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PASSENGER VEHICLE SPEED CONTROL USING PID ON SIMULINK PLATFORM AND BODY CONTROL MODEL WITH TECHNOLOGICAL IMPROVISATION

Pramod Chikali[1], Prof. S. B. Kulkarni[2]

[1]PG Student, Electronics and Communication Engg, K.L.E Dr. M.S.Sheshgiri Collage of Engineering and Technology, Belagavi, Karnataka, India
[2]Head of Department, Electronics and Communication Engg, K.L.E Dr. M.S.Sheshgiri Collage of Engineering and Technology, Belagavi, Karnataka, India

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Abstract - This paper proposes the involvement of modern embedded system in the field of automobile industries. In this nearly five applications will improve the user-friendly environment for the passenger. Involvement of the modern-day technology has to deploy the necessary features in the vehicle which will give rise to easy handling approach of the vehicle and other functions of the vehicle. The involvement of PID controller Using MATLAB Simulink will enhance driving ability of the vehicle, where it will control the capability of the wheels at any point of time. Further in remaining applications manual obstruction avoidance and speed variations can be handled followed by surveillance of the vehicle with temperature and humidity controlling. Finally, the safe drive assistance will indicate the parameter by which driver can take necessary steps in driving the vehicle. These features will run parallel. Some of the applications will be assisting the driver or the passenger during the motion and reaming will be assisting during off condition of the vehicle. The overall improvisation in technology will help the passenger with better results while handling the vehicle.

Key Words: PID controller, MATLAB Simulink,Modern embedded system.

1. INTRODUCTION

The world today is engulfed with modernized embedded systems wrapping from home appliances to entertainment to security systems to automobile industry. The pace at which the advancement is happening in Automobile Industry is irresistible. Embedded System which was designed to work for a specific function within electrical or mechanical system with its constraint for computation being in real-time has undergone inspiring innovations, from sophisticated functionality to lowering cost of manufacturing to low power utilization and dissipation. Not only electrical systems are benefited by this advancement in embedded systems but the usage of electronics say, microcontrollers, DSP (Digital Signal Processors), or both, in automobile (mechanical) industry has expanded on the whole. It began by Volkswagen designing the first automobile using embedded systems in 1968 and now it is widespread to cruise control, wipers with rain sensing, event data recorders, sensors for back-up collision, anti-lock brake systems, air bags, emission control, traction control, advanced navigation systems, in-vehicle entertainment and monitoring tyre pressure.

- **AIR-BAGS**: The air bag system controlled by air bag control unit commands, endow extra protection against head in case of crash or accident by providing soft surface to land on. A signal is sent to air bag control unit on detecting event by collision sensor during accident.
- **EVENT DATA RECORDER**: Black box, an event data recorder, is a device that keeps the track of information of vehicle accidents or crashes.
- **ANTI-LOCK BRAKING SYSTEM**: In case of wheel lock-up detected by wheel-speed sensors, individual wheel pressure is reduced by control unit. Before the lock-up threshold, high-speed correction of braking pressure takes place. It makes safe, reliable and cost-effective system because the brake-fluid returns along with closed loop break circuit.

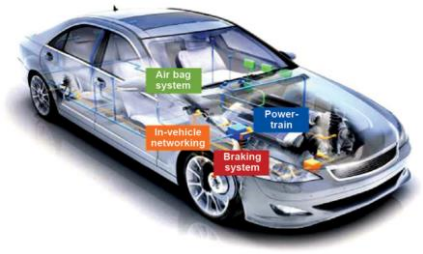


Fig - 1: An automobile with embedded systems

- **DYNAMIC TRACTION AND STABILITY CONTROL**: To avoid surplus loading of any of the wheels causing slip either through throttle or brake application, traction control system is used.
- **EMBEDDED NAVIGATION SYSTEM**: The navigation system stores the map values that are compared with received current longitude and latitude values using GPR receiver.

- **EMBEDDED RAIN SENSING SYSTEM:** In this system, opposite to rare window front of windshield, an optical sensor is placed at 450 angles, as shown in figure 8, which emits infrared light back into the sensor when the glass is dry but if any droplets are present the light is reflected in different directions.
- **EMBEDDED BASED AUTOMATIC CAR PARKING SYSTEM**: The sensors deployed in front of vehicle and on rare bumpers sense the parking space and road side distance to help the driver park the car into parking space, by sending a signal which is reverted back on meeting an obstacle nearby.

2. METHODOLOGY

The above diagram represents the overall block diagram of the project implementation and its applications. The project is mainly divided into five main applications which will combine all the parameters and form body control model with technological improvisation. Considering the first and main application of the project which elaborates about the passenger vehicle speed control using MATLAB Simulink, in this application graphical programming environment for modelling is used to implement PID controller. By adjusting the parameters in the blocks and interfacing those in the form of open loop and in closed loop configuration the desired development will be done and finally the desired simulation results will be verified for the closed loop and open loop configuration. In this open loop configuration and closed configuration, the output wave form will depict the variation in the loop feedback system. Finally, the blocks will be converted into the hex file by suing the packages available for the Arduino microcontroller. The packages will convert the blocks with specified parameters into specified hex files which will be helpful for the microcontroller to run the application. The interfacing of DC motors with the microcontroller using encoder will finally elaborate the speed control using PID controller's. As it is represented using the blocks.

