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EV Battery Protection System

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Abstract - *The Main objective of this project is to detect the any abnormal fault in the lithium-ion battery. The purpose of our research is to use ATmega328P and sensors like smoke sensor, temperature sensor to monitor the parameters like temperature, leak gases in surrounding of Lithium-ion battery of Electric vehicle. And protect it from unwanted situations occur during charging and discharging also with the help of solenoid valve, the condition of hazardous fire can be stopped*

Key Words: PCB Board, Heat, LCD (Liquid Cristal Display), cable Fault, sensors, Digital Data, Solenoid valve and Lithium-ion battery.

1. INTRODUCTION

The safety of lithium-ion batteries in vehicles could be a priority of the automotive industry. the main focus of the event activities are the reduction of the risks and also the improvement of the protection ideas and systems. Constant observance of battery parameters like temperature, gas level, and voltage, current can alert the system for any abnormal or worse condition of emergency. As these conditions could lead into battery hearth or battery explosion early indication of such activates become terribly important. If in sensible case fire or any accidental impact on the battery may cause the interior tangency of the battery which leads into excessive warming of the battery that leads into explosion and fire. Our good sensor-based network can keep batteries incessantly monitoring. This method are going to be very helpful for saving the precious lifetime of the motive force and valuable investment on the vehicle.

2. EXISTING SYSTEM

The automotive business is admittedly serious regarding electrical Vehicles now and also the most significant elements of associate EV, the Battery Pack. Cost-wise, it constitutes nearly 40% of the vehicle cost. Battery pack contains the Lithium-ion cells that power the EV drivetrain and together with that, a sensible resolution referred to as the EV Battery Management System aka BMS. The BMS monitors each cell of the battery and uses its complicated formula to calculate battery percentage, health and so forth after we extrapolate the battery management facet to an electrical vehicle, the quality gets many notches higher.

Following are the same old functions that a daily electrical Vehicle BMS performs.

1. Cell observance

2. Power improvement

3. Safety of electrical vehicle

4. Battery Charging improvement

2.1 LITERATURE SURVEY

The idea of dedicated planned model of Battery protection system of work unit came from the incident once we watch countless news on catching fireplace in EVs. As transport is a elementary demand of contemporary life, however the normal combustion engine is quickly changing into outdated. hydrocarbon or diesel vehicles are extremely polluting and are being quickly replaced by totally electric vehicles. totally electric vehicles (EV) have zero pipe emissions and are far better for the environment. the electrical vehicle revolution is here.

thus, safety of EVs is most important. and therefore, the combination of electrical and electronic information will do this terribly effectively. Growing population and demand of safe travel is necessity of any person. As we have a tendency to all recognize that India is a developing country and therefore the weather of India is heat most of time. These factors produce a problem on EVs.

thus, for the demand and problem, we review countless research paper on EVs and their safety parameters like

- Research on fault diagnosis system of electric vehicle power battery based on OBD technology.
- Review of lithium-ion battery safety concerns: the issues, strategies and testing standards.
- A power management IC used for protection system of lithium-ion battery packs.
- Design Study of Battery System Protection Structure Based on Hybrid Material Fibber Metal Laminate (FML).
- Thermal safety issues of lithium-ion batteries for electric vehicle application.
- Battery faults diagnosis for EV based on voltage abnormality by combining the long short term memory neutral network and equivalent circuit model.

- Detection of Li-ion battery failure and venting with Carbon Dioxide Sensors.
- Experimental study on a novel safety strategy of lithium-ion battery integrating fire suppression and rapid cooling.

And we conclude with important point like

I. to scale back the thermal runaway, the potency of gas fire extinguisher ought to be sensible on suppressing lithium-ion battery fireplace. the current work is to mix a gas fire ending agent (C6F12O) with the water mist system for LIB fire suppression, such the battery flame is initial controlled by the extinguisher and therefore the water mist is then applied for effective cooling of the battery.

