Application Notes for the VMS and GBTS

1. The VMS: Includes three major parts. Which are

Cell voltage monitor with warning buzzer, over-high, and over-low signal outputs.

Balance during charging, referring to cell-voltages, compensated by historical records.

Digital interface able to communicate with the GBTS, diagnostic PC, dedicated charger, and power controller.

The VMS is built in functions of the cell voltage monitor, balance during charging, and digital interface. The digital interface of the VMS includes signals of OVP (over voltage protection, OVP/OHV), LVP (low voltage protection, LVP/OLV), and UART interface. This UART interface is used to communicate with the GBTS or the diagnostic PC, and it is allowable to be directly serially connected.

The balance criterion used in this VMS is comprehensive to deal with all of possible cell-statuses. And its target to make sure all cells controlled by this VMS to be fully charged at same time.

Its functional block is shown in following figure.
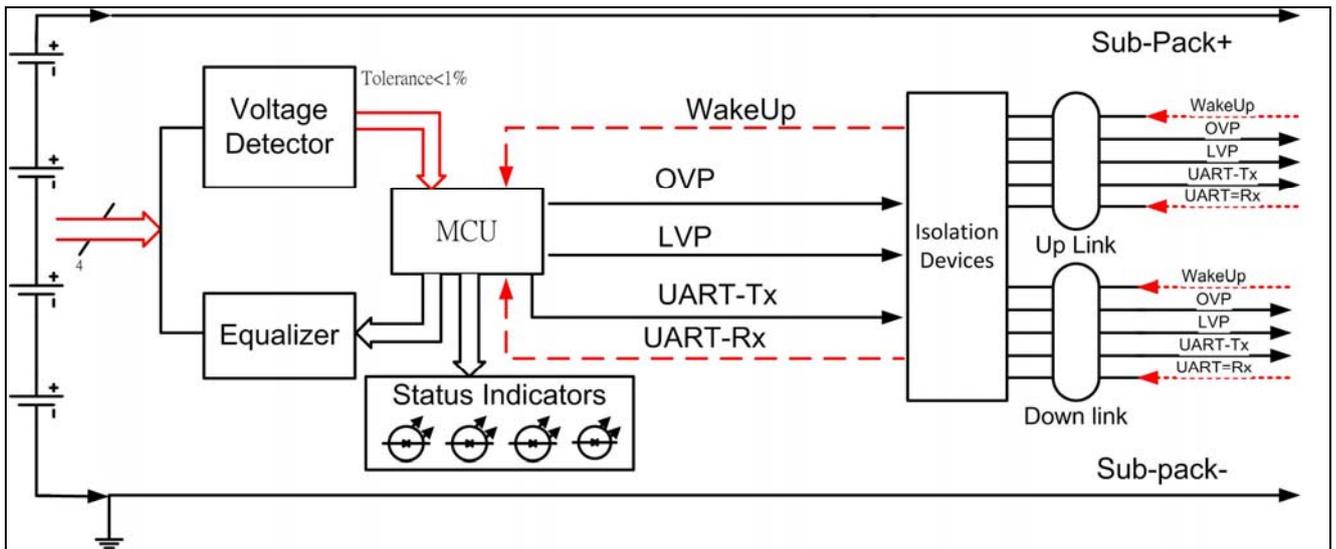
a. Voltage level signals: which is put on the topside of battery pack. There are 4pcs of LEDs used as the pack voltage indicator. Normally, the last led, green one, and shall be turned on under wake-up condition. If not, please charge your battery pack as soon as possible.

Pack Voltage V>13.2V 🟠🟠🟠🟢

Pack Voltage 12.6V<V<13.2V 🟠🟠🟢

Pack Voltage 12.0V<V<12.6V 🟠🟢

Pack Voltage 11.4V<V<12.0V 🟢

Pack Voltage<11.4V

b. Warning Buzzer:

● Buzzer noise 3 times in long cycle: which is to notice the battery cell voltage is close to the limited-operating voltage (up voltage or low voltage).