The second application will be the extension of first with the smart way of approach. In this application, the Arduino microcontroller will be programmed with the help of driver circuit for DC motor. Whenever the robotic vehicle will detect the obstruction the speed of the vehicle will be reduced based on the programming on the microcontroller. The ultrasonic sensor will read the parameters of the objects and it will be notified to microcontroller. As the obstruction to vehicle is removed or avoided then the speed of the vehicle gradually increases again. If the vehicle obstruction to the vehicle does not avoided for the longer time then for fuel efficiency the vehicle will go into off condition which has to be ignited again for the movement.

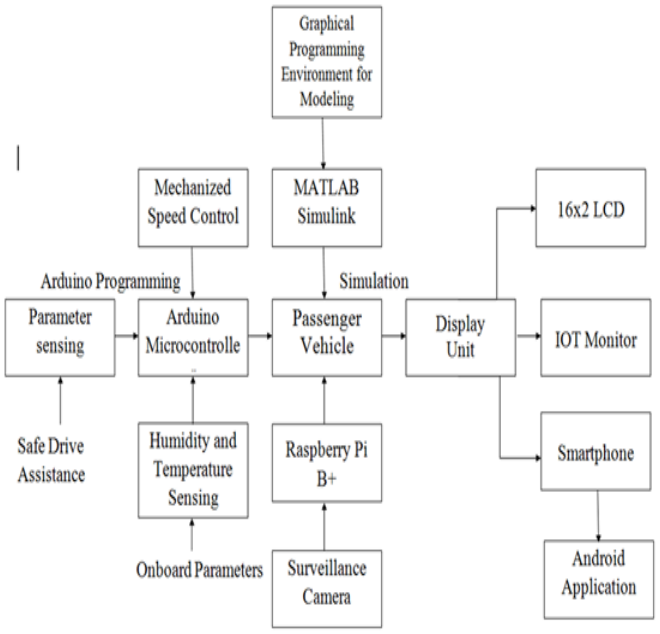


Fig - 2: Block diagram Implementation of passenger vehicle speed control using PID on Simulink platform and body control model with technological improvisation

The third application is related to modernize approach in the field of automobile industry because in this a raspicam interfaced with Raspberry pi will be mounted on to the vehicle. This will take the real-time images and the videos, which will happen during the absence of the passenger. These images or videos can be viewed in the Smartphone which has been already installed with raspicam remote application in it. Using the IP address of the Raspberry pi the android application in the Smartphone will be linked with the raspicam of raspberry pi and finally it will be start taking images or the videos. The images or the videos can be saved on to the memory which is already being installed on to the raspberry in the form of a memory card as a secondary storage device.

The fourth application is related online monitoring of humidity and temperature of onboard passenger vehicle. When the passenger is out for period then before coming back to the vehicle he can check the status of the humidity and temperature online using the IOT application using the Smartphone and the thinkspeack platform and the status of the humidity and temperature can be stored on to the memory for future analysis. The representation of humidity and temperature will be done in graphical way, where the passenger can analyses the moderate variation with the parameter. Based on the parameter variation the air coolant system within the vehicle can be put on and varied so that when passenger catches the actual vehicle at that time the temperature and humidity of the vehicle should be maintained properly.

The last and final application is related to safety driving assistance which will have Arduino microcontroller and moisture content reader as a hardware unit. In this application whenever the driver borrows the vehicle and when he tries drive on to the particular path the moisture content of that path will be read out and safety measures will be displayed on to the LCD display panel as warning assistance. It is basically an alert indicator by means of this in real time the driver can change the path which he has chosen early to travel.

3. RESULTS AND DISCUSSION

The overall results will be divided into the individual results of the application's involved in the project, so will examine the results one by one.

- Consider the first application i.e.

