used to indicate the temperature of the engine. The output of the data would be processed and passed on the LIN bus. At the Master node the FAN would be controlled depending on the set value .The Crystal would be used for the clock generation. Reset is use for resetting logic.

LIN Bus

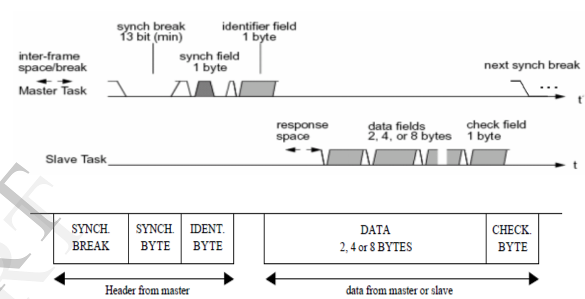

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Fig. 3 LIN Communication Procedure

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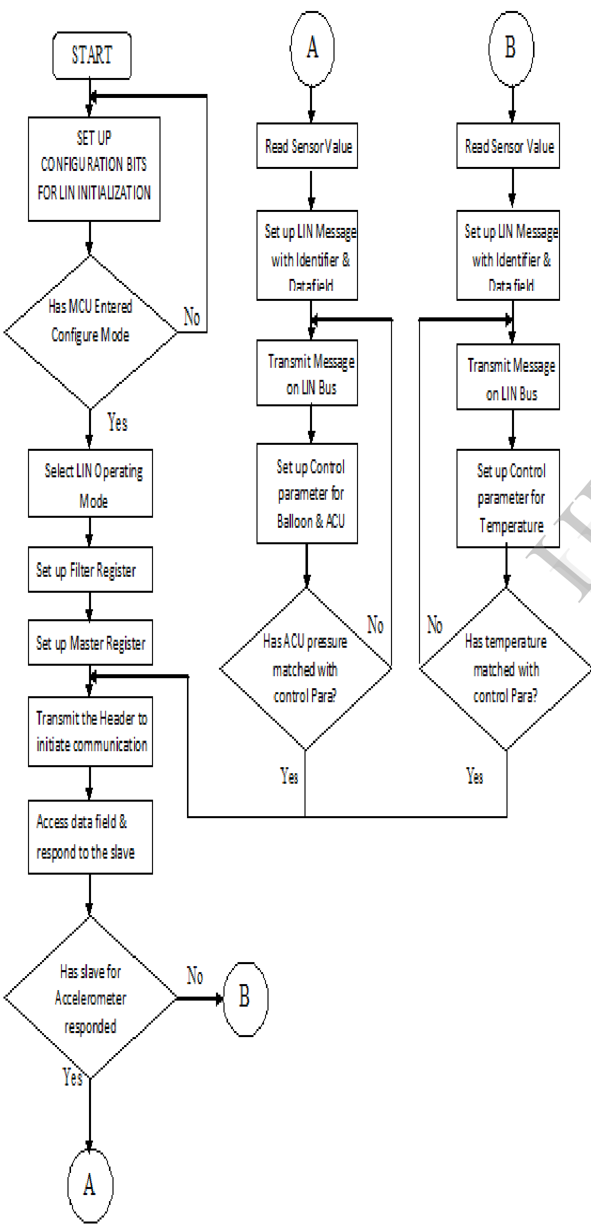
The LIN communication is based on message frames in a fixed format of selectable length. Every message frame contains 2, 4 or 8 bytes data and 3 bytes control and security data. The bus communication is controlled by a single master. The transmission of every message frame is initiated with a break signal, and then a synch field and an identifier field, all of which are transmitted by the master task while the slave task is to transmit back the data field and the check field. Data can be transmitted to any slave control unit by the slave task in the master control unit. The slave-to-slave communication can be triggered by corresponding message ID in the master.

Master Task: Master has control over the whole Bus and Protocol .The master controls which message at what time is to be transferred over the bus. It also does the error handling.(1)Determines order and priority of messages.(2) Monitors Data and check byte and controls the error handler.(3) Serves as a reference with its clock base (stable clock necessary)(4)Receives Wake- Up Break from slave nodes

Slave Task: (1) Is one of 2-16 members on the bus. (2) Receives or transmits data when an appropriate ID is sent by the master.(3) The node serving as a master can be slave.

Flowchart



Conclusion

Thus I can conclude that with unanimous efforts and the tremendous Support from the my guide, I find myself in a position to be able to effectively Simulate LIN Protocol and its significance or importance in future Automation Industries through this project. LIN bus can not only lower the cost, but also provide a hierarchical network structure for fully using operational and diagnostic information of fundamental technical devices. LIN Bus gives high degree of immunity against conducted EMI. Apart from these, the system can keep working steadily for long time, which indicates that this design is logical and feasible. In other words, it can be applied in the real vehicle network to replace the existing wiring control units. Single-wire implementation for the LIN bus i.e. weight reduction is maximized. Also, the master/slave architecture avoids the need for contention control of the bus, simplifying hardware.

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