II. Battery operational in higher temperature have an adverse impact on the performance as well as fast capability fade and aging. Similarly, the decline of battery performance results from reduction of the activity of conductor material and lithium-ion diffusion rate within the solution and therefore the conductor material. Temperature distribution non uniformity throughout the one battery or pack is additionally a crucial operational index which can cause chemical science imbalance over time, and accelerate the capability loss and premature aging.

III. a whole power management system IC with full-integration, high-precision and high-reliability for battery pack which might monitor and defend the system is demonstrated, achieving lower application costs. The IC protects the battery from over-voltage, over-current and overtemperature once charging and discharging with 0.5 mV discrimination accuracy.

IV. The outline of previous battery abuse experiments with overheating, overcharging and nail penetration all indicated the presence of dioxide within the vent-gas. At identical time, CO, H2 and VOCs were found in several batteries abuse experiments, however lacked consistency across completely different testing conditions. Considering the early presence in first emanation, sensible consistency, ability to notice cell outflow and detector feasibility, CO2 was hand-picked because the indicator for gas venting events.

3. PROPOSED SYSTEM

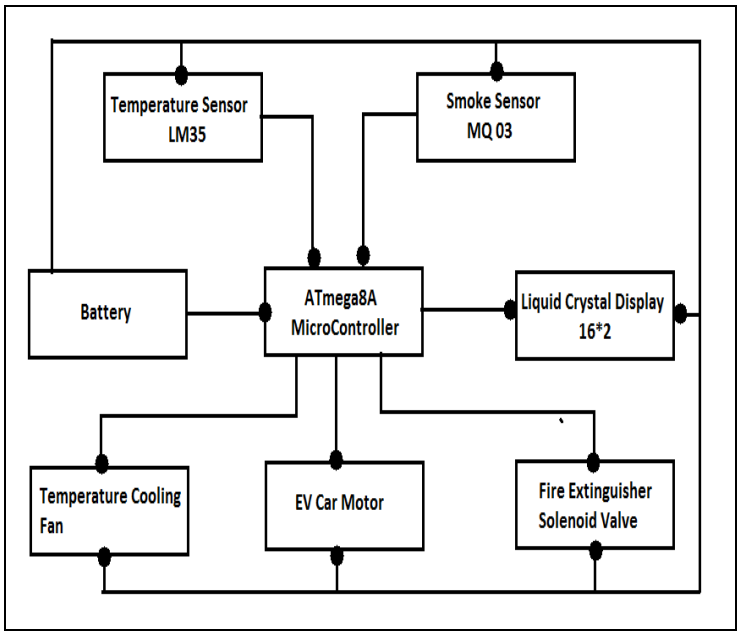

Fig -1: Block Diagram

3.1 PCB layout