● Buzzer noise in short cycle until battery energy is pretty low: Battery cell voltage is over the normal operation condition (fully charged or fully discharged). Please cut-off outer power connector as soon as possible, no matter it is the charger, or power controller. Under such condition, there is one of over/low signal output. If your system takes those two signals to control your

charger or power controller, your charger or power controller shall cut off automatically.

c. Over/low voltage signals:

- As your battery voltage is fully charged, the OVP (OHV) led is turned on your battery pack. If the OVP (OHV) led is turned on and your charger still works, please manually cut off your charger, and contact your charger provider.

- As your battery voltage is fully discharged, the LVP (OLV) led is turned on your battery pack. If the LVP (OLV) led is turned on and your power controller still works, please manually cut off your power controller, and contact your controller provider.

- They are signal-level. Current driving capacity I_{OH}: 5mA, I_{OL}: 1mA, V_{OH}: 4.2V, V_{OL}: 0.2V

- OLV(LVP): is used to shut down the vehicle controller. As the OLV is high, that warns the cell voltage is too low. Therefore, they vehicle controller shall shut down to prevent the battery from over-discharging risk.

- OHV(OVP): is used to cut-off the charger, As the OHV is high, that warns the cell voltage is too high. Therefore, the charge shall cut-off the output to prevent the battery from over-charging risk. Please note the OHV is a signal only. The OHV is not able to drive a relay. But you may use this signal to drive a photo-coupler, photo-MOSFET.
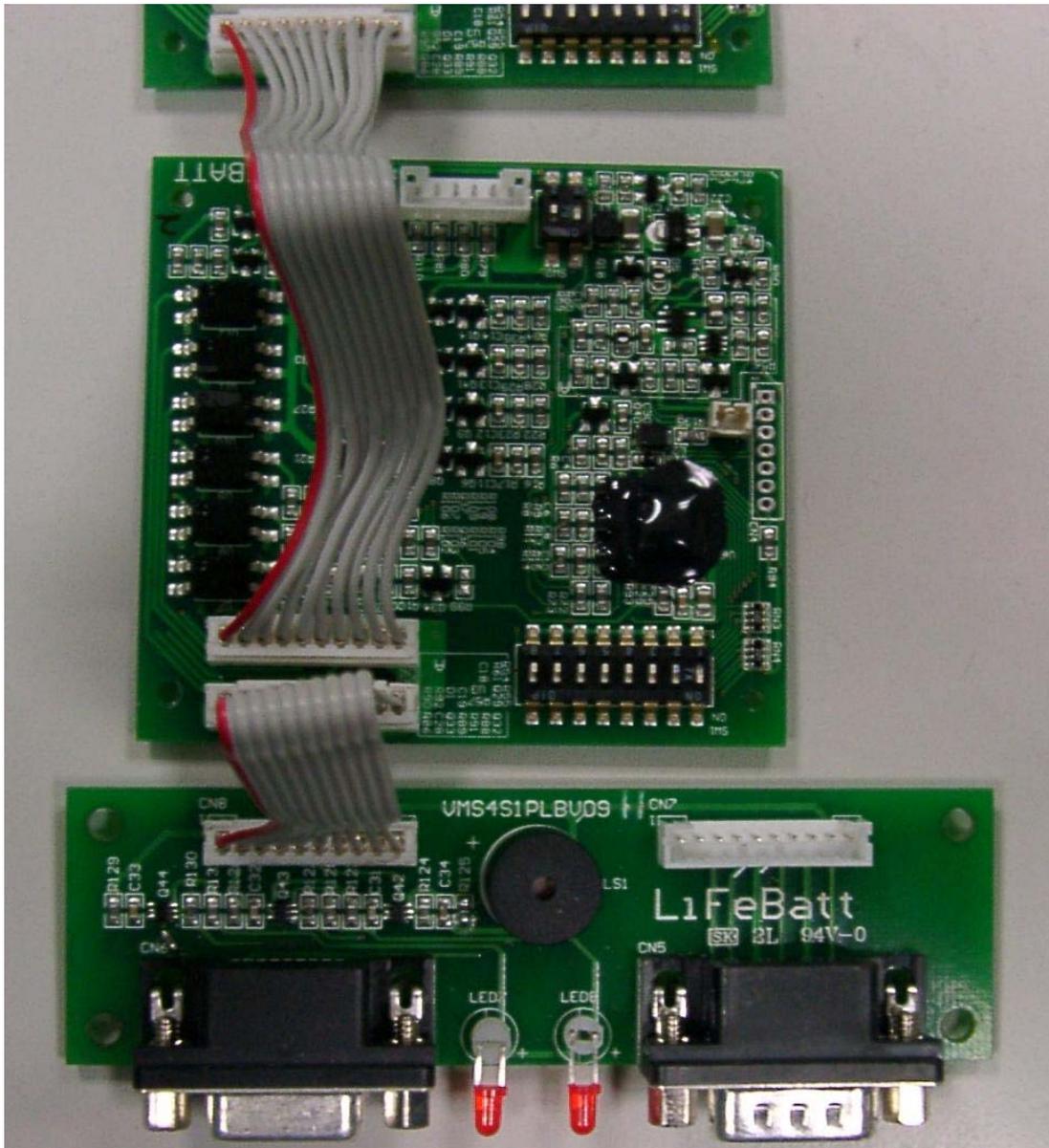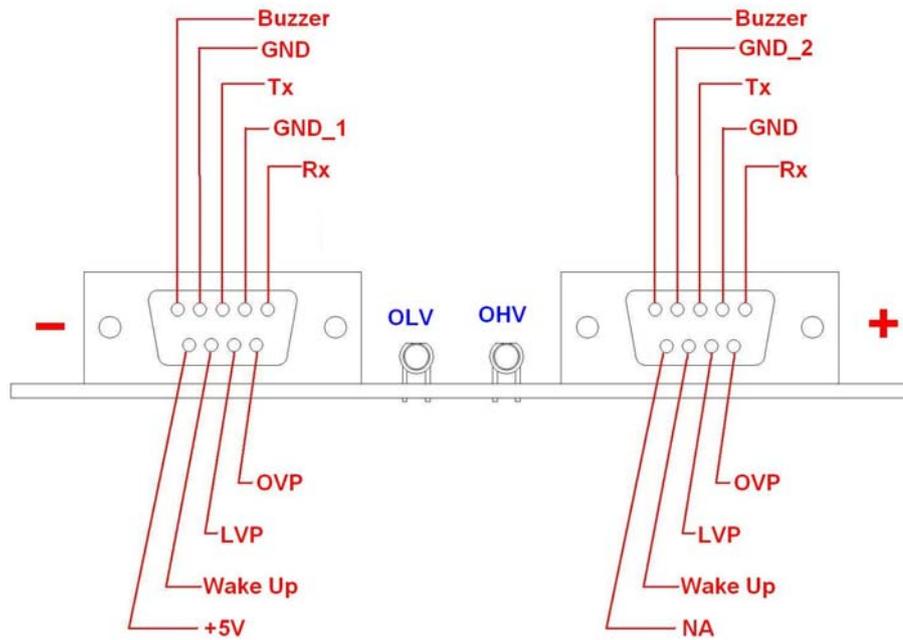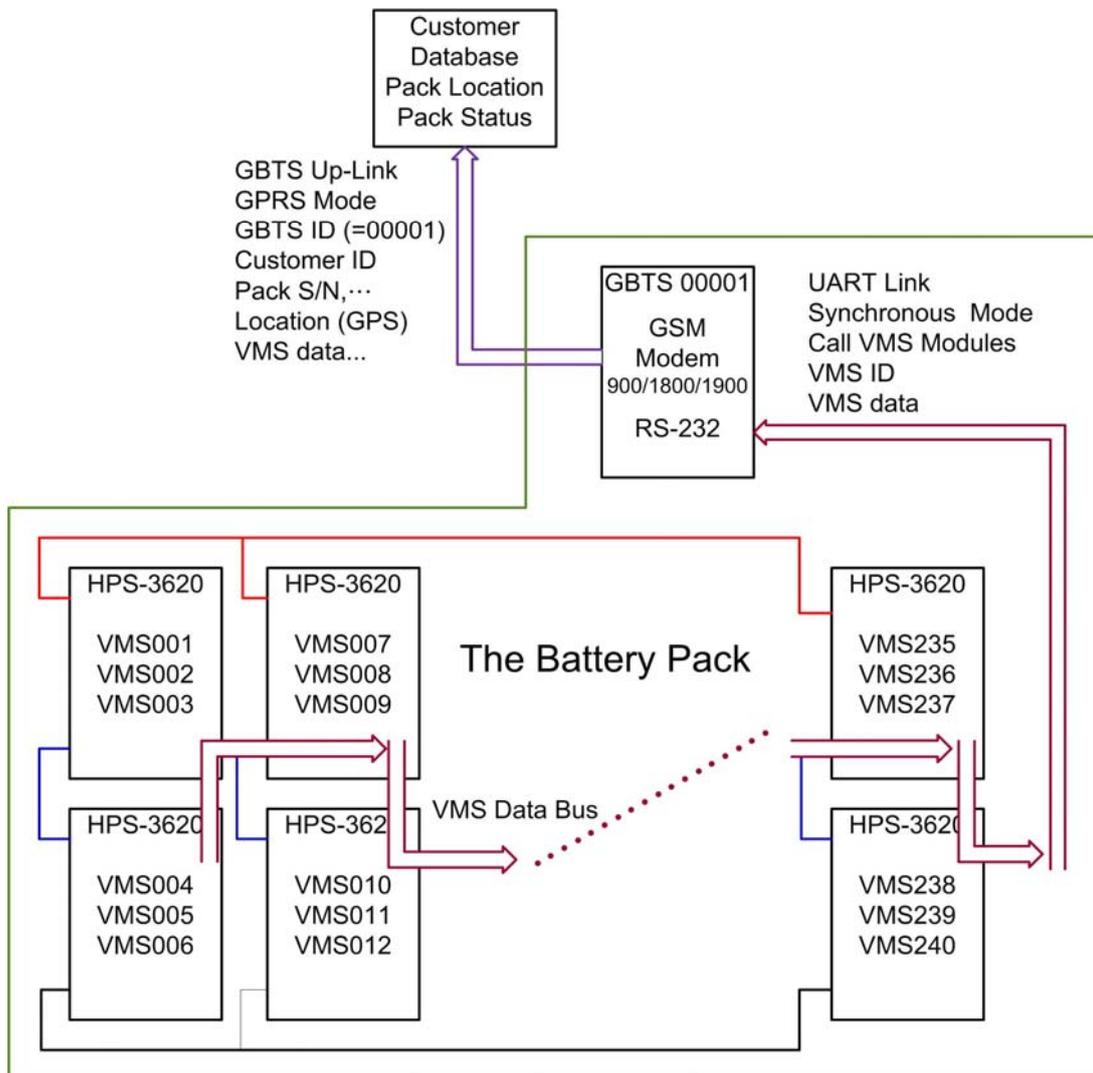
- Example as the VMS used in power pack of 80V/800Ah.

