IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 10, S.Iss 1, 2021

Design and Implementation of WIU for CAN/WLAN/ AN Bridge

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Abstract

The integration of wired and wireless technologies into hybrid networks has become a prominent research topic due to the increasing demand for wireless networks in industrial applications. Hybrid networks exhibit varying delay characteristics depending on the technologies involved. This paper represents the blueprint and execution of a Campus area Network/Wireless Local Area Network / a Campus area System for network interaction. The framework utilizes Wireless Interworking Units (WIUs) to link distant nodes that support the CAN 2.0B standard across an IEEE 802.11b Wi-Fi network. The objective is to enable reliable and efficient communication between Controller Area Network (CAN) segments across wireless local area networks, leveraging the strengths of both technologies., offering a practical solution for expanding the distributed area of CAN networks. This method promotes interaction among CAN networks and various Local Area Networks (LANs) by leveraging the least technology with the highest data transfer speeds.

Keywords - Campus area Network/Wireless Local Area Network

INTRODUCTION

Development and Application of a Cross-Platform Interworking System Through Wireless Communication Devices. The increased prevalence of multiple CAN (Controller Area Network) networks in recent organizational contexts requires the integration and synchronization between these networks, as well as the connection between CAN and other significant public or private networks [1-4]. The Controller Area Network (CAN) is extensively employed in distributed, real-time control systems, especially in the industrial and automotive sectors, owing to its resilience, dependability, and predictable communication features. Nevertheless, its wired dependency restricts its accessibility and adaptability. By incorporating CAN with Wireless Local Area Networks (WLAN) through the use of Wireless Interworking Units (WIUs), it's possible to broaden the accessibility and adaptability of CAN networks while ensuring consistent communication.

BACKGROUND: CAN and IEEE 802.11 WLAN References [5] and [6] provide a comprehensive overview of CAN features, which can be summarized as follows:

High-Speed Serial Interface: Enables rapid data transmission.

Low-Cost Physical Medium: Affordable infrastructure for network setup.

Short Data Lengths: Efficient for short messages.

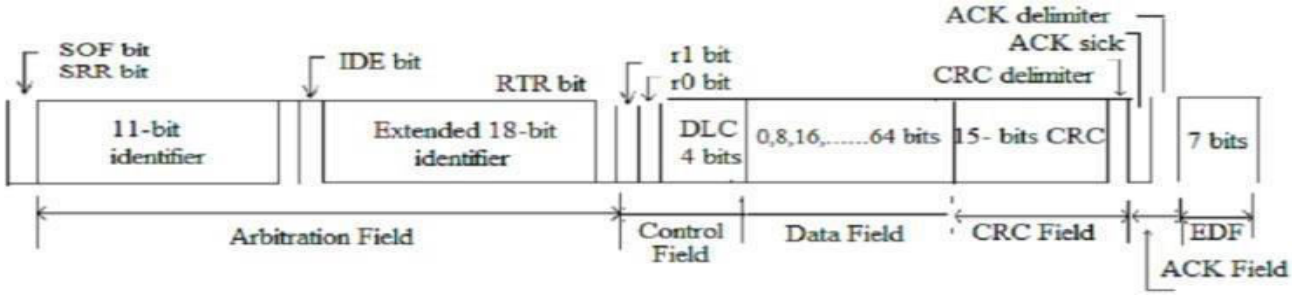
Fast Reaction Times: Quick response capabilities.

High Level of Error Detection and Correction: The Controller Area Network (CAN) is a

robust vehicle bus standard designed to facilitate communication among various electronic components within vehicles without a host computer. Developed by Bosch in the mid-1980s, CAN has become a standard in automotive and industrial applications due to its reliability and efficiency in real-time data transmission.

Robustness: CAN is designed to operate in harsh environments and is resistant to electrical noise.

Deterministic Communication: Ensures that messages are transmitted with precise timing, which is crucial for real-time control applications.



High Level of Error Detection and Correction: Implements multiple layers of error detection and correction mechanisms, ensuring data integrity.

Fig.1 CAN2.0B message format

IEEE 802.11 WLAN is a local area network that operates wirelessly, offering mobility and cost-saving advantages in installation. This integration can be particularly beneficial in applications requiring robust real-time communication over extended distances or in environments where physical wiring is impractical. The design and implementation of such an interworking system involve addressing challenges related to protocol translation, data integrity, and maintaining the real-time capabilities of CAN over a wireless medium.

