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# LIN Based Lighting Control System for two wheeler vehicles.

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**Abstract— This paper presents the introduction of the LIN (i.e. Local Interconnect Network) 2.0 Protocol in two wheeler vehicles. This technology has never been implemented before in the two wheeler vehicles. The proposed technology would be widely used for controlling lighting system of two wheeler vehicles. It will achieve the reliable communication between the front and rear panel of the two wheeler vehicles. This technique will introduce the characteristics of microcontroller (XC836) and the LIN transceiver (TLE6258) to achieve the put forth objective. The lighting control system will efficiently achieve the data sharing between the both the panels. The proposed system would also solve the space constraints and some reliability problems of the system. It is the integration of network and modern control technology which has many advantages such as a significant reduction body weight and costs, improving the efficiency of fault diagnosis and enhancing the level of intelligent control. The final prototype after testing would effectively replace the existing system by the proposed system for industrial validation.**

***Keywords*- LIN Protocol, Reliable communication, Lighting system, Remote fault diagnosis, Intelligent control of panels.**

## I. INTRODUCTION

In this paper we propose the design and implementation of the LIN Based Lighting control system for two wheeler vehicles. The paper flow will give general description of the lighting control system proposed and the brief introduction of LIN protocol. It would be followed by detailed description of the hardware and software including schematics and flow diagrams. Growing with the enhancing demand to the automotive function, the importance of the electronic body control system stands out increasingly. Traditional body control system employs the centralization of the lighting control system. Increase in the complexity of the existing lighting control system results in overmuch wiring and thus makes the reliability considerations inevitable [1].

CAN bus and LIN bus are the most enduring bus protocols which are applied in vehicular technology. The CAN bus runs as a high-integrity serial data communications bus, often runs real-time critical functions like engine management, antilock brakes, etc. To some simple control objects, however, the bandwidth and versatility of the CAN bus is too powerful and expensive. To meet the need and benefits for an industry-standard protocol, the Local Interconnect Network (LIN) Consortium was founded in 1999 [2]. The LIN specification was originally visualized as a UART-based protocol which would allow the use of inexpensive, readily available components to enable a serial communication standard which is economically feasible for various applications. It is low cost, short distance and low speed sub bus-system to complement CAN in various other automotive applications [3] The protocol's main features are listed below-

1) It is based on Single-Master/Multiple-Slave concept i.e. one master and slaves up to 16.
2) LIN is a single-wire serial communications protocol based on the common SCI (UART) byte-word interface
3) Communication via single wire reduces wiring complexity as well as cost.
4) Baud rate up to 20Kbits/sec.

The LIN bus consists of one master node which has both the master task and the slave task, and several slave nodes each of which has the slave task only. In the LIN network, data is transferred across the bus in fixed form messages of selective lengths. The functions of the master node defines the transmission speed, sending synchronization pulse, data monitoring & switching slave nodes to sleep/wake up mode. The slave node will wait for synchronization pulse,

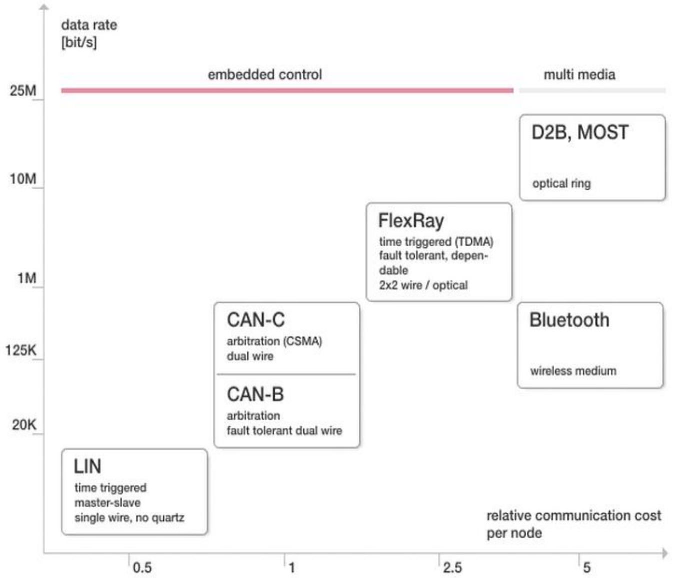


Fig 1. Comparison of various protocols.

synchronize using synchronization pulse and then identifies the message identifier. The master task is to transmit the message header which carries the synchronization and identifier information. The slave responds to this header with data frame [3].Thus the reliable communication is established.