d. How the VMS works: As the VMS embedded with cell voltage monitor and digital interface (UART), it is easy to capture data from VMS and show those data on your PC or server through USB/RS-232 interface or the GBTS (Wireless/GPRS) interface. The data for the system monitor include cell voltage, cycle usage, error counter (over temperature, over voltage, low voltage). In principle, we will not release our instruction codes to our customers because of service and guarantee based on those data. Thus, we prefer to provide the standard program.

The following figure shows the diagnostic program on Window 2K/XP.
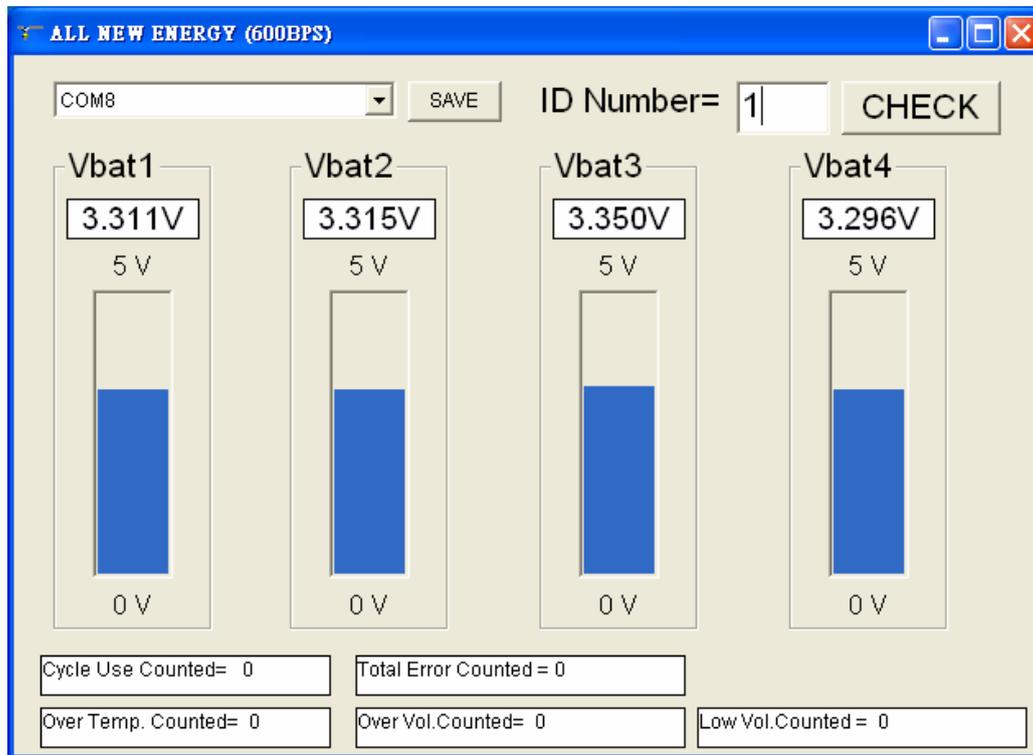
2. The GBTS: includes three major components, Which are

   GPRS (GSM modem) to communicate the network through he GPRS (General Packet Radio Service) channel (the digital protocol of the GSM mobile phone).

   WinCE core to provide real-time-operation-system, and the interface to the VMS.

   GPS (Global positioning system) module to identify the GBTS location. (Optional)

   a. Therefore, the GBTS is able to

   ● Global position: may be used as the data of the handling or security control. (Optional)

- Sub-pack information: the service center is easy to control the pack status, and the information includes cycle use and all of abuse records (over high voltage, over low voltage, over operation temperature).

- The data is transferred through GPRS. That means the current system only works within the radiation range of the GSM cell station. (CDMA system will be later.)

- The service server allows our customer to access the GBTS system. After the GBTS gets the request from the service server, the GBTS will poll the VMS of each sub-pack, and feedback the current data to the service server.

b. How the GBTS works

- Each GBTS has a unique ID code.

- Each High Power Series (HPS) battery module contains it's own Voltage Monitor System (VMS).

- Using serial UART port, the VMS of each HPS battery module is connected to the GBTS controller.

- The GBTS controller, using GPRS, sends a battery Status Record, every 12 hours to our data centre about the condition of each cell it is attached too.

- Each Status Record includes the number of cycles, vehicle position and error codes.

- Should an error be recorded, our administrator will then take appropriate action. That may be an email to advise the vehicle

owner that the battery needs a service, or a phone call or SMS to advise the driver that the vehicle should be stopped immediately, in extreme circumstances.

