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AUTOMATIC SYSTEM FOR CAR HEALTH MONITORING

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Abstract

Many portions of our technical infrastructure are approaching or exceeding their initial design life. As a result of economic issues, Vehicle (car) structures are being used in spite of aging and the associated damage accumulation. Therefore, the ability to monitor the health of this structure is becoming increasingly important. Most often, the replacement is done by used part(s) which life spam is not ascertaining but because of the cost of new parts, there are needs for management of the Vehicle by the uses which will constituted a big risk to the owner or passage and generally a danger to the nation at large. Most of the accidents course in Nigeria today is mainly the replacement of substandard of used parts. In this technology will allow the current time-based maintenance philosophies to evolve into potentially more cost-effective condition-based maintenance philosophies. The concept of condition-based maintenance is that a sensing system on the structure will monitor the system response and notify the operator that damage has been detected. Life-safety and economic benefits associated with such a philosophy will only be realized if the monitoring system provides sufficient warning such that corrective action can be taken before the damage evolves to a failure level. The trade-off associated with implementing such a philosophy is that it requires a more sophisticated monitoring hardware to be deployed on the system and it requires a sophisticated data analysis procedure that can be used to interrogate theme assured data. As well as we are providing automation of car which is a low budget. This includes the automatic light dimming and car seat control.

1. *Introduction*

Automation aims at making our lives simpler and smarter. With smartness comes information and awareness of the technology around us. Taking this idea of information automation in our vehicles, we need to be aware of the processes taking place in the vehicle. The idea is to collect the important data and inform the vehicle in our personalized smartphones through an application. The car automation system is a collection of data relevant to the present and future performance of a vehicle system and this information can be used to support operational decisions. In car automation we use ECU (engine control unit) to sense many parameters in cars and also control them. By using several ECUs in cars it improves the efficiency of the engine, reduction in requirement of fuel & overall it reduces expenses. Also, electronic control unit which is used to analyses and control many things such as door control unit, automatic windows control, fuel indicator, speedometer, odometer, headlight, wiper and much more. This paper aims at developing an embedded system prototype for detecting the vehicle condition by monitoring the internal parameters collected from various sensors through OBD-II that are used in evaluating the vehicle‘s current health condition. Electronic control unit senses the various parameters using a different kind of sensors like ultrasonic sensor, humidity sensor, temperature sensor. All these features enable the user to take decisions regarding the information we get from the sensors and devices. Though the limitation of these automation techniques are that the information is only available to us when we are seated inside the vehicle. Now, we are applying internet of things and developing a relation within the parts of the vehicle. The sole advantage is to get all the information in our handy smartphones. One of the important thing used in IOT is the use of raspberry pi. A raspberry pi is a popular platform to operate LINUX based things easily. A car automation is a technology by using which we can control different things or we can keep a track on the vehicle for the security comfort and efficiency.

2. Literature Survey

The origins of OBDII actually date back to 1982 in California, when the California Air Resources Board (ARB) began developing regulations that would require all vehicles sold in that state starting in 1988 to have an onboard diagnostic system to detect emission failures. The original onboard diagnostic system (which has since become known as OBDI) was relatively simple and only monitored the oxygen sensor, EGR system, fuel delivery system and engine control module. OBDI was a step in the right direction, but lacked any requirement for standardization between different makes and models of vehicles. You still had to have different adapters to work on different vehicles, and some systems could only be accessed with costly "dealer" scan tools. So when ARB set about to develop standards for the current OBDII system, standardization was a priority: a standardized 16-pin data link connector (DLC) with specific pins assigned specific functions, standardized electronic protocols, standardized diagnostic trouble codes (DTCs), and standardized terminology.

3. Proposed Methodology

3.1.Objectives

• Develop a low budget embedded system which allows to monitor all major parameters of a car and helps the owner in the diagnosis in case of breakdown.
• Add a luxurious touch to a car by providing automation of various parts, which can be found only in high end models of cars.
• Develop a user-centric interface software to monitor and control.
• Develop an in-vehicle embedded system to generate a vehicle health report (VHR) whenever needed by the user through IOT connectivity.
• Prevent the breakdown by using the collected data and encourage the user for preventive maintenance.