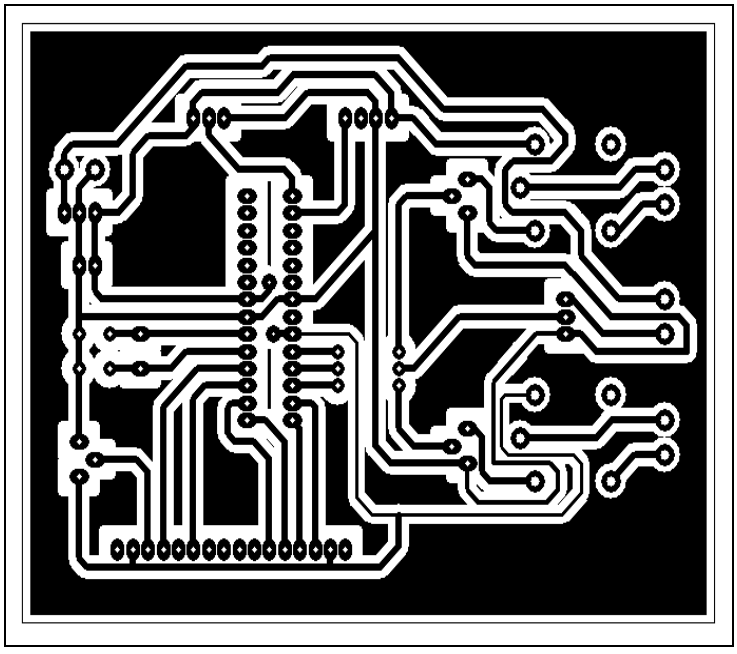

Fig -2: PCB design

3.2 Internal Circuit

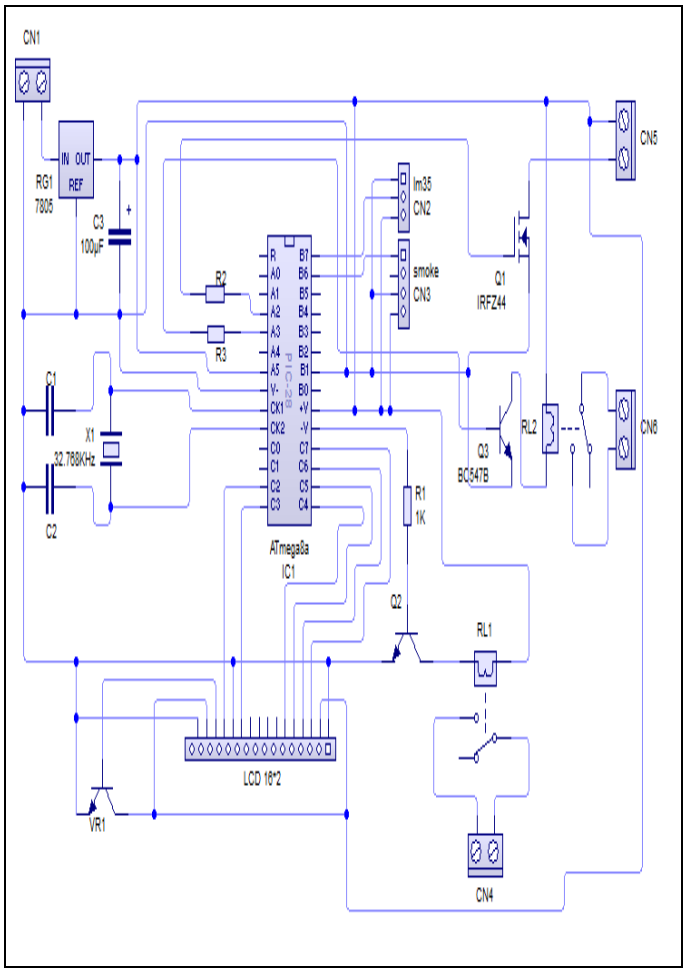

Fig -3: Circuit diagram

4. HARDWARE

- Micro-Controller – Atmega328p
- Temperature Sensor – LM35
- Smoke Sensor – MQ3
- Crystal – 16Mhz
- Voltage Regulator – 7805
- Display – LCD 16*2
- Relay – DC 5V
- Transistor – BC547
- Capacitor – 22pF, 100uF
- Resistor – 330 Ohm
- Variable Resistor – 10Kohm
- Terminal Block – Screw
- Battery – 12v, 2000mah
- Fan – 12vDC
- Buzzer – 12vDC
- Motor – 500Rpm

4.1 Atmega328P

The ATMEGA328P-PN may be a well-liked microcontroller thanks to it being a significant part within the Arduino board products. The ATMEGA328P-PN is that the 8-bit reduced instruction set computing heart of the Arduino Uno and Nano, with a most clock frequency of 20MHz, 32KB program FLASH, and 2KB of RAM. The ATMEGA328P-PN contains several on-board peripherals, together with UART, SPI, timers, ADC, comparators, and a watchdog, and is housed in a very 28-DIP package that allows designers to simply model their styles before committing to surface mount technology. With a temperature vary of -40°C to 105°C and voltage range of 1.8V to 5.5V, the ATMEGA328 actually is a versatile, cost-efficient microcontroller.

Fig -4: Controller

4.2 Temperature sensor

LM35 is a temperature detector that outputs an analog signal that is proportional to the instant temperature. The output voltage will simply be taken to get a temperature reading in Celsius. The advantage of lm35 over thermistor is it doesn't need any external calibration.

