Automotive Technology

VE/TI Lab

Experiment 4

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4. CAN-LIN Gateway (Part 2)

In the previous part, we have activated the keypad via LIN bus and we have visualized the pushing of the hazard lights button in CANoe. In the following part, we will activate the instrument cluster and show the hazard lights function both visually and acoustically on this component.

Sending and Receiving LIN messages with a development ECU

4.1. Introduction

- Revise the chapter dealing with the CAN bus in your lecture documents.

a) How is a CAN message set up?

A Controller Area Network (CAN bus) is a robust vehicle bus standard designed to allow microcontrollers and devices to communicate with each other in applications without a host computer. It is a message-based protocol, designed originally for multiplex electrical wiring within automobiles to save on copper, but is also used in many other contexts. All nodes are connected to each other through a two wire bus.

b) What does stuffing bit mean and what is its polarity?

Bit stuffing is the insertion of non-information bits into data. It is used for various purposes, such as for bringing bit streams that do not necessarily have the same or rationally related bit rates up to a common rate, or to fill buffers or frames. The location of the stuffing bits is communicated to the receiving end of the data link, where these extra bits are removed to return the bit streams to their original bit rates or form. Bit stuffing may be used to synchronize several channels before multiplexing or to rate-match two single channels to each other. The polarities are 0 and 1.

c) How is the messages' possible collision on the bus avoided?

Logical collisions can be avoided *completely* by making source node ID a part of arbitration field and enforcing node ID uniqueness. More often message IDs are carefully mapped by their priority *in particular application* and further distributed between *nodes with different functions* so that each node can only send messages within its own unique range. This approach further reduces chances of collision.

d) What are the properties of the CAN bus concerning interference immunity?

CAN transceivers must be able to survive the high energy surges produced by transient voltages. Transceivers are available that meet the minimum ISO 7637 specifications; however, a higher immunity level can be achieved using protection circuits. The increased immunity level provides for a more robust communication system

e) What are the electrical connections needed for the CAN bus?

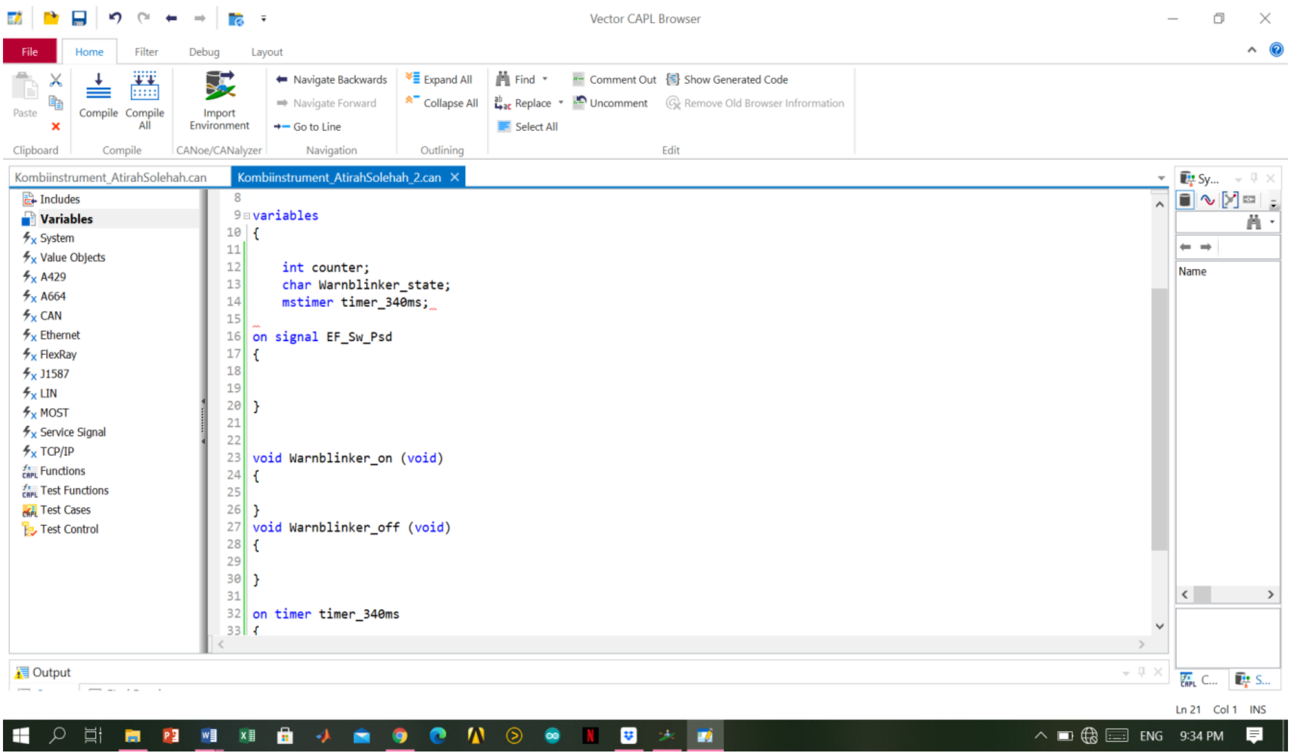
A terminating bias circuit provides power and ground in addition to the CAN signaling on a four-wire cable. This provides automatic electrical bias and termination at each end of each bus segment. An ISO11783 network is designed for hot plug-in and removal of bus segments and ECUs.