3.2. Block Diagram

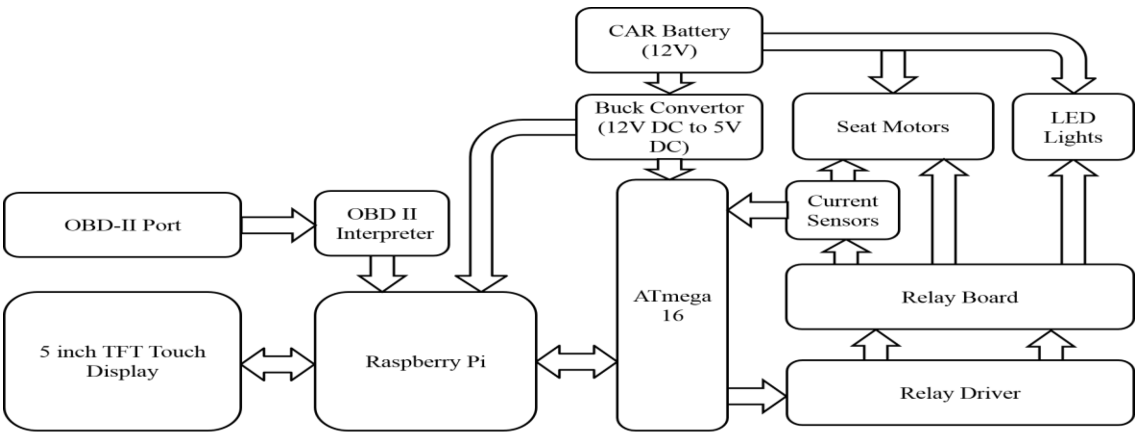

Fig 1. Block Diagram

Raspberry Pi communicates with OBD-II port and drives 5 inch display. In this GUI we designed four pages through which we controlled seat motors, lights as well as it is used to show the information obtained through OBD-II port. There are two pages designed each for seat control & light control. One pages displays the parameter names and their values.
HDMI display is interfaced to Raspberry Pi. The GUI designed by Raspberry Pi is shown on display. User can control lights to turn ON & OFF also to automate car seats (front two seats) using display. The information obtained from OBD-II port, the parameter names and respective values are displayed on the display.
There are two seats and eight lights. When we touch any button at three positions backward or forward, Raspberry Pi communicates a code through which AVR controller understands the seat (1/2), motor (1/2/3) & direction via serial communication. Then AVR rotates the particular motor of given seat in forward or backward as per given direction. One out of four pages dedicated for light control. There are buttons designed like ALL ON, ALL OFF etc. According to the tab touched Raspberry Pi communicate the LED number to AVR and AVR controller turn ON or OFF the lights.
Raspberry Pi communicates with OBD- II port using OBD-II interpreter. Using AT commands Raspberry Pi obtains data codes for each specific parameter. The parameter name and its value is displayed on the TFT touch display.

3.3. Methodology and Design Steps

• The very primary stage of this project is to estimate power budget of this project. According to the power budget, AVR controller and Raspberry Pi required 5V supply & relays 10V.
• 10V is supplied through car battery & using 10V to 5V converter controller is supplied.
• First basic GUI is configured using Raspberry Pi which include Pages. These pages have icons & buttons which shows the lights and seats. By this GUI we can turn ON & OFF the lights also change position of seats.
• Raspberry Pi is then interfaced with AVR controller through serial communication to transmit the signal whenever the any button is pressed.
• The seat motor and lights used in car are high current rated. Hence to drive the components a driver IC and relays are used.
• The other part of this project, which is health monitoring, in this part we communicate with OBD-II port using OBD-II interpreter.
• The DTCs are sent to OBD-II port and in response to that we receive data in terms of codes. From this codes parameters value are obtained. These parameter and values are displayed on HDMI display.
• From the display the car seats & lights can be controlled as well as some important parameters of car are also displayed.

4. *RESULT ANALYSIS AND DISCUSSION*

• Current sensor ACS712 senses current up to 20 A and gives output in range of 0-5V. Following graph shows the current sensor gives output in voltage linearly with respect to input current.

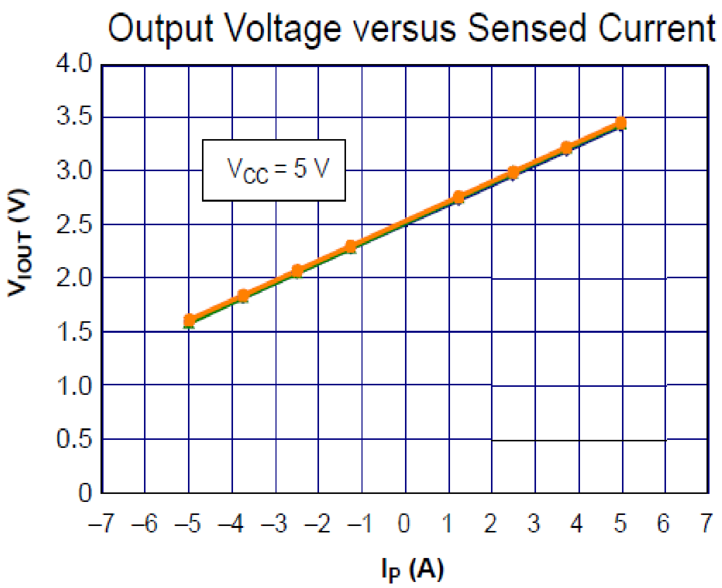

Table 1. Input and output of current sensor

Sr.No.	Input current in Ampere	Output current in Voltage
1	0	2.511
2	0.972	2.621
3	-0.962	2.452

• In each seat there are three motors. These motors need to be rotated in both directions for movements of seat i.e. backward and forward. For this we prepared codes by trial and error method in order to rotate motors in clockwise and counter clockwise direction.

Table 2. Code for motor directions

	Motor	Direction	PB0	PB1	PB2	PB3
Seat 1	Motor 1	CW	1	0	0	0
		CCW	0	1	1	1
	Motor 2	CW	0	1	0	0
		CCW	1	0	1	1
	Motor 3	CW	0	0	1	0
		CCW	1	1	0	1
	All OFF		0	0	0	0

	Motor	Direction	PB4	PB5	PB6	PB7
Seat 2	Motor 4	CW	1	0	0	0
		CCW	0	1	1	1
	Motor 5	CW	0	1	0	0
		CCW	1	0	1	1
	Motor 6	CW	0	0	1	0
		CCW	1	1	0	1
	All OFF		0	0	0	0

5. Conclusion

• We can implement this system in any car because this system is cheaper than other system but we have to take care of back EMF from OBD-II port to ECU.
• Also this system continuously monitors the health of every part of vehicle so user get to know that which part is damaged and how to repair it, so it helps to improve car lifetime

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