Dynamic Scheduling In Automobiles Using Controller Area Network Protocol

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Abstract **-** The Controller Area Network (CAN) is a serial, asynchronous, message based protocol. This protocol is used mainly for connecting electronic control units known as nodes in automotive applications. It needs very high levels of data incorruptibility and rates of data up to one megabit. The use of the controller area network for automobiles communication needs finding appropriate and robust preference levels. This paper proposes various algorithms for the arithmetic calculation of tough preference orders that solve the dilemma of extending presented message sets and dynamic scheduling algorithm for increasing low priority needs. The problem of message scheduling can be removed by producing the message identifiers matched up to every message dynamic in CAN protocol. It shows that the id window changes with every message.

I. INTRODUCTION

The Controller area Network is a serial bus prescript developed by Bosch within the early Eighties. CAN is basically a vehicle bus standard which is used to connect microcontrollers and other devices. This communication is carried out without a host computer. This protocol is based on messages. CAN is a standard for communicating ECU's which are also called electronic control units or nodes. For CAN network to communicate, 2 or more nodes are needed. The message or frame of the CAN consists up of identifiers. These ID's are used to describe the preference or priority of the messages.

In the related work, it is described that how controller area network protocol is used in automotive industry. It can be considered as an intelligent method to guarantee the fair allocation of network bandwidth resources. The dynamic scheduling algorithm guarantees the real time constraints during network data transmission and avoids the low priority without bus control. For vehicle monitoring system, the CAN protocol is implemented using PIC. Supervision of various vehicle parameters e.g. temperature, battery voltage, CO level in the exhaust and light due to spark is done. Also, CAN Bluetooth gateway is used for converting CAN messages into Bluetooth message and then into RF format. The open core CAN IP is needed to update the implementation of EDF algorithm. The use of CAN bus protocol in automobiles for connecting various electronic control units known as nodes is described by QRC algorithm. Up to 40% compression is achieved by QRC algorithm.

II. RELATED WORKS

In (1) the problem was expanding existing CAN messages sets that are added to automotive applications by new messages. The messages which already prevail have fixed identifiers and the necessity is to find a preference order which is feasible where already present messages keep their permanent identifiers. Here the priority levels are allocated to new messages so that they fit themselves in the space involving the priorities levels of fixed IDs messages. In this an algorithm is proposed for performing arithmetic of robust priority levels. The worst case response time is considered using which robust priority algorithm (RPA) is proposed. The algorithm known as RPA-F finds a resilient preference order that selects the message. This message allows the nosiness at each priority level. There is no other feasible preference order that have the fixed identifiers of already present messages and interference is large.

In (2) In order to guarantee that the transmitted messages will not exceed their deadlines, the mechanism of CAN protocol is described in the term of real time message transmission scheduling. CAN is a communication protocol and it is based on message priority. To adjust the network deduced delay while allocating the message identifier, this protocol applies dynamic message scheduling. That is why it can be considered as an intelligent method to guarantee the fair allocation of network bandwidth resources. The dynamic scheduling algorithm guarantees the real time constraints during network data transmission and avoids the low priority without bus control. In this paper the possibility of increasing low priority nodes is discussed. The negative impact on network bandwidth resources and overall system performance is indicated.

In (3) to reduce the frame length of controller area network protocol, CAN message compression method is presented. As period or span of data transmission is proportionate to length of frame, this is required to reduce the length of CAN frame. Bus load increases due to increased number of electronic control units or sensors associated to bus. Bus overload problem can be decreased by applying data compression technique to controller area network data. So signal rearrangement algorithm (SRA) is proposed to obtain

compression efficiency. The use of two message identifier is restricted in the proposed algorithm. The transfer of CAN data are decreased up to 22% with the proposed work. The proposed algorithm can be efficiently used in automotive applications.

In (4) the controller area network bus protocol is used to fulfill the needs of load box test, designs the input/output section of signal and CAN communication part. The dynamic performance of the vehicle depends upon the power of engine. Electronic control unit calculates the injection rate and quantity of fuel. Actuators carry out better fuel control which is driven by ECU. The performance of vehicle depends on ECU of engine and stack box is used to test it. The data transmitted between engine's ECU and load/stack box on the basis of controller area network is realized in this paper and function of ECU is tested. The experiments are showed to prove the ECU control testing programs.

