CAN Project 2018

The aim of this project is to build a network comprising a master node and up to 7 standard (i.e. not master) nodes. The master will be in charge of setting up the network. Then, any node can send a message to any other node which will display its contents and perform the appropriate action.

1 General specifications and constraints

- Each node is a group of two people.
- To each node will be assigned a unique identifier (nodeID) in the range 1 to 15 (decimal).
- Each node can be either master or standard node without code modification.
- In the network, the role of master is drawn at random.
- Only base frames will be used, that is 11 bits message identifiers (msgID).
- Polling the MCP2510 to check for new messages is strictly forbidden: any new message must generate an interrupt.

2 Scenario of network operation

There are two successive modes of operation: scan mode and normal mode.

2.1 Scan mode

Upon reset, the node to which is assigned the master role initiates a network scan. During this scan, the master sends wake-up messages which contents cycle through all possible nodes ID. When a standard node recognizes its own node ID, it sends an acknowledge message. The master is therefore able to set up a list of the node ID of all the active nodes in the network. This list is then broadcasted to all the nodes in the network.

- Scan mode begins upon action on SW9 (I2C section)
- Scan mode starts at least 5 seconds after reset to allow the other nodes to set-up.
- A node must answer within 2 seconds after wake-up reception. It is otherwise considered disconnected and is not allowed to join the network in normal mode.

msgID	action	Data field contents	Message length (bytes)
0x100	Wake-up	nodeID	1
0x101	Acknowledge	nodeID	1
0x102	Node list	NodeID (including the master)	2 to 8

2.2 Normal mode

After receiving the active nodes list, all the nodes enter the normal operation mode (i.e. the node to which was previously assigned the master role becomes now a standard node and has no special privilege). In this mode, any node can send a message to any other node belonging to the network. The recipient then displays the message ID, the sender node ID, the contents of the message and executes the prescribed action. Normal mode is the only operation mode until the next reset.

- The sender chooses the node ID of the recipient from the previously received list. The potentiometer will be used to scroll through the list, a switch selects the desired ID

(remember that the list includes 2 to 8 items, depending on the network configuration).

- The message ID is the sum of the base ID (0x200) and the node ID of the sender.
- The contents of a message is:
  - 1st byte: recipient node ID
  - 2nd byte: operation code (see opCode table below)
  - 3rd byte (when applicable): data (8 Least significant bits)
  - 4th byte (when applicable): data (2 or 4 most significant bits)

opCode	Initiated by	Sender action	Recipient action	Message length (bytes)
0x00	SW8, SPI section	Sends SW9..SW12 status	Writes to SPI LEDs	3
0x01	SW7, SPI section	Sends SW9..SW12 status	Writes to I2C LEDs	3
0x02	SW6, SPI section	Asks for potentiometer value	sends potentiometer value	2
0x03	Message with opCode 0x02	sends potentiometer value	Writes the received value to LCD display (decimal)	4

For switches, the data byte has the following format:

Bit 7							Bit 0
SW9	SW10	SW11	SW12	X	X	X	X

SWx = 0, switch pressed SWx = 1, switch released

switch	Corresponding LEDS
SW9	LD9 or LD5
SW10	LD10 or LD6
SW11	LD11 or LD7
SW12	LD12 or LD8

LDx = 0, LED off LDx = 1, LED on

WARNING: On the receiver side, the LED must be on when the corresponding switch is pressed on the transmitter side.

For example, node 0x1A wants to ask potentiometer value of node 0x20:

- The message sent by 0x1A will have its identifier msgID= 0x21A (0x200 base ID + 0x1A sender node ID), the first data byte set to 0x20 (recipient node ID) and the second byte set to 0x02 (opCode).
- Assuming a potentiometer value of 0x37C, the answer from 0x20 will have its identifier msgID= 0x220 (0x200 base ID + 0x20 sender node ID), the first data byte set to 0x1A (recipient node ID), the second set to 0x03 (opCode), the third set to 0x7C (8 least significant bits) and the fourth set to 0x03 (the 2 most significant bits).

3 Hints

- Do not attempt to write all the code at once. It is advisable to work with (and save) many versions of code, each with increased functionalities.
- For sake of simplicity, use CAN bus timing parameters given in the examples.
- Warning: the MCP2051 and the MCP23008 use the same interrupt vector (INT0).