## II. SYSTEM DESIGN

Our proposed system consist of two panels i.e. front and rear panel which represents the corresponding panels of the existing two wheeler vehicles. The LIN bus will establish the communication between both the panels, thus controlling the lighting system present on both the panels. Thus the data transmission between both panels will be completely based on LIN 2.0 protocol. Figure 2 shows the LIN network

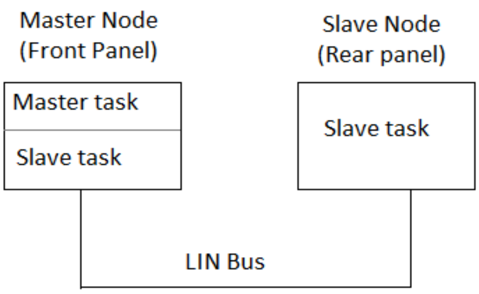


Fig 2. Structure of LIN Network.

In the above figure the master node will be present on the front panel and correspondingly the slave node will be present on the rear panel.

*A. Hardware Design*

The hardware of master node i.e. front panel consists of MCU (Infineon XC836, 8-bit Single chip microcontroller), LIN Transceiver (TLE6258-2G), serial communication, IFX2931(Low Dropout Linear Voltage Regulator) and switching IC's such as-

1) BTS 5020-2EKA (Smart High-Side Power switch)
2) BTS 5120-2EKA (Smart High-Side Power switch, Dual channel)

The rear panel consists of microcontroller IC (Infineon XC836, 8-bit Single chip microcontroller) which acts as slave, LIN Transceiver (TLE6258-2G), IFX2931(Low Dropout Linear Voltage Regulator) and switching IC's such as-

1) BTS 5120-2EKA (Smart High-Side Power switch, Dual channel)
2) BTS 5090-2EKA (Smart High-Side Power switch)