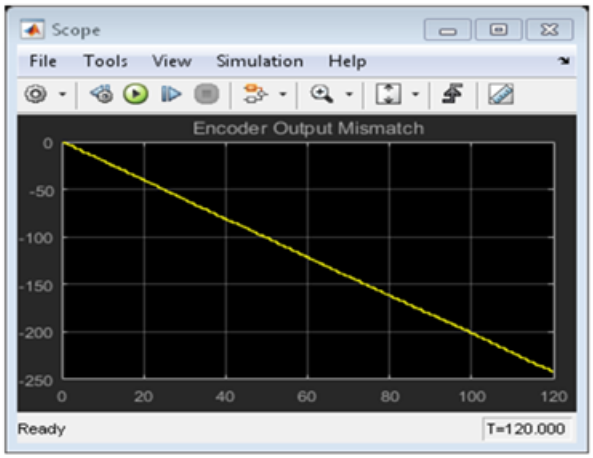


Fig - 3: Encoder mismatch output when the system in open loop configuration

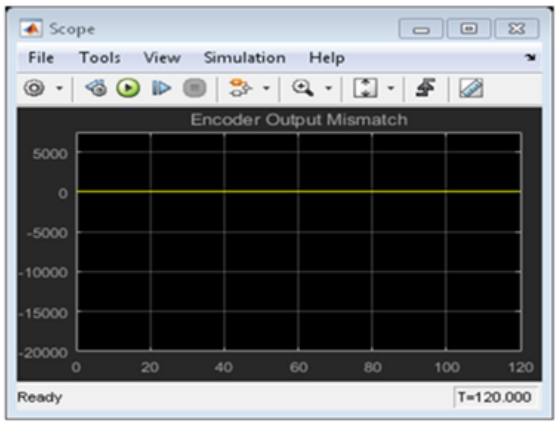


Fig - 4: Encoder mismatch output when the system is under closed loop configuration

The above results are the expected simulation results for drive with PID control.

- Consider the second application.

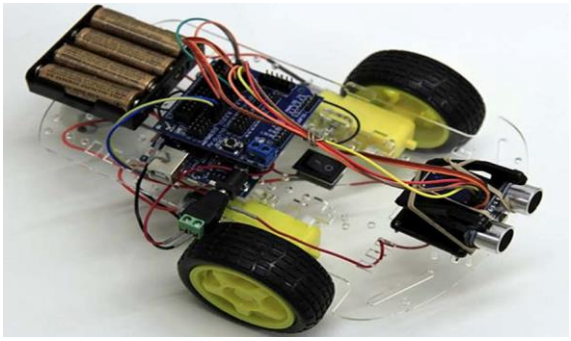
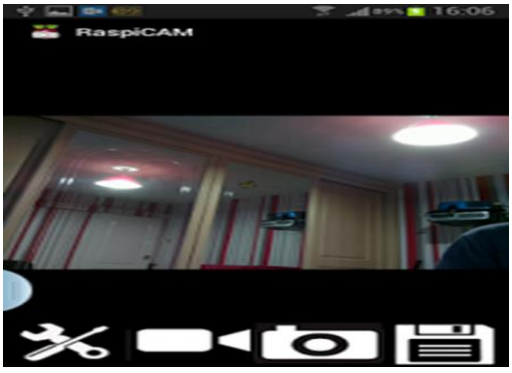


Fig - 5: Manual setup elaborating the Mechanized speed control of passenger vehicle

In the above application, as the system mainly controlled by the Arduino microcontroller the expected results are not shown in the form of simulation results. Because it is an automatic system in controlling the speed of the vehicle.

- Consider the third application

Fig - 6: Manual setup of Vehicle surveillance camera for object detection using Raspicam and Android application



The expected results are shown in the above diagram when all setups are done which is explained in the implementation.

- Consider the fourth application.

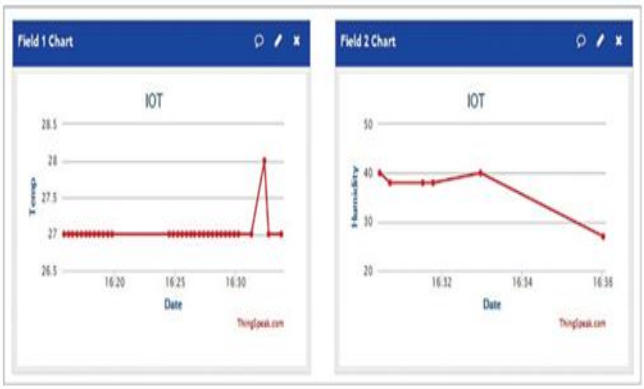


Fig- 7: Graphical representations of Humidity and Temperature on Thinspeack platform

The above representation is for the Passenger vehicle interior humidity and temperature monitoring with IOT and to maintain onboard temperature with air coolant system.

- Consider the final application.

Fig-8: Safe drive assistance Indications on LCD

Fig-9: Safe drive assistance Indications on LCD

The above representation is for the Safe drive assistance, where the results are displayed on the 16*2 LCD display.

4. CONCLUSION AND FUTURE SCOPE

In accordance with the objectives of this project as mentioned earlier in this report as applications, the required results are obtained.

- First application i.e. Drive with PID control with simulation result obtained and real-time implementation is done.
- Second application is related to Mechanized speed control of passenger vehicle, the speed variation and controlling acquired with ideal results.
- Third application is related to Vehicle surveillance camera for object detection using raspicam and Android application, in which video and images have the clear visibility to recognize the objects using IOT application.
- Fourth application is related to Passenger vehicle interior humidity and temperature monitoring with IOT and to maintain onboard temperature with air coolant system, in this application parameters involving with IOT are acquired with the ideal results and represented them on the graphical platform using Thingspeack.
- Fifth application is related Safe drive assistance in which using moisture content reader, the alert messages are obtained based on the parameter variations. Finally, to alert the driver.

The involvement of embedded systems in the field of automobile systems will create a great impact in future technology improvisations. As the electronic control unit moderates, number sensors and actuators will be increased. So that Automatic and smart way approach of the system will have great reliability and accuracy.

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