Car Black Box

A project based on PIC16F877A Microcontroller

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Project Brief

As part of a personal project, I successfully designed a Car Black Box System using a PIC16F877A development board and implemented it using C programming with the XC8 compiler. The primary objective of this system was to record and store various important data points related to the car's performance and incidents, such as gear shifting, speed changes, and collisions. The data was logged in an external EEPROM, allowing for easy access and editing of the recorded information, including the ability to modify timestamps, passwords, and other relevant parameters.

System Architecture

- Microcontroller: PIC16F877A
- Programming Language: C
- Compiler: XC8

Data Inputs

- **Gear Shift:** The system records the timing of gear shifts, capturing when the driver changes gears.
- **Speed Change:** It logs the time when there is a significant change in the car's speed.
- **Collision Detection:** The system detects and records collision incidents, capturing the timestamp of the event.

Data Logging

- The system utilizes an external EEPROM to log the recorded data securely.
- Each data entry is assigned a unique identifier for easy access and retrieval.

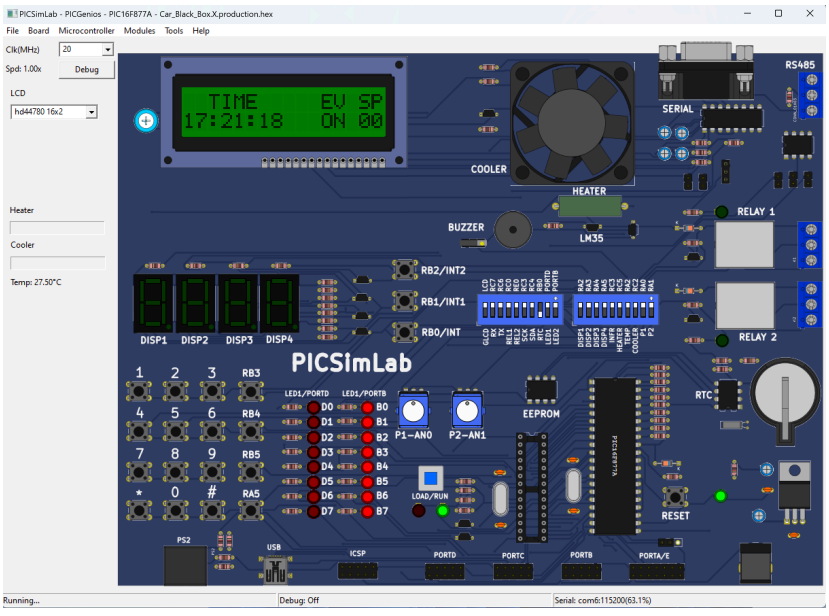
User Interface

- The system provides a user-friendly interface for accessing and editing the logged data.
- Users can review recorded events and make modifications as needed.
- Functionality includes changing timestamps, passwords, and other relevant parameters.

System Workflow

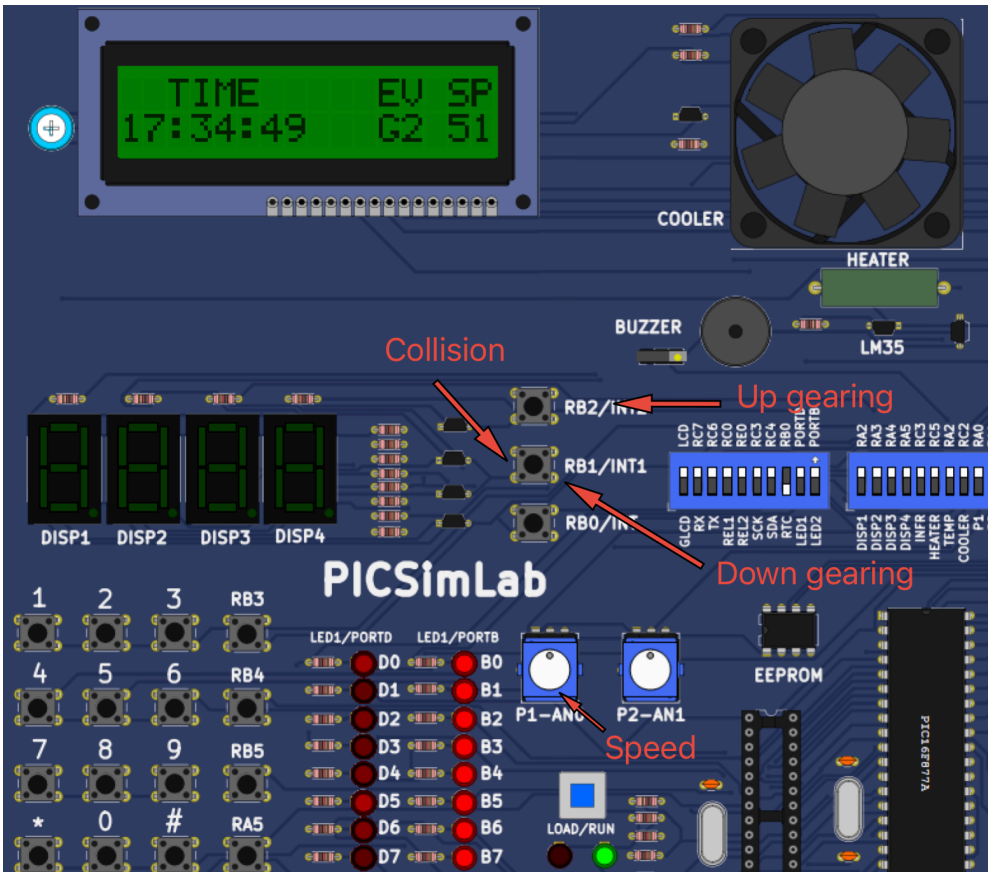
Initialization: Upon startup, the system initializes the PIC16F877A microcontroller and the external EEPROM. You will be able to see the Dashboard screen on the builtin LCD screen

