Review on CAN based Intercommunication between Microcontrollers

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Abstract—: In real time applications, the transmission with less collision is said be more appropriate than with more number of collisions. CAN bus used to run real time critical functions in various fields. In the proposed work we are combining the protocol of CAN and LIN with the help of using addressing scheme of CAN and using the one master multiple slave of LIN. This will help us to achieve high speed with minimum loss of data at maximum distance as transmitter and receiver nodes are fixed. This will work on a request response mechanism as provided by CAN and LIN. Also by using single wire transmission we make it a cost effective.

***Index Terms*— CAN, LIN, ARM7(LPC2129).**

I. INTRODUCTION

Recently automotive nets are adopted to solve increasing problems in automotive electronic systems. Technologies of automotive local area network from CAN and LIN can solve the problems of the increasing of wire bunch weight and lack in module installation space. However, the multilayer automotive nets software becomes more and more complex, and the development expense is difficult to predict and to keep in check. [1]

CAN:

Early CAN development was mainly supported by the vehicle industry, as it was used in passenger cars, boats, trucks, and other types of vehicles. Today the CAN protocol is used in many other fields in applications that call for networked embedded control, including industrial automation, medical applications, building automation, weaving machines, and production machinery. CAN offers an efficient communication protocol between sensors, actuators, controllers, and other nodes in real-time applications, and is known for its simplicity, reliability, and high performance.

The CAN protocol is based on a bus topology, and it requires two wires (CANH and CANL) for communication over a CAN bus. The bus has a multimaster structure where each device on the bus can send or receive data. Only one device can send data at any time while all the others listen. If two or more devices attempt to send data at the same time, the one with the highest priority is allowed to send its data while the others return to receive mode [2].

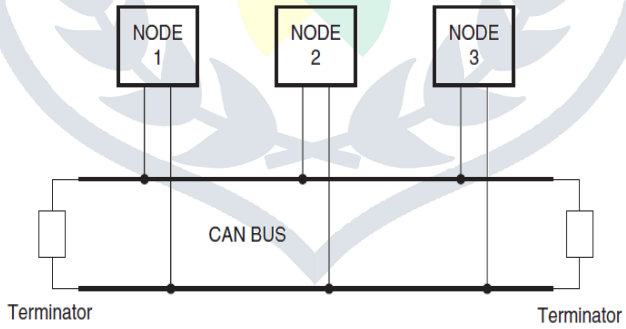

FIG.1 Example CAN Bus

LIN:

The LIN-bus (Local Interconnect Network) is a low cost vehicle bus standard which has been designed to provide simple and low cost bidirectional communication infrastructure for simple peripherals connected to ECUs (Electronic/Engine Control Units).

The LIN-bus is response to the demand for low cost peripherals bus. Its introduction and the first standard preparation goes back to late 1990s. Actual standard revision is freely available from LIN Consortium.

The configuration of a LIN Network consists of a single master and one or several slaves and communicates serially on a single wire. The master initiates all data transfers on the bus. Thus no arbitration scheme is necessary and contention for bus access is not an issue. This leads to deterministic traffic behavior and guarantees the latency times calculated for the specified frames transmitted on the LIN-network. The message frame format of LIN is as shown below.

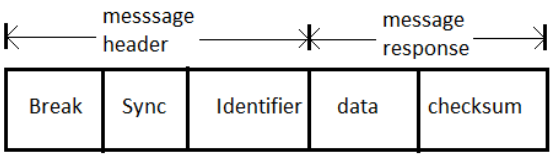

Fig.2 Message frame format of LIN

Message header transmitted by master node while response is attached by either master or slave depends on operation type. Break indicates start of message and sync bit helps the synchronization between master and slave. Identifier consists information about end nodes, action to be filled by slave and data field length. Checksum is used to determine the reception of frame with or without error.

