International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 3 Issue 11, November-2014

PIC Controller Based Vehicle Alternator Checking System

Joshi Krunal K.
Automotive Electronics
M S Ramaiah School of Advanced Studies,
Bangalore, India

Mantry Pavan Kumar
Real Time Embedded System
M S Ramaiah School of Advanced Studies,
Bangalore, India

***bstract* – Battery is the main electric power storage element in vehicle and its power can be utilized by accessories and other electro-mechanical systems which can be operated by electricity. Maximum power is utilized by starter-motor during starting of the engine from rest position. During engine running time, these electrical loads are supplied by vehicle alternator. Therefore, it is not permissible for the vehicle alternator to fail in running condition. The system discussed herein mainly aims to monitor generated voltage and displaying the message by identifying the condition of alternator whether vehicle battery is being charged properly, poorly or not charging.**

Keywords: Vehicle alternator, PIC controller, alternator checking

I. INTRODUCTION

Battery pack is the electrical energy storage device in conventional Internal Combustion (IC) engine based vehicle. Nowadays in automobile vehicles, most of the accessories (such as music system, lighting, etc.) and electro-mechanical systems (such as electric power steering, power window, etc.) are operated by electric supply and that is fed by battery pack. Consumption of electrical energy is more while engine is running and at this point battery becomes an electrical load with respect to alternator. Due to this, it is required to keep battery in charging during running condition.

Vehicle charging system consists of the alternator, regulator (that is usually fixed inside the alternator housing) and the interconnecting wiring. The purpose of the charging system is to maintain the charge in the vehicle battery and to offer the main source of electrical energy during the engine is running. If the battery is weak or dead and alternator is not functioning, the engine may not have enough electrical current to ignite the spark plugs, therefore the engine will stop running.

Figure 1 MIL for Battery Charging [1]

In modern vehicles, Malfunction Indication Lamp (MIL) for battery charging is available in cluster unit. Figure 1 show the MIL for battery charging that incorporated in cluster unit. If that light glows 'ON' then the vehicle battery is not being charged by alternator and if that is 'OFF' during engine running condition then the battery is being charged.

The need for an alternator checking system is identified for continuously monitoring the battery voltage and displaying suitable message on Liquid Crystal Display (LCD).

II. OBJECTIVIES

12 volt electric network system is placed in most of the passenger cars, few commercial vehicles and some construction equipments. Alternator is producing AC electric supply (as it is mechanically coupled with engine through belt) while engine is running. Rectifier and regulator are placed inside alternator housing assembly (in most cases) that converts AC into regulated DC power supply. During engine running, this regulated DC power supply is used to charge the battery and accessories of vehicle[2].

The main objectives of this proposed work is to display the alternator generated voltage and predict different alternator situation that is based upon voltage level in a user friendly manner to the driver.

III. DIAGRAM

A. Block Diagram

This system can be sub-divided into battery voltage detection circuit and micro-controller. Generated voltage and alternator condition is displayed on LCD that is connected with micro-controller.

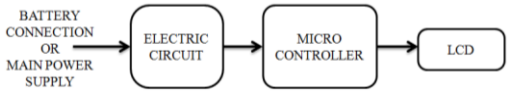

Figure 2 Block Diagram

Figure 2 shows the general block diagram of proposed system. As electrical power supply network is interconnected in vehicle, alternator generated voltage can be measured either from battery connection or from main power supply in fuse box (or in junction box).

B. Circuit Diagram

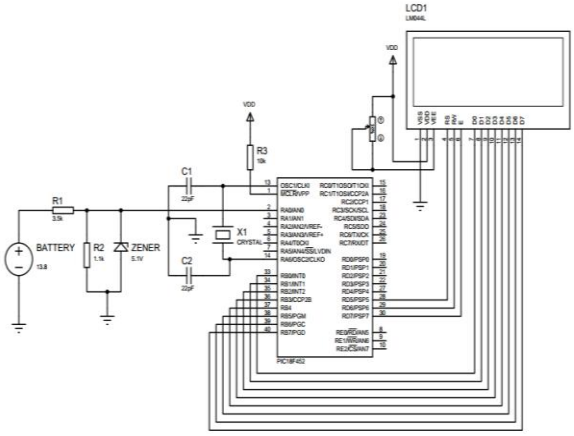

Figure 3 Electrical Circuit Diagram

Figure 3 shows the electrical circuit diagram of PIC controller based alternator checking system. PIC micro-controller can withstand up to 5V DC as an input therefore it is required to scale down the alternator generated voltage in 5 volt range. Combination of two appropriate resistors creates voltage divider that scale down the generated voltage in 5V range which can directly apply to PIC micro-controller in parallel with 5.1 volt rating of zener diode, which is used as voltage regulator [3].

C. Flow Chart

Figure 4 shows the flow chart diagram of system. Developed system continuously monitors generated voltage from battery and satisfy any one of four conditions. According to condition, specific message is displayed in LCD [4].