Battery Life Remote Monitoring System
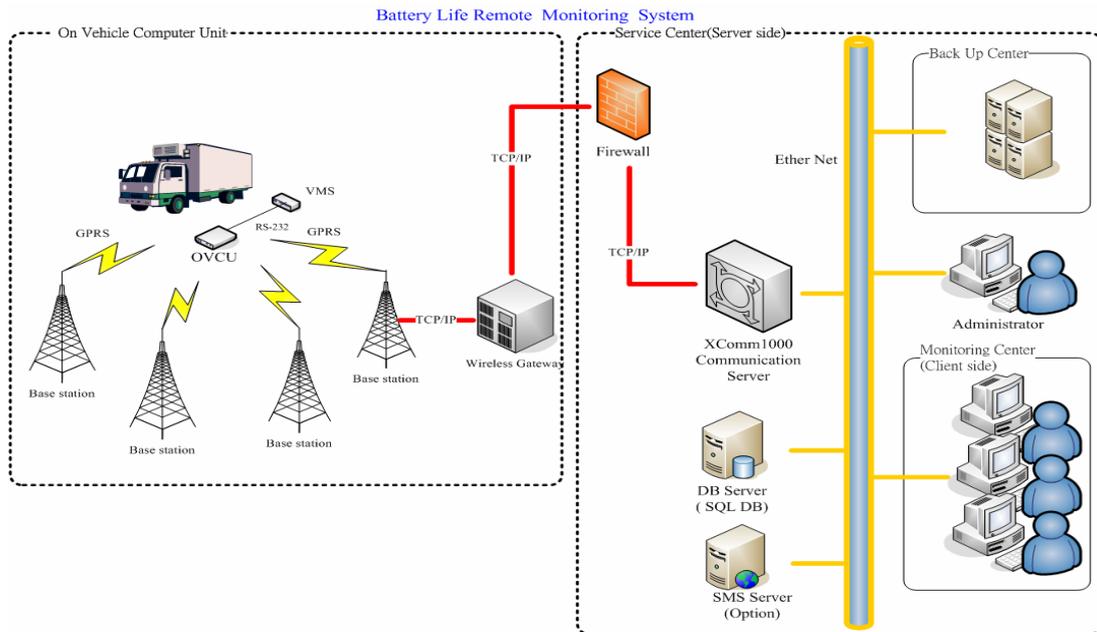
With GBTS we are able to pre-empt service requirements, notifying the vehicle owner of any potential problems even before the vehicle performance is impaired. This will also allow the vehicle owner to plan the vehicle service schedule.
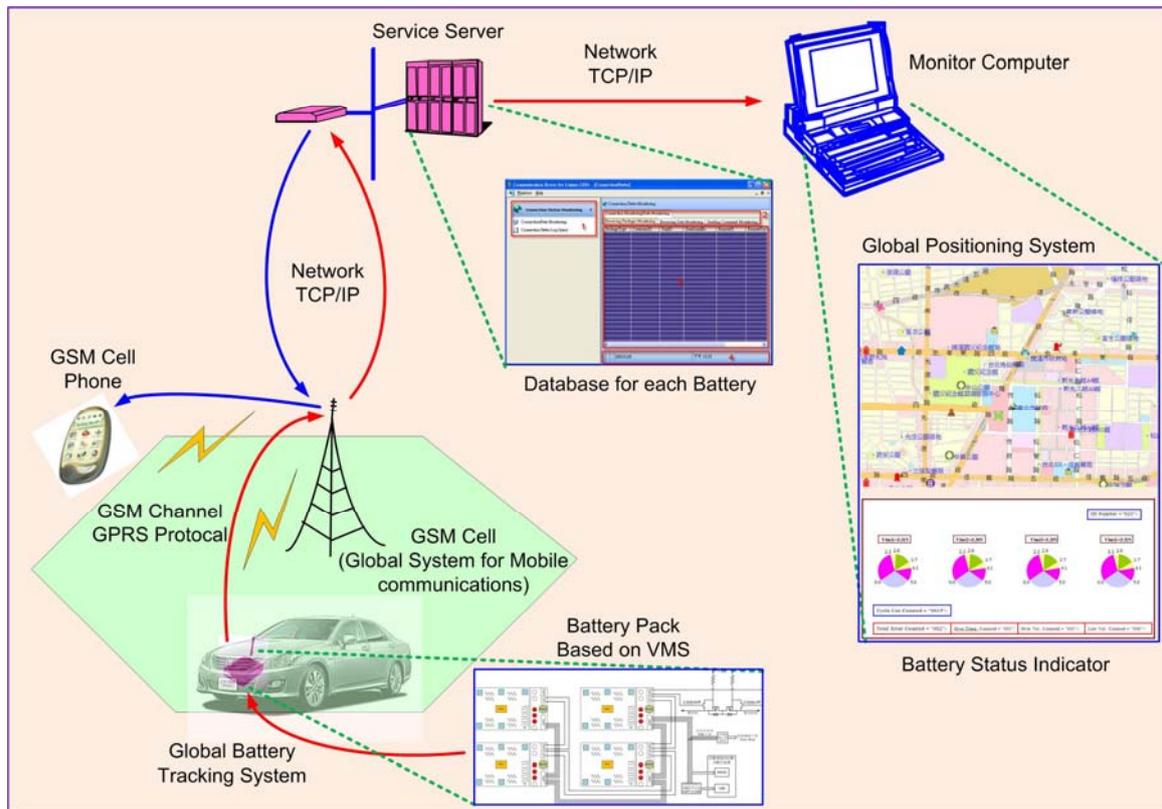
GBTS is peace of mind for the vehicle owner.