LPC2129: It is based on ARM7TDMI 16/32 bit CPU embedded with high speed flash memory. It can execute 32-bit code at maximum clock rate. The alternate 16 bit Thumb mode helps in reducing the code by more than 30% with minimal performance penalty. It has 64 pin package, various 32-bit timer, 4 channel 10-bit ADC, 2 advsnce CAN channel, with low power consumption.

II. LITERATURE REVIEW

Based on requirements of modern vehicle, in-vehicle Controller Area Network (CAN) architecture has been implemented. In order to reduce point to point wiring harness in vehicle automation, CAN is suggested as a means for data communication within the vehicle environment. The benefits of CAN bus based network over traditional point to point schemes will offer increased flexibility and expandability for future technology insertions.
Real-time, reliability and flexibility, all these characteristics make CAN BUS an indispensable network communication technology applied in automobile network communication field. In this paper, the CAN-bus based communication system for vehicle automation is designed. Software system and hardware system are easily to be expanded and upgraded [4].

Present Automobiles are being developed by more of electrical parts for efficient operation. Generally a vehicle was built with an analog driver-vehicle interface for indicating various vehicle status like speed, fuel level, Engine temperature etc., This paper presents the development and implementation of a digital driving system for a semi-autonomous vehicle to improve the driver-vehicle interface. It uses an ARM based data acquisition system that uses ADC to bring all control data from analog to digital format and visualize through LCD. The communication module used in this project is embedded networking by CAN which has efficient data transfer. It also takes feedback of vehicle conditions like Vehicle speed, Engine temperature etc., and controlled by main controller. Additionally this unit equipped with GSM which communicates to the owner during emergency situations [5]

The better the technology, the more user friendly it becomes. An emergency is a deviation from planned or for expected behavior or a course of event that adversely affects people, property, or the environment. This paper reports a complete research work in accident (automobile) emergency alert situation and emergency service provider. They were able to programmed a GPS / GSM module incorporating a crash detector to report automatically via the GSM communication platform (using SMS messaging) to the nearest agencies such as police station, hospitals, fire services, neighbour, etc, giving the exact position of the point where the crash had occurred. This will allow early response and rescue of accident victims; saving lives and properties. A special Controller Area Network (CAN) bus application layer protocol is designed for the high reliable and high real-time control network of the beam control system. In this paper, messages on the network are classified and the identifier coding, data coding, network management mechanism and physical interface are defined. Basically CAN used in many areas in industry, medical equipments, instrumentation, and any other field. These protocol are used to perform operation in the automotive industry and it plays important role in transmission and receiving unit. These system are used for debugger, editor, compiler and assembler. Then network load analysis for the real-time control network is introduced. Experiment results indicate that the developed CAN control network for the beam control system is very reliable and has good real-time performance and real time low network load rate [6].

In order to keep the communication fast and stable between a variety of control modules, the CAN bus communication system was designed in this paper. CAN bus communication system was designed as follow: the eCAN module of DSP chip TMS320F2407 was applied as CAN controller and the chip SN65HVD230 was applied as CAN transceiver, a variety of control modules was linked by the bus. For illustration, the chassis communication of a security robot is utilized to show how the CAN bus works. Empirical results show that the chassis communication of robot security is fast and stable with CAN bus. The CAN bus communication system designed in this paper can solve the unstable problem in the communication between control modules; it can be promoted to other control system. With excellent characteristics, extreme reliability and unique design, CAN protocol is especially suitable for industrial process monitoring equipment of the interconnections, and has been recognized as one of the most promising field bus[7].