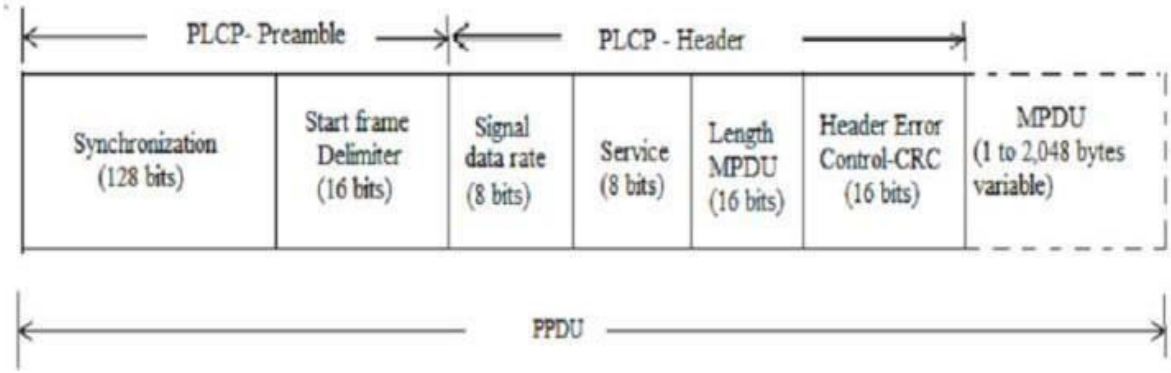


Fig.2 IEEE802.11B dssspclp packet format

CAN-BLOCK DIAGRAM OF CAN/IEEE802.11B/CAN

WIUUNIT This Wireless Internetworking Unit (WIU) enables interaction among two CAN2.0B networks utilizing IEEE 802.11b. The WIU contains two terminals, each equipped with a unique protocol, frame/message structure, and the process for receiving and sending frames. Consequently, the tasks needed at each terminal of the WIU vary. Charts 3 and 4 display the two CAN networks exchanging messages through WLAN.

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Fig.3 CAN Network1 with WIU

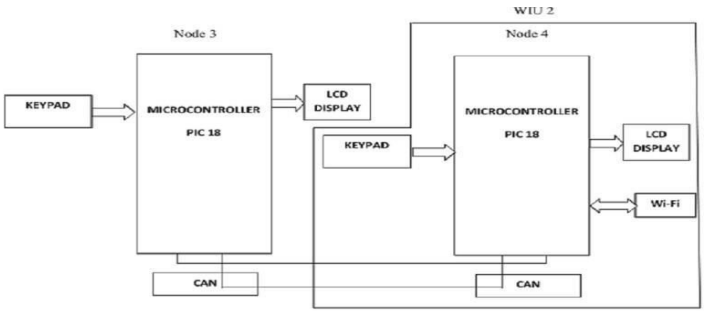

Fig.4 CAN Network 2 with WIU

Functionality of the Wireless Internet Networking Unit Unitis reveals that by integrating Protocol Data Units (PDUs) from CAN messages with WLAN technologies, the advantages of both can be combined:

Increased Distance and Versatility: WLAN has the ability to enhance the communication capabilities of CAN networks by wirelessly connecting distinct CAN segments.

Enhanced Mobility: Devices connected through WLAN can move freely within the network range, enhancing flexibility in industrial and automotive applications.

Cost-Effectiveness: Reduces the need for extensive wiring, lowering installation and maintenance costs.

Scalability: WLAN can support a larger number of devices and nodes, making it easier to scale the network as needed.

Intense Error Checking and Fixing Capabilities: Both CAN and WLAN utilize strong error checking and fixing systems, guaranteeing dependable communication throughout the connected network.

CAN NETWORKS

Campus area Network -to- Campus area Network communication and Campus area Network -to-Wi-Fi, and Wi-Fi-to- Campus area Network communication. The proposed communication scheme between these networks involves the following algorithms:

Campus area Network -to- Campus area Network Communication: This is the direct communication between nodes in the two Campus area Network.

Campus area Network -to-Wi-Fi and Wi-Fi-to- Campus area Network -to- Campus area Network Communication: This involves interaction where Campus area Network -to- Campus area Network nodes communicate with each other through a Wi-Fi network.

The networks, as shown in Figures 3 and 4, consist of four nodes. The algorithms detailing the communication processes for each node are as follows:

Node 1 and Node 3: The algorithm for these nodes is depicted in Figures 6(a) and 6(b).

Node 2 and Node 4: The algorithm for these nodes is illustrated in Figures 7(a), 7(b), 7(c), 7(d), and 7(e).

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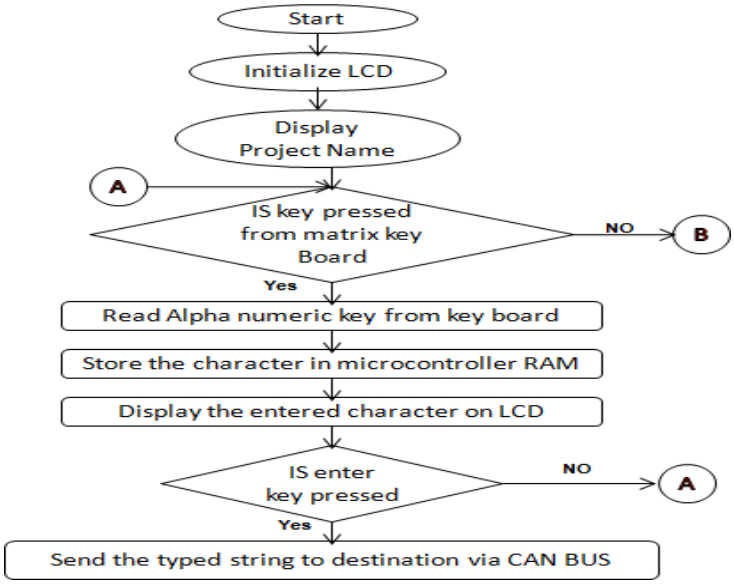

