Smart Features for Electric Vehicles

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***Abstract* - Various technological advancements in science & technology had led to the invention of automobiles which has now become a quintessential part of everyone's lives. Advanced technologies are integrated into these automobile systems which make them convenient and easy to use. However, these advanced technologies still have their own drawbacks owing to its dependence on man. The working features of the automobile systems if made smart, it would make the automobile systems more efficient, effective and reliable. The demand for smart features for automobile systems arises from the need to develop ways in which the vehicle can be controlled automatically and monitored from anywhere thereby removing manpower from the front line. In this project, the first system is a passcode-protected engine access system. This is analogous to the passcode lock we use in our phones. Using keys for starting automobiles are effective but becomes a problem when the keys are misplaced or lost. Also, as the emergence of electric vehicles has begun, having a passcode system as opposed to a key seems more reliable. The motive of the second system is the cruise control system which analyses and monitors the speed at which the vehicle is moving. At times, the electric vehicle might stop functioning and the detected reason would be because of a drained or damaged battery which is not easily known to the user. By implementing our third system, where the user can continuously monitor the battery level and its performance, this problem could be rectified.**

***keywords* - Battery, Cruise Control, Electric Vehicle (EV), Pass-Code.**

I. INTRODUCTION

With fuel prices at historic high during these recent days and the plummeting crude oil, there is the need for electric vehicles which reduces the cost of fuel for the owner and also emerges as the best alternative for the existing conventional vehicles. The demand for such electric vehicles is increasing, smart electric cars have become very popular in western continents like Europe, and North America. The smart electric car also plays an important role in building the nation's economy. The advantage of this car is that it is environment-friendly and easy to park in small spaces. The main features of this smart car which makes it energy efficient are the use of induction motor in it. It also has a smart engine access system, cruise control method and battery management system. This smart car is the best alternative that has been produced to date.

II. PASSCODE PROTECTED ENGINE ACCESS SYSTEM

This sub-project provides security for the user. The user will be prompted to carry a key with an embedded keypad and will be allowed to enter the password. On the successful entry, the user will be provided access to the engine or motor. If the user enters an invalid password, the engine would not start, hence will not be provided the engine or motor access. This microcontroller based security project can be used in both diesel and electric cars. This project uses an Arduino UNO kit that consists of ATMega 328 and it allows more than one user to gain access to the motor or engine. The motor used was SG 90 Micro servo motor. In this project, a 4X4 matrix membrane keypad is used. This 16-button keypad provides a user interface component for Arduino project. This is programmed using the Arduino library.

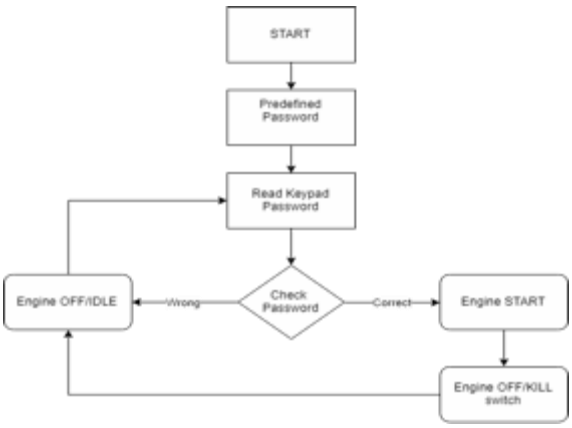

Fig. 1. The architecture of the Pass-Code System

The password is predefined and when the device is switched ON, the servo motor rotates, to the desired angle, thereby establishing physical contact between spark plugs. This causes the engine to crank. The user enters the password through a keypad which is read by the Arduino. Now the entered password is checked with the predefined password. If the password matches, then the servo motor deflects and the physical contact is established between the spark plugs for the engine to crank, else, the engine doesn't crank and a message is displayed, indicating the invalidity of the password.

Fig. 2. The Pass-Code System for vehicles

In the case of electric vehicles, the motor will not be supplied with electricity from the battery if the password is invalid. This project provides good security as long as the password of the user isn't revealed. In future this "Password-based engine cranking" can be provided great security, to satisfy user's needs. Hence, a common man can afford to purchase such a security system at minimal cost to protect his car, as the overall cost of manufacturing and production is minimal. Since this system can be incorporated for both conventional vehicles and also for electric vehicles, this is a robust and one of the best protection systems.