4.2. Connecting the CAN/LIN network

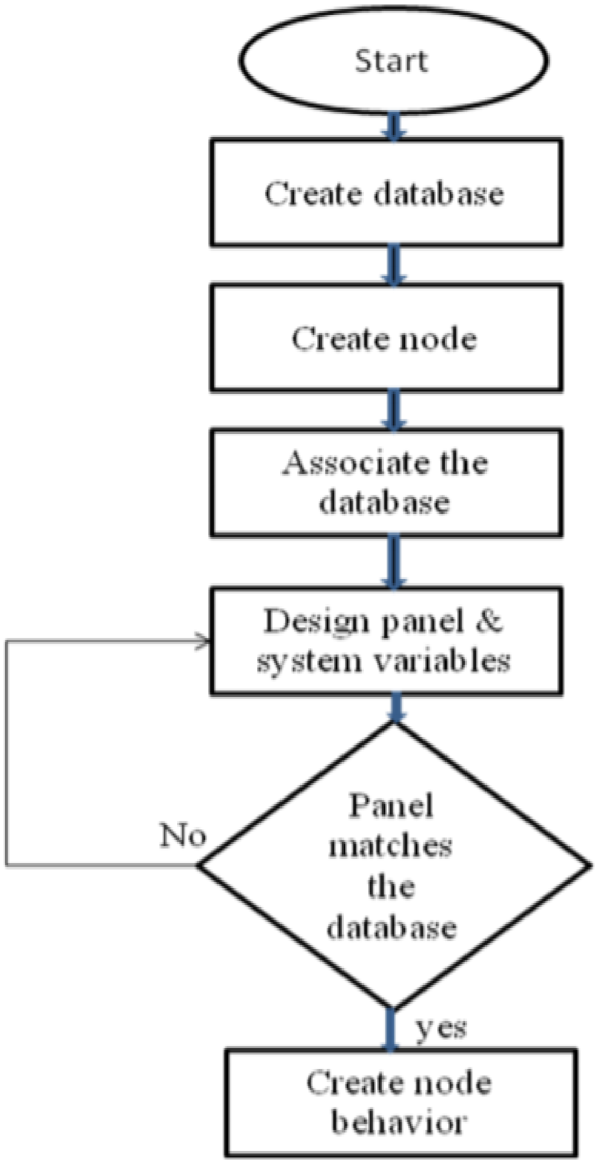
In order to use the state of the hazard light (on the LIN keypad) in both networks, it is necessary to save the value into a global variable (system variable). System variables can be administrated in CANoe via *environment -> system variables*. The system variable Status_Warnblinker used here has already been created in your configuration.

- Extend your CAPL code already created for the LIN keypad by adding the system variable Status_Warnblinker. When the hazard light is activated, the variable should have the value 1, otherwise, the value 0.

- In the next step, connect the CAPL file Kombiinstrument.can with the network node and open the source code afterwards.



- Create the following function that you will visualize in a flowchart at first.



Please consider the following constraints:

- The state of the ignition will be activated durably from the start of the measurement on. Use an appropriate event handler for realizing this.
- The request for the lights' flashing (*message "TIM"*) should take place every 680 ms, the duration (*TurnLampONdur*) should be 340 ms.
- Please take into consideration that the flashing of the two control units should occur simultaneously.