In (5) hybrid electric vehicle's loading services and measurement method are analyzed in the chassis dynamometer. The advancement of chassis dynamometer of amalgam vehicle is considered. It is based on CAN. Chassis dynamometer can test hybrid car vehicle. This testing includes testing of batteries, motors, energy management system and braking energy recovery system. Chassis dynamometer uses DC motor to control its torque for resistance simulation. The driving resistance of vehicle can be simulated by controlling the analog voltage very precisely. Vehicle dynamic resistance can be simulated. The analog voltage of hybrid vehicle is controlled. This research based on chassis dynamometer is conducted to increase the level of hybrid automobiles and car assembly

In (6) this is presented that a wireless attack with large range is physically possible. For this a real automobile and a smart phone application is connected in car environment. A security protocol for controller area network is designed. The driver's smart phone is connected to the CAN automobile. The experimental attack consists of two parts i.e. preface and real attack. In preface attack, an attacker before beginning a real attack first requires data frame of CAN to compel control of the objective vehicle. A protection protocol that can be applied to the car atmosphere is designed after demonstrating the attack model with an examination of liability of CAN based vehicle. The safety and performance of planned safety protocol is analyzed. It is examined through an evaluation based on electronic control units and CANoe. The usefulness of planned security protocol using CANoe software and a DSP-F28335 microcontroller is estimated.

In (7) for vehicle monitoring system, the CAN protocol is implemented using PIC. Supervision of various vehicle parameters e.g. temperature, battery voltage, CO level in the exhaust and light due to spark is done. Temperature sensor LM35 is used to measure electrical output dependent on temperature. Light dependent resistor (LDR) is used to measure light intensity. It is a variable resistor whose value is inversely proportional to incident light intensity. Gas sensor is used to find different combustible gases, especially methane. For implementing these sensors, the programming of LCD, LED, and interfacing of ADC with microcontroller is done using embedded C. Proteus schematic software is used to get simulation results.

In (8) a CAN to Bluetooth gateway is used by which a CAN message is converted into Bluetooth message. It is necessary to achieve wireless communication via Bluetooth modules on one hand and on the other hand it is important to maintain the reliability of communication offered by CAN, the wired network. A lab car is used for experimentation which introduces the Non-line-of-site (NLoS) paths and closed environment between Bluetooth modules. In automobiles, sensors/switches and ECUs are connected using CAN. Within CAN a message is available to all or no nodes and this is called message broadcasting. 'CANblue' modules are used to convert CAN message to Bluetooth format and is modulated into RF format. An optimal solution to reduce the latencies is provided in this paper.

In [9] the main focus is on establishing the earliest deadline first (EDF) scheduling technique. The problem of high CPU overhead occurs due to continuous priorities updates at each scheduling level. An approach to reduce overhead of CPU by carrying out earliest deadline first scheduler dedicated hardware is explained as well as is further embedded within the open core internet protocol CAN controller. The hardware execution of the earliest deadline first algorithm resolves high CPU overhead problems as overhead is shifted. This overhead is shifted from software to hardware. At the start of each arbitration level, the hardware execution updates the message identifier accurately which is impossible in software implementation. The open core CAN IP is needed to update the implementation of EDF algorithm. This algorithm do not introduces CPU overhead.

In (10) use of CAN bus protocol in automobiles for connecting various electronic control units known as nodes is described. In [10] CAN base quotient remainder compression algorithm are described. This is used in automotive applications. The basic idea is division in QRC algorithm. As length of CAN data frame is of 8 bytes, the first byte is known as compression information byte (CIB). The algorithm has two parameters as GE5 parameter and L5 parameter. The GE5 parameters describe temperature of engine, pressure of tyres or vehicle speed. Parameters in this category are QR compressed. Up to 40% compression is provided by QRC algorithm. The L5 parameters indicate the gear status. The compression ratio of QRC algorithm is equivalent to earlier data reduction (DC) and enhanced data reduction (EDC) algorithm.

III. CONCLUSION

By activating the IDs corresponding to every message, the problem of message arrangement in Control Area Network bus protocol can be untangled. This shows that with each message the identifier window changes. These message IDs are selected from an already described window message ID. The worst case response time is considered and with the help of which robust priority algorithm is proposed. Signal rearrangement algorithm (SRA) is proposed to obtain compression efficiency. The driving resistance of vehicle is obtained. Using a CAN to Bluetooth gateway, CAN message is firstly converted into Bluetooth message and after that converted into RF format.

IV. REFERENCES

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