This is an era of automation where replacement of manual efforts are achieved by mechanical power in all degree of automation. Automotive motorized window or door apparatus which closes automatically involve risks for trapping, squeezing or injury to people. They must reverse their movement in case the force applied by the motor gets higher than one normalized limit. In this paper we describe Anti-Pinch Control System for Electrical Window as application of LIN protocol. This paper describes the

possibility and advantages of using LIN as multiplexed electrical system in vehicle.LIN is communication protocol designed for controlling simpler electrical components in a vehicle like sensors, switches etc. [8]

This thesis describes and investigates the possibilities and the advantages of using LIN as a multiplexed electrical system in a modern FH/FM-range Volvo truck. LIN is a communication protocol designed for controlling simpler electrical components in a vehicle, like for example switches, sensors and actuators. In a modern truck there can be up to 20 ECUs controlling various functions such as ABS, gearbox, lighting etc. in the truck. However, today many of the simpler functions in the truck are connected directly to the controlling ECUs and the amount of wiring is therefore substantial. The introduction of a multiplexed network such as LIN would not only cut the wiring cost and weight considerably but also introduce new and more flexible solutions of connecting component in the truck. Investigations have been done concerning the technique behind LIN as well as the hardware and software recourses needed in order to implement LIN-communication between components in the truck. A demonstrational implementation of the LIN-protocol was successfully carried out on the light control panel of a Volvo truck, which enlightens some of the benefits of using LIN. Due to the complexity of the electrical systems in a truck today, an incorporation of a supplementary network such as LIN would not be possible without the support of development tools. Therefore the thesis work takes a look at various tools on the market today and their basic properties and functionality is presented [9].

III. EXPERIMENTAL STUDY

While dealing with the real time applications, the system should be reliable and have high error handling capability. The CAN has a multimaster structure. Hence there is a scope of bombardment of packets into each other if they get transmitted at the same time. When system comes to know about collision it attempts to repeatedly retransmit the packets until it get received by the destination point. This can be seen as the little lack in the reliability of CAN. To make the CAN more reliable we can use the some features of LIN in the CAN. Also we can make CAN single wire bus instead of double wire to make it cost effective.

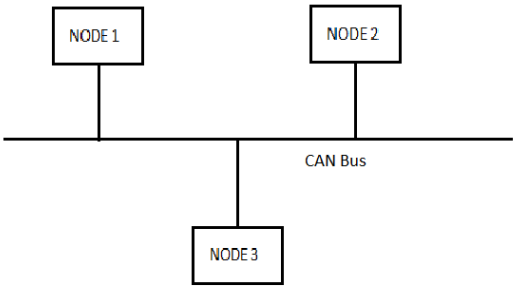

Fig. 4 Single wire CAN bus

If any node wants to transfer the data or wants to become the master it first has to get acknowledge itself for that by sending the data frame.

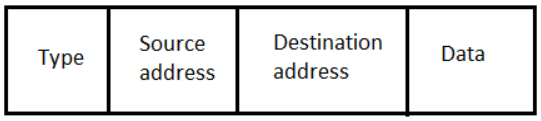

Fig.3 Data frame generalize format

As node becomes master, now it occupies the bus and can communicate safely over bus.
Suppose there are three ARM7 acts as nodes. Use of LPC2129 IC gives us the ease of using CAN bus since it has inbuilt CAN channel.
Assume node 1 wants to become master it first sense the bus and transmits over bus and if no other nodes wants to transmit then node 1 is acknowledged as master. Information send in frame as shown above it consist of type, source address, destination address and data. Type is to know the whether the node is transmitter type or receiver type. Then address of both source and destination nodes. Data may contain any type of information like request or any action regarding command. If node 1 wants to send the data to node 3 then, in type it gives the code of transmitter then address of itself as source address and node 3 address as the destination address. Data field contain information which node1 wants to deliver to node 3. After receiving the frame node 3 acts according to data field information.
Using source and destination nodes address instead of traditional addressing scheme of CAN gives us better performance in speed and reliability. By this we make CAN in one master multiple slaves, where master also can be slave.

IV. FUTURE WORK AND CONCLUSION

The design of electronic system presented here is expected to be compact in size, reliable, high performance, real time, low power consumption and cost effective in Embedded Control and Data Acquisition System based on integrated 32 bit ARM RISC Processor. The design here is used mainly to establish Communication between multiple single chips through single wire CAN Bus which simply gives the advantage over traditional CAN bus.

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