LM35 Temperature sensor Features-

I. tag Directly in Celsius (Centigrade)

II. Linear + 10-mV/°C multiplier

III. 0.5°C Ensured Accuracy (at 25°C)

IV. Rated for Full −55°C to 150°C vary

V. appropriate for Remote Applications

VI. Operates from four V to thirty V

VII. lower than 60-µA Current Drain

VIII. Low Self-Heating, 0.08°C in Still Air

IX. Non-Linearity solely ±¼°C Typical

X. Low-Impedance Output, 0.1 Ω for 1-mA

4.3 Smoke sensor

MQ-3 module is appropriate for detective work Alcohol, Benzine, CH4, Hexane, LPG, CO. Sensitive material of MQ-3 gas device is SnO2, that with lower conduction in clean air. once the target alcohol gas exist, the sensor's conductivity is higher at the side of the gas concentration rising. MQ-3 gas sensor has high sensitivity to Alcohol, and has smart resistance to disturb of gasoline, smoke and vapor.

Specifications of MQ-3 Gas device

I. Power requirements: five VDC @ ~165 mA (heater on) / ~60 mA (heater off)

II. Current Consumption: one50mA

III. DO output: TTL digital zero and 1 (0.1 and 5V)

IV. AO output: 0.1- 0.3 V (relative to pollution), the most concentration of a voltage of concerning 4V

V. police investigation Concentration: 0.05-10mg/L Alcohol

VI. Interface: 1 TTL compatible input (HSW), 1 TTL compatible output (ALR)

VII. Heater consumption: not up to 750mW

VIII. in operation temperature: fourteen to 122 °F (-10 to 50°C)

IX. Load resistance: 200kΩ

X. Sensitivity S: Rs(in air)/Rs(0.4mg/L Alcohol)≥5

XI. Sensing Resistance Rs: 2KΩ-20KΩ(in 0.4mg/l alcohol)

XII. Dimensions: thirty-two x twenty-two x sixteen mm.

4.4 Power supply

A lithium-ion battery could be a sort of reversible battery usually employed in laptops and cell phones. to form power, lithium ions move from the negative conductor through an solution to the positive electrode. A battery Management System (BMS) is an intelligent element of a battery pack accountable for advanced observation and management. it's the brain behind the battery and plays a crucial role in its levels of safety, performance, charge rates, and longevity.

5. WORKING

We use two sensors LM35 for temperature and MQ3 for smoke detection.

Smoke sensor mainly used to detect any gas leakage or fire outbreak in the battery system.

Nowadays, the problem of electric vehicle is less configuration on battery so if battery runs for long time, then it's got heated. That's why we use LM35 to measure the temperature.

All the data or readings will be showed on display. If in initial condition when the temperature and smoke both are below threshold value " READY TO GO" will display on LCD and motor starts. The threshold point of temperature sensor is 32 degree and the smoke is 199 unit So, when temperature exceeds to threshold point the cooling fan will ON and cools up to 38 degrees after that controller shows INGNITION OFF message and cut the power supply of motor. When the smoke exceeds its threshold value the solenoid valve will ON and controller shows INGNITION OFF message and cut the power supply of motor

