Design and Development of a CANopen-Bluetooth Gateway

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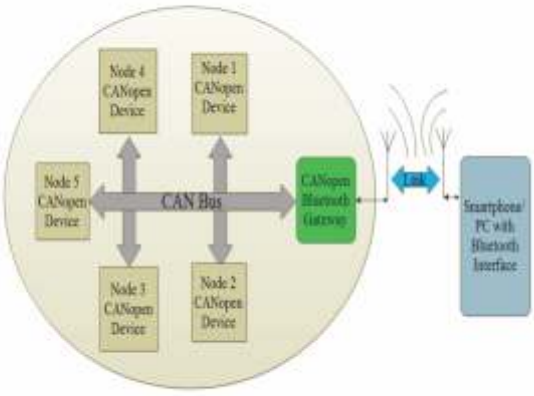
Abstract:

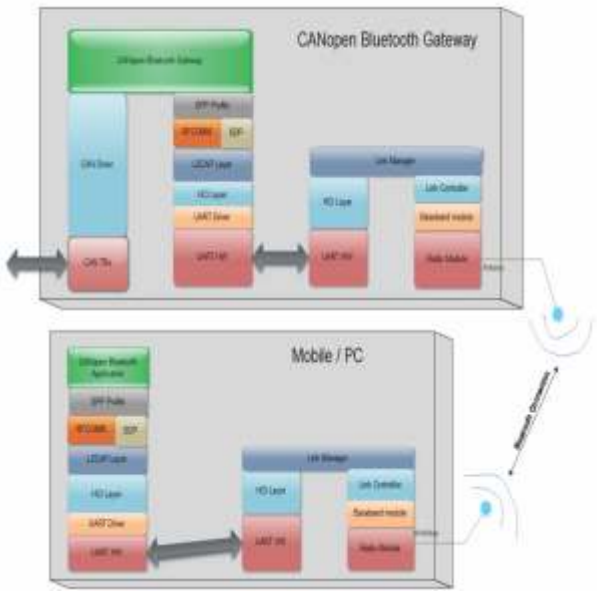
CANopen is an application layer protocol that uses the CAN physical layer. For CANopen to be used in applications that involve elements such as diagnostics and calibration correction, it needs a separate device that has to be part of the CAN network. This may not be feasible or user friendly in situations that mandate remote diagnostics. The solution to this problem is to provide a mechanism that allows wireless access to the remote devices on a CANopen network, using wireless communication protocols. The first step for such a technology is the development of a gateway that allows interconnection of networks with different network protocols by performing required protocol conversions. No such realisation is reported in literature.

This project deals with the design and development of a CANopen-Bluetooth gateway to enable communication between the nodes on a CANopen network and a Bluetooth device. The gateway is mounted on the CAN bus such that it can access CANopen nodes and query required information on the bus using the Bluetooth Serial Port Profile (SPP). The CANopen frames are packed into a generic frame of the Bluetooth SPP. Any CANopen device node will accept only corresponding SDO requests. Suitable modifications are done at CAN Driver and CO_SDO module of the existing open-source CANopen stack. On the Bluetooth side, all the commands that are transmitted or received are in the form of command frames which are sent as a part of payload under the SPP profile.

The developed gateway was tested and verified against the functional requirements and its performance analysed. The results show that the gateway can connect to one Bluetooth device at a time, carrying out full duplex SDO (Service Data Object) and half duplex TPDO (Transmit Process Data Object) communication. The overall gateway functionality was achieved within 2 ms, of which the communication overhead was 1.5 ms. The current gateway implementation does not provide any security mechanism while connecting with a Bluetooth node, this may be an interesting area of future work to look into, especially considering the latency requirements of the gateway.



CANopen-Bluetooth gateway block diagram



CANopen-Bluetooth gateway layers