The basic block diagram of the overall system is as follows-

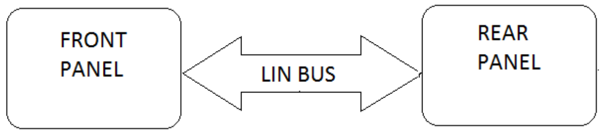


Fig 3 Basic block diagram of overall system

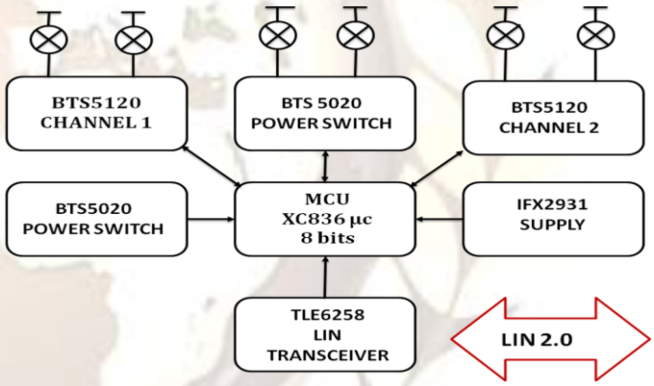


Fig 4 Front panel of the proposed system

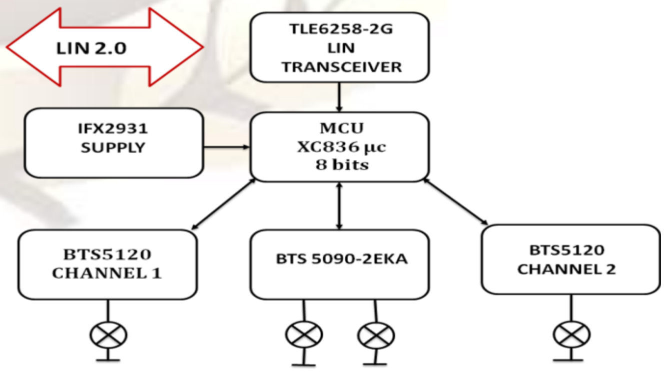


Fig 5 Rear panel of the proposed system

The schematics of the overall system is given below-

The schematics of the front panel is given in Fig 6 and Fig 7

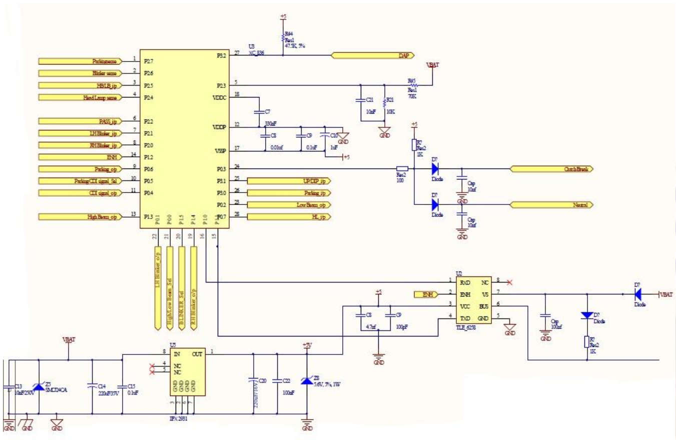

Fig 6. Schematic diagram of interfacing of Master node MCU Part with LIN transceiver.

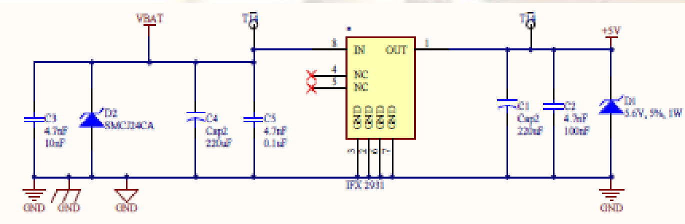


Fig7 .Schematic diagram of the Low dropout voltage regultor.

Fig 7 gives the schematic diagram of the IFX2931 present on the Front panel of the system.

The schematics of the slave node on the rear panel is given below:

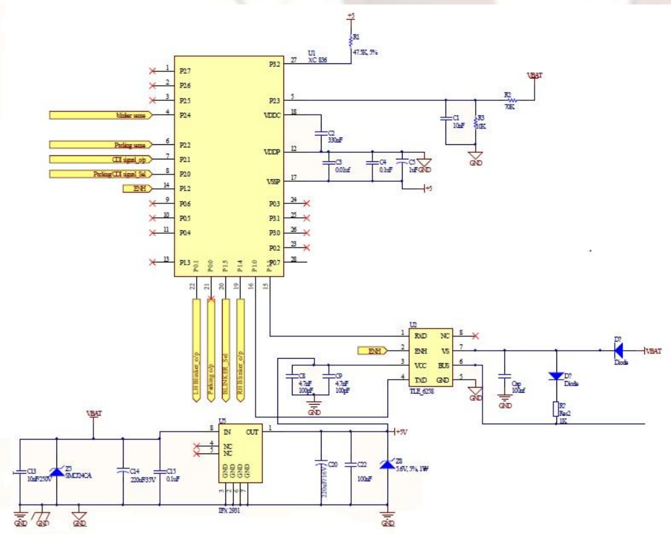

Fig 8. Schematic diagram of Slave node MCU Part with LIN transceiver and voltage regulator.

Fig 8 depicts the schematic diagram of the interfacing the slave microcontroller with LIN transceiver IC and voltage regulator.

*B. Software Design*

The software design will allow the reliable flow of the data between both the panels. As LIN protocol is byte oriented, the data is sent one byte at a time. Thus the signal coming from the switches of the respective panels will be represented in the digital manner. The transfer of the data on the LIN bus will be in the digital form. The frame format of LIN protocol is given the Fig 9

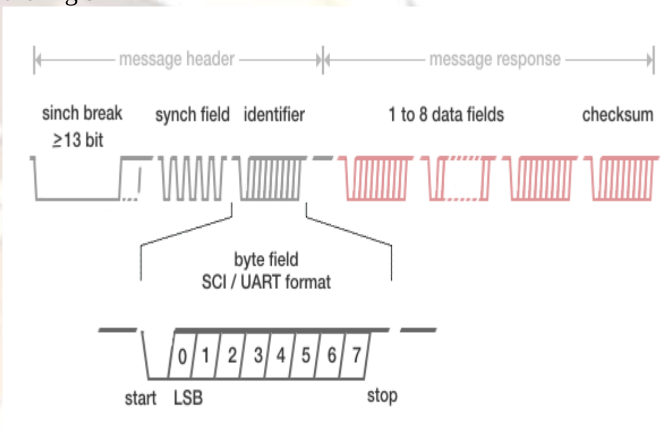


Fig 9. Frame format of LIN protocol.

