Battery management system

This part of my graduation project focuses on creating a battery management system for 4p7s battery pack with approximately 8.8 Ah. It uses a board based on bq76PL455A IC (see figure 1) from Texas Instruments as slave circuit that monitor the cell voltages and temperature and battery current. Also, it detects faults and send it to master MCU. The master MCU we used was C2000 microcontroller and the following are description for master software:

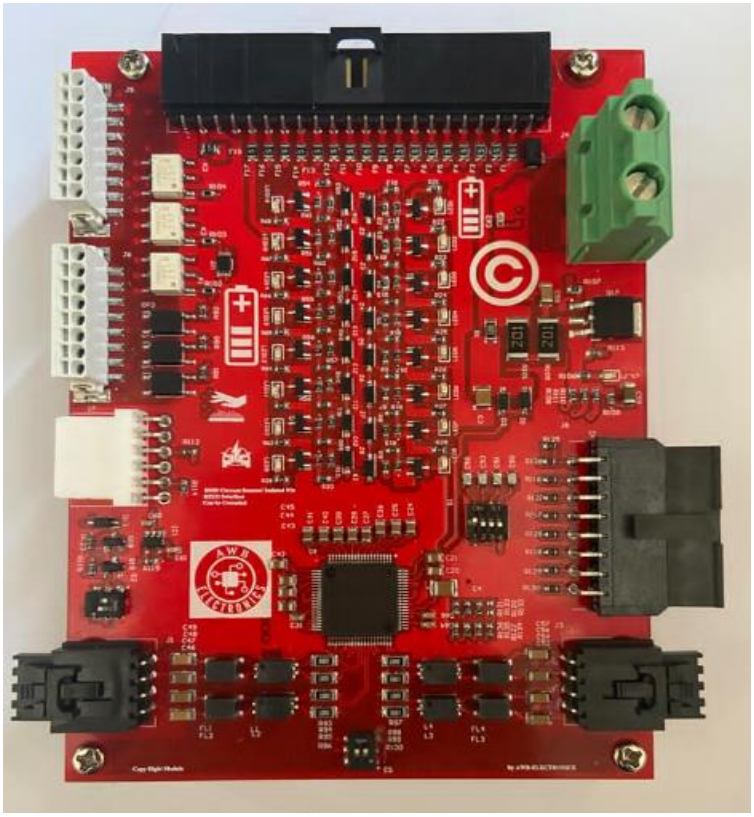

Figure 1: bq76PL455A board

Software description

1. Master BMS software inputs:

Name	**Data type**	**From**
StateRequest	enum	UART (from touching screen)
Cell_Voltages	uint16 (will be converted inside SW)	UART (from BQ board)
Cell_Temperatures	uint16 (will be converted inside SW)	UART (from BQ board)
Pack_Current	uint16 (will be converted inside SW)	UART (from BQ board)

Pack_Voltage	uint16 (will be converted inside SW)	UART (from BQ board)
Fault	Boolean	GPIO pin from BQ board

2. Master BMS software outputs:

Name	Data type	To
PosContactorChgrCmd	Boolean	Contactor
PreChargeRelayChgrCmd	Boolean	Contactor
NegContactorChgrCmd	Boolean	Contactor
PosContactorInvtrCmd	Boolean	Contactor
PreChargeRelayInvtrCmd	Boolean	Contactor
NegContactorInvtrCmd	Boolean	Contactor
BMS_State	enum	Touch screen through UART
Current Limits	single	To other blocks inside SW
BalCmd	uint16	BQ board through UART
SOC	single	Touch screen through UART
Wake command	Boolean	Pin to BQ board

3. Master BMS software architecture.

The software is divided into 5 modules:

1- **State machine**: This block is responsible for determining the state of the BMS, sending this information to other blocks. Also, based on this information, it controls the switching of the contactor.
2- **Current & power limit block**: it calculates the maximum charging and discharging current and send this information to fault monitoring block.
3- **SOC estimation**: it estimates the state of charge of the battery using extended Kalman filter.
4- **Balancing Logic**: This block generates balancing commands based on the cell voltages information.
5- **Fault monitoring**: This block is responsible for collecting the sources of faults and based on these sources sends one signal to state machine block.