III. CRUISE CONTROL FOR ELECTRIC VEHICLE

In that case of long drives on highways, constant speed might be required for charge optimization. Thus, without accessing the accelerator the digital-switches are used for speed control. Various switches are used for various speeds. The motor runs at a particular speed until we apply the brake or any other alteration done to the dynamics of the vehicle. Pulse Width Modulation (PWM) method is used to vary the speed by varying the duty cycle of the converter.

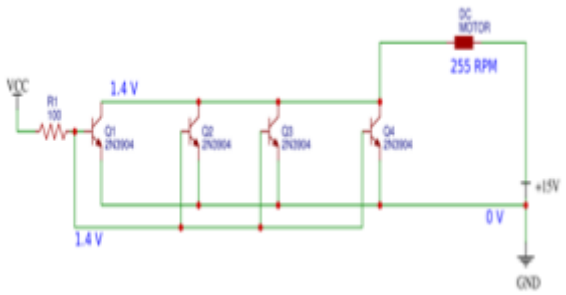

Fig. 3. Circuit diagram of cruise control

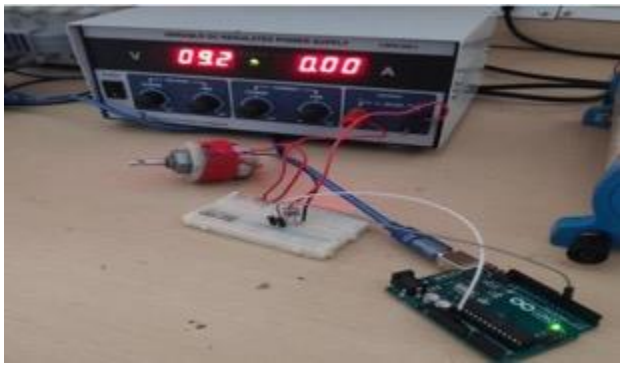

Fig. 4. The cruise control system

This project will definitely help in long drives. Addition of sufficient features would improve its reliability further. Incorporating artificial intelligence where a car can automatically vary the speed in continuous iterations may be one among the aforementioned.

IV. BATTERY MONITORING SYSTEM

A battery management system for an electric vehicle is a low-cost electronic system which takes care of the rechargeable battery by protecting it from operating outside its safe operating area, monitoring its state, preventing its leakage and keeping a check on the occurrence of defects.

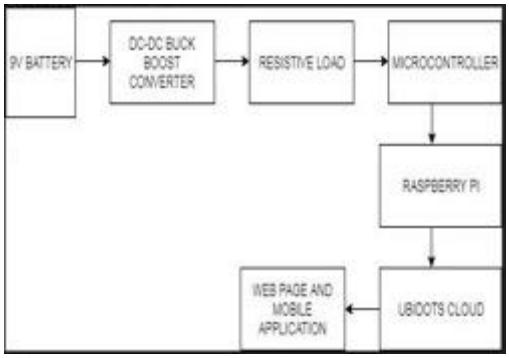

Fig. 5. The architecture of the battery monitoring system

The components used are Arduino UNO, raspberry pi, XL-6009 DC-DC boost converter, 9 Volts battery. The programming was done on Arduino IDE, python and UBIDOTS Internet of Things (IoT) platforms. This system helps us to make sure that the battery quality is maintained and the battery defects are kept in check. Hence, a common man can afford to purchase such a system to maintain his car's battery, as the overall cost of manufacturing and production is minimal.

Fig. 6. The battery monitoring system

It also performs the function of recharging the battery by making use of the energy which it obtains from the regenerative braking of the electric vehicle.

Fig. 7. Real-time result of the battery monitoring system

V. RESULT AND DISCUSSION

The aim of this research is to provide a smart, yet cost-effective features for an electric vehicle. There are several methods to accomplish these sub-projects, however, most of them involve exorbitant production costs. Since the electric vehicles have a bright future, these features if incorporated, the overall cost of the vehicle would come down and can be made affordable. This project results in improving the robustness, reliability of the vehicle and since there is also a smart unlocking feature, additional security is embedded. This project can be further expanded and could have its scope further open, with respect to the budget.

VI. CONCLUSION

This project comprises of the prototypes of various possible features that could make an automobile system *"SMART"*. These prototypes can be implemented practically in electric vehicles. The need of the hour is smart features which make life easier & comfortable. By implementing these smart features, the automobile systems can be automated which makes them more reliable & user-friendly.

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