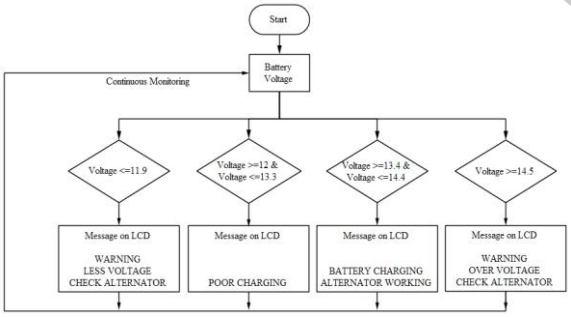

Figure 4 Flow Chart Diagram

Table 1 shows the LCD messages according to voltage level that is derived from figure 4.

Table 1 Voltage Condition Table

No	Voltage Level	LCD Message
1	Voltage <= 11.9	WARNING LESS VOLTAGE CHECK ALTERNATOR
2	Voltage >= 12 & Voltage <= 13.3	POOR CHARGING
3	Voltage >= 13.4 & Voltage <= 14.4	BATTERY CHARGING ALTERNATOR WORKING
4	Voltage >= 14.5	WARNING OVER VOLTAGE CHEK ALTERNATOR

IV. TOOLS USED FOR EVELOPMENT

A. Software

- *Mplab IDE* : used to develop C and hex code for this specific application
- *Proteus* : used to simulate developed system

B. Hardware

- *PIC Development Board and Debugger* : used to dump the hex code in PIC controller
- *Electrical Circuit* : as PIC controller cannot fed with battery, voltage divider electric circuit is required

V. RESULT AND DISCUSSION

In most of the vehicles and alternator is working efficiently. Therefore, it produces almost regulated 14.0 to 14.2 volt. Hence, it is quite difficult to analyze remaining cases. It is possible to simulate remaining cases in Proteus software that is shown in figure 5.

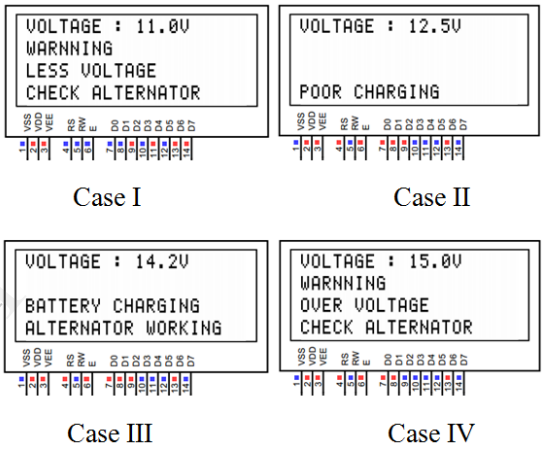

Figure 5 Simulation Results

Case I – When 'Less Voltage' message is displayed in LCD which means alteratnor has failed and it shows respective battery voltage.

Case II – When 'Poor Charging' message is displayed in LCD which means alterantor is working but not in efficient manner. There is a chance that the alternator driving belt is loose.

Case III – When 'Battery Charging' message is dispalyed in LCD that indicates alterantor is working properly and battery is being charged. Entire vehicle's electrical load is supplied by alternator voltage.

Case IV – When 'Over Voltage' message is displayed in LCD that indicates alternator is generating excess voltage. In this case, there is a chance that the ragulator might fail which may lead to damaged battery also.

VI. CONCLUSION

Current system is useful in vehicles to identify whether the battery is being charged by alternator or not. It is more useful in construction equipment where hydraulic are operated by engine and controlled by the electric power supply. The failing of the alternator in construction equipment, may lead to discharge the entire battery power also. In heavy machinery, this system warns driver to take preventive actions including, not placing heavy loads during battery fail conditions, so that no equipment damage happen.

VII. FUTURE WORK

Current system can be further modified for passenger vehicle that are operated by 12 volt. By modifying some program logic and electrical circuit, system can be used for commercial vehicle and construction equipment that is operated on 24 volt. Buzzer and light indications can be implemented along with this system for different conditions. Instead of PIC 18F452 controller used for this system, if Controller Area Network (CAN) supported PIC controller is used then it could communicate with Engine Management System (EMS) also.

REFERENCES

1. Kerata. (2012). Car Education. http://kereta.info/car-education-warning-indicator-lights-part-1/.
2. Ofria, C. (2014). A Short Course on Charging System. http://www.carparts.com/classroom/charging.htm
3. Jony, I.H., Rahman, M. (2014), "Construction of microcontroller based voltmeter. IJSR vol. 3.
4. Mazidi, M.A., Mckinlay, R.D. and Causey D. "PIC Microcontroller and Embedded Systems" Pearson International Edition, New Jersey, 2008, pp. 473 – 528.