3. Q&A:

1. If there is such LED indicators built-in the VMS, may I use it as a capacity gauge?

   Answer: Due to the flatness of discharging/charging curve, we suggest treating this indicator as voltage monitor, or cell voltage go/no-go indicator.

   The voltage level signals (LED indicator) will vanish after non-using for one minute to save battery energy.

2. To use the OHV/OLV signals, how can I make sure?

Answer: Please only use the certified charger or power controller by LiFe Batt. Otherwise, you will loss your guarantee from LiFe Batt. Also we, LiFe Batt, will not be in charge of battery safety.

3. Why there are such error counted in your system?

   Answer: Because we are proud of our products, and we are able to provide 2 years' warrantee to our customers. Therefore, we need to make sure our products free from abuse.

   Any extreme battery voltage during guaranteed life will be recorded in our VMS record. We reserve the limited service, if there is any extreme condition recorded. Please don't worry anything going wrong. So-called extreme battery condition is impossible to happen, if LiFe Batt certifies your charger and power controller.

4. Should I keep my battery pack fully charged? I means to charge my battery pack every month, even no use.

   Answer: Yes, to maintain your battery performance, please charge your battery pack every month, even no use.

   Although our VMS will automatically count cycle use, every charging and discharging, such maintaining charging will be excluded. We recommend user make your battery pack fully charged every time.

5. Shall I connect the final converting board at same ground with the GBTS/PC?

   Answer: Yes, please!

   The output board must be grounded same as your GBTS/computer system. Therefore, please make this output board connected to the last battery

pack, which negative port is connected to the ground of power system.

6. Dose the VMS monitor each cell voltage?

   Answer: Any cell voltage in the whole battery system touching the voltage limit in the will enable the OVP (OHV) or LVP (OLV) signal, then output a 5V signal.

7. May I prepare this serial cable by myself?

   Answer: Please don't do it!

   The connecting wire between packs is a dedicated D9 (com-port) wire. Please do not use any D9 wire from retail store. That is because we embed other digital signals (OVP, LVP, and wakeup) to complete the whole controlling functions.

8. Is the diagnostic program free?

   Yes, it's free. But you need a dedicated converter.

9. May I monitor all of battery packs through this GBTS?

   Answer: Yes, that is why GBTS.

   But we only provide data relative with the packs providing from you. You may check every pack status with our server, on pack level sub-pack level, or cell level. Basically, we will provide data on pack level only because of data flow. The data we provide will be concluded based on battery knowledge. Therefore, our customers don't need to take care what is the LiFePO4 battery.

10. Why I need a GBTS system? I suppose the LiFePO4 battery is much safe!

Answer: Yes, the LiFePO4 battery is much safer than others. But the Lithium battery is still expensive. We prefer to warn, or call user before battery gets harm.

11.   Since there is an embedded Win CE, may I use the GBTS as a navigator?

Answer: Not for now!

We reserve a LVDS interface for optional LCD. But due to cost of LCD and software fee, we treat such requirement as a dedicated project.

12.   Whether the GBTS is able to perform as a GPS security system?

Answer: Because of personal privities, the GPS module is optional; it depends on your application. With GPS module, the GBTS is able to track the position of your battery pack, if needed.