The initialization of the inner microcontroller register, the I/O port, and LIN transceiver is done firstly and then the program will run into an infinite-cycle. The status of switch which is being pressed is confirmed when the ADC output signal is equal to some desired specific value. Master node will send a frame to LIN bus via LIN transceiver when the signal within the range is detected and then it will request a frame including the error information from the slave node. The remote fault diagnosis will also be implemented in the proposed design with the help of negative feedback system [3].

The software flowchart of the overall design is as shown below-

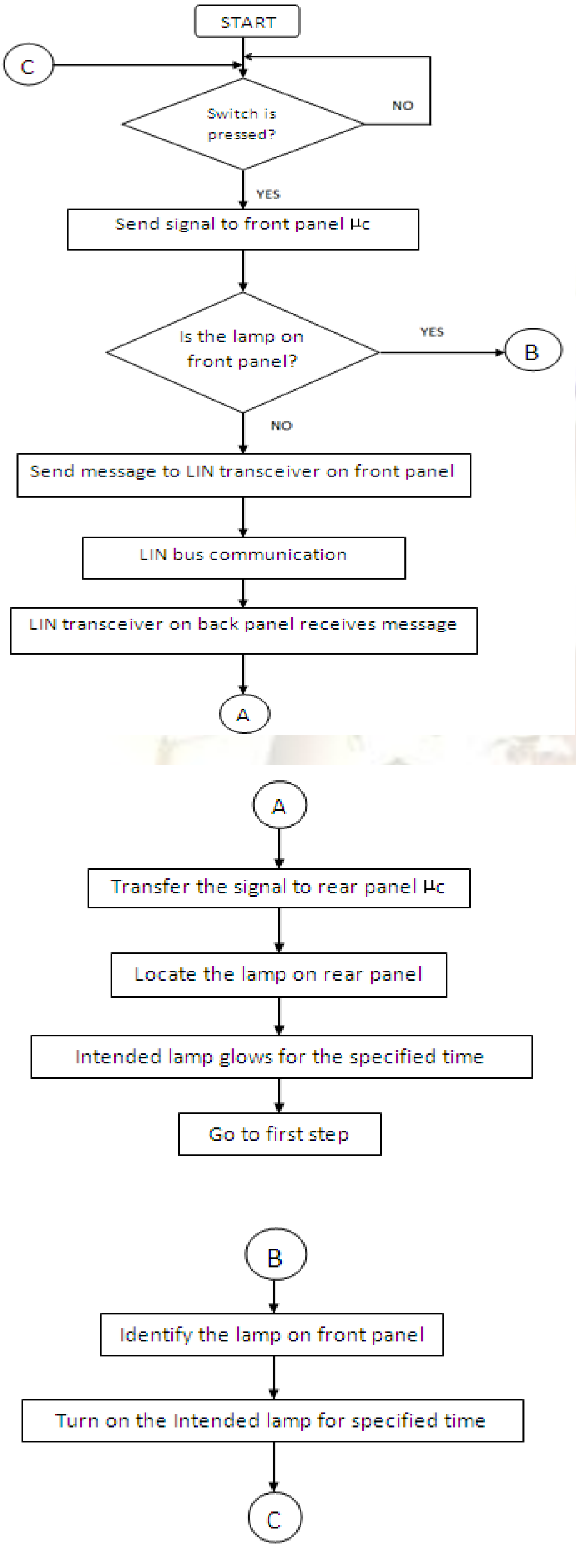


Fig 10.Flowchart of the overall system .

## III. CONCLUSION

In the proposed system, use of the LIN protocol will provide reliable communication between the front and rear panel of the two wheeler vehicle. This system is low cost effective application to the existing problems in two wheeler automotives. It can be applied in the real vehicular network to solve the space constraints and some reliability problems of the system. Thus overall efficiency of the two wheeler vehicles is improved as compared to the present system.

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