Fig.6 (a) algorithm for node1 or 3

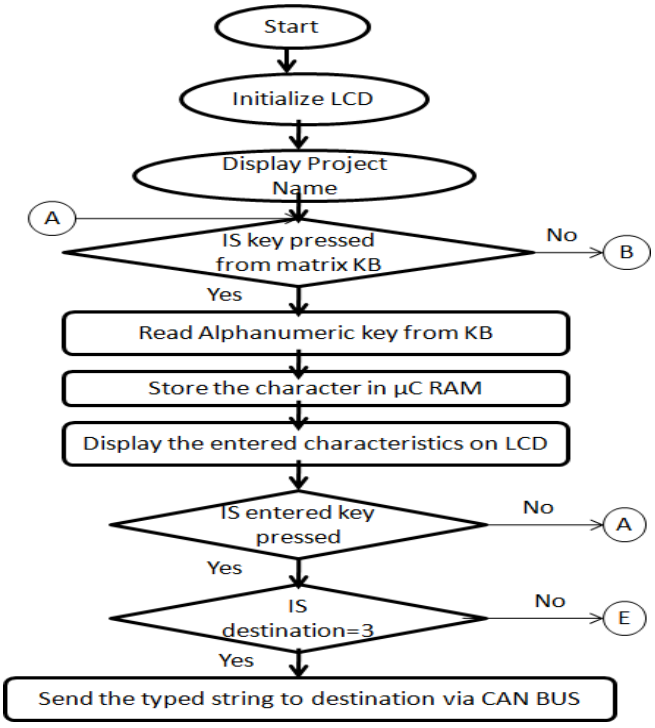

Fig.7(a) algorithm for node 2 or 4

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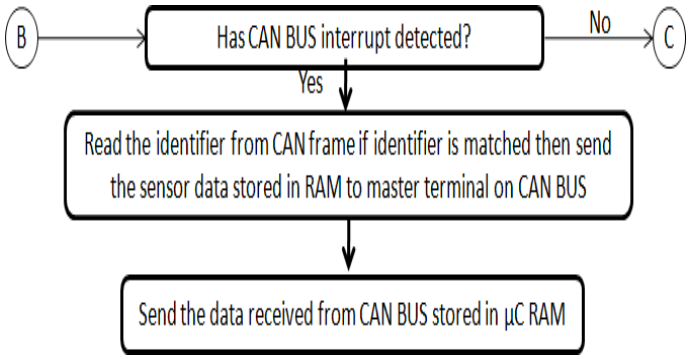

Fig.7(b) algorithm for node 2or4

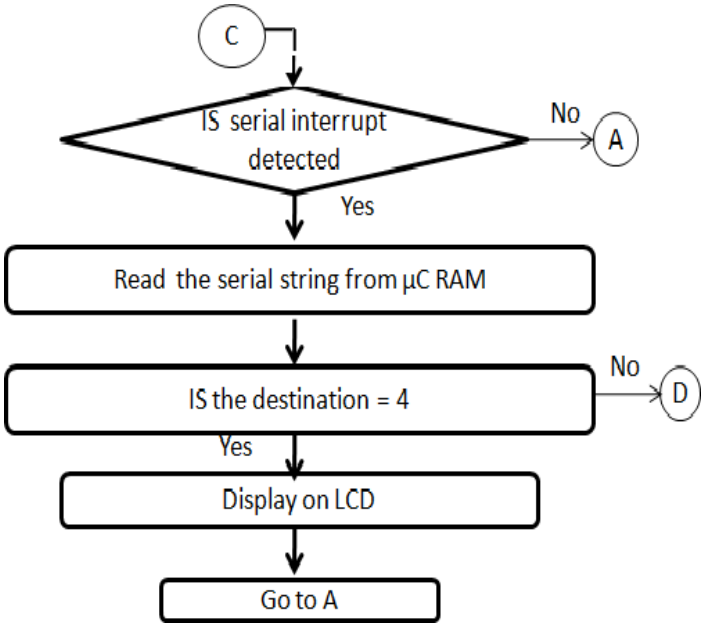

Fig.7(d) algorithm for node 2or4

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Fig.7(e) algorithm for node 2or4

CONCLUSION

The goal of this task is to propose the make and implementation of a he Campus area Network /Wire Local Area Network / Campus area Network interworking system is designed to bridge Controller Area Network (CAN) segments using Wireless Local Area Network (WLAN) technology. Co-related of different CAN 2.0B component via an IEEE 802.11b WLAN. Given the widespread use of CAN nodes in various industrial applications, there is an increasing need for such wireless internetworking solutions to enhance flexibility and enable remote control of these applications.

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