5.1 Actual model

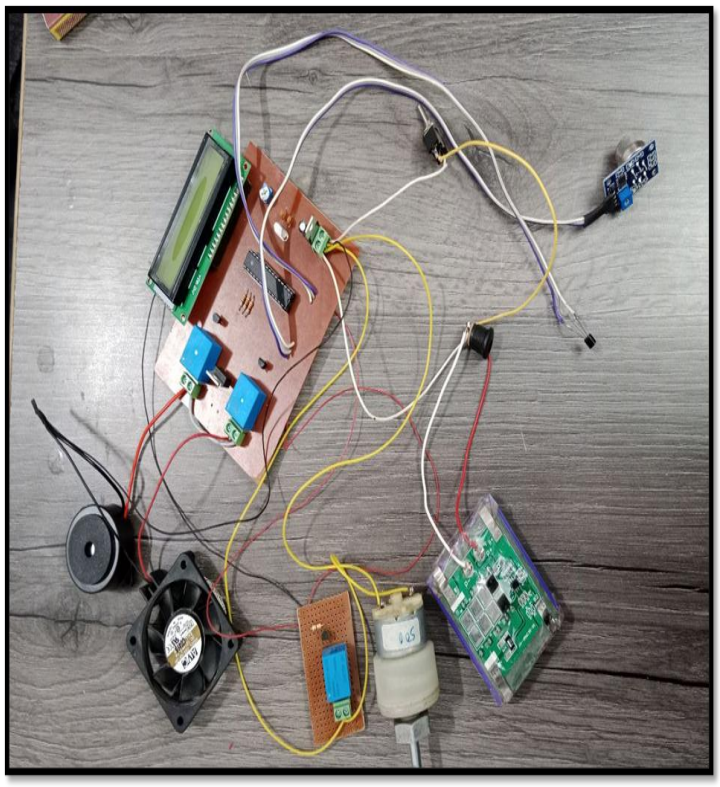

Fig -5: All devices

6. ADVANTAGES

- A more reliable and safety ensuring system for the safety while using electric vehicles.
- Automatic and trouble-free operation which should not disturb the normal operation of the vehicle.
- Automatic battery health parameters monitoring will make Electric vehicle drive more safer and trouble free.

- The circuit could have a wide range of uses, which conforms to the design trends of electronic products currently being released.
- Due to simple and cost effective this design can be use in small scale of production or startup.

This project is having a huge future scope under the aegis of the project, the worthy consumer will have a lot of positive results.

Since the world is heading towards EVs and safety of lithium-ion batteries is very much important.

Through this setup, the consumer and industry can install low but accurate protection system in their vehicle.

6. CONCLUSION

The final approach for making this hardware modules is to give a easy way of protection.

We tried to fulfil almost all the missing requirement for these types of platforms make this hardware modules as much as:

- Flexible
- User friendly
- User interactive
- Latest use of technology

After all this feature there is lot, more scope left in this platform so the development will continue.

7. REFERNCES

1. K. Kadirvel, J. Carpenter, P. Huynh, J. M. Ross, R. Shoemaker, and B.Lum-Shue-Chan, "A Stackable, 6-Cell, Li-Ion, Battery Management IC for Electric Vehicles With 13, 12-bit ΣΔ ADCs, Cell voltage balancing, and Direct-Connect Current-Mode Communications," IEEE J. Solid-State Circuits, vol. 49, no. 4, pp. 928–934, 2014.
2. Sun P, Bisschop R, Niu H, Huang X. A review of battery fires in electric vehicles.Fire Technol 2020:1e50.
3. N. Noda, "21st century cars and ICs," in 2000 IEEE International Solid-State Circuits Conference. Digest of Technical Papers (Cat.No.00CH37056), 2000, pp. 12–17.
4. Johnson. A. Asumadu, Mohammed Haque, Helio Vogel, Charles Willards. Precision Battery Management System[C]. IMTC 2005
5. Wu Y, Yin Y. Distributed power battery management system base on CAN bus. Automot Eng.2004;27(5):530–3.
6. Deng S, Wang Y, Li X, Huang H. Lithium battery protection circuit design. Electron Technol.2006;1(10):68–72 (in Chinese).
7. Wang S. MOSFET/IGBT driver ICs and application (in Chinese). Beijing: People's Posts and Telecommunications Press; 2009. p. 153–62.
8. Chen Y, Li J, Song B. Cortex-M3 + μC/OS-II introduction to embedded system development and application (in Chinese). Beijing: People's Posts and Telecommunications Press; 2010. p. 123–6.
9. Hande A.. Internal battery temperature estimation using series battery resistance measurements during cold temperatures [J]. Journal of power sources, 2006, 158(2): 1039–1046.
10. Pesaran AA.. Battery thermal management in EVs and HEVs: issues and solutions [C]. Advanced Automotive Battery Conference, Las Vegas, Nevada. 2001.