The simulations were done on a simulator software called PICSIMLAB, which can run on Windows and LINUX operating system.



Dashboard Screen

The Dashboard screen will display the Time, current event and speed, as you can see in the image below. You can interact and make changes in the events and speed accordingly.



Up gearing: To increase the gear to higher level you have to press **RB2** switch.

ON → Neutral → Reverse Gear → Gear1 → Gear2 → Gear3 → Gear4

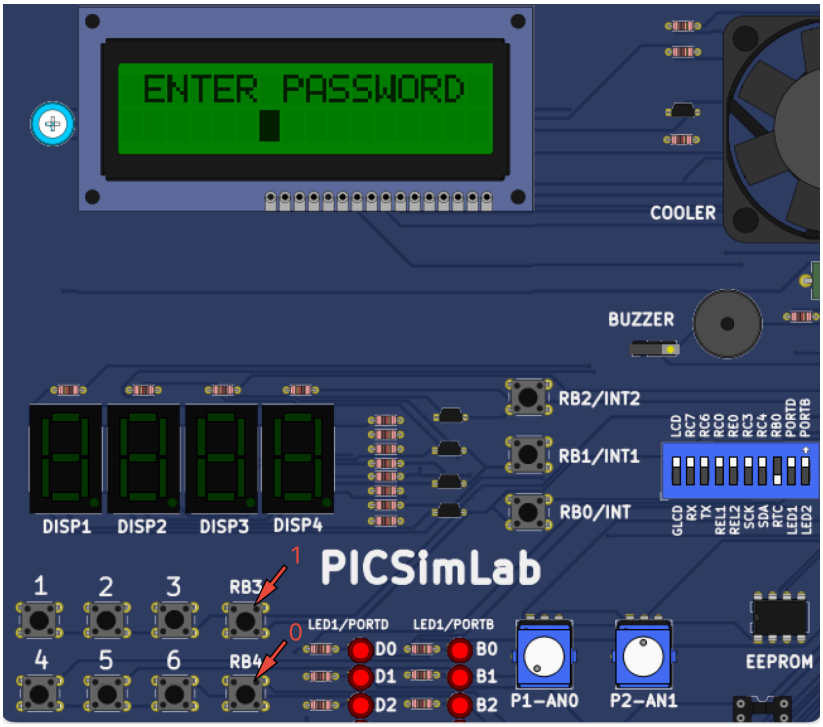
Down gearing: To decrease the gear level, you have to press **RB1** switch.

Gear4 → Gear3 → Gear2 → Gear1 → Reverse Gear → Neutral

Collision: If you press the **RB0** switch the system will record the event as collision. You will see ‘C’ mentioned in the event section of the dashboard.

Speed: The speed can be changed by rotating the potentiometer knob P1 as shown in the above image.

Login Screen



While you are in the dashboard, if you press **RB3** switch you will be directed to the login screen. Here you will have to enter a 4 digit password with 1s and 0s, where **RB3** will enter 1 and **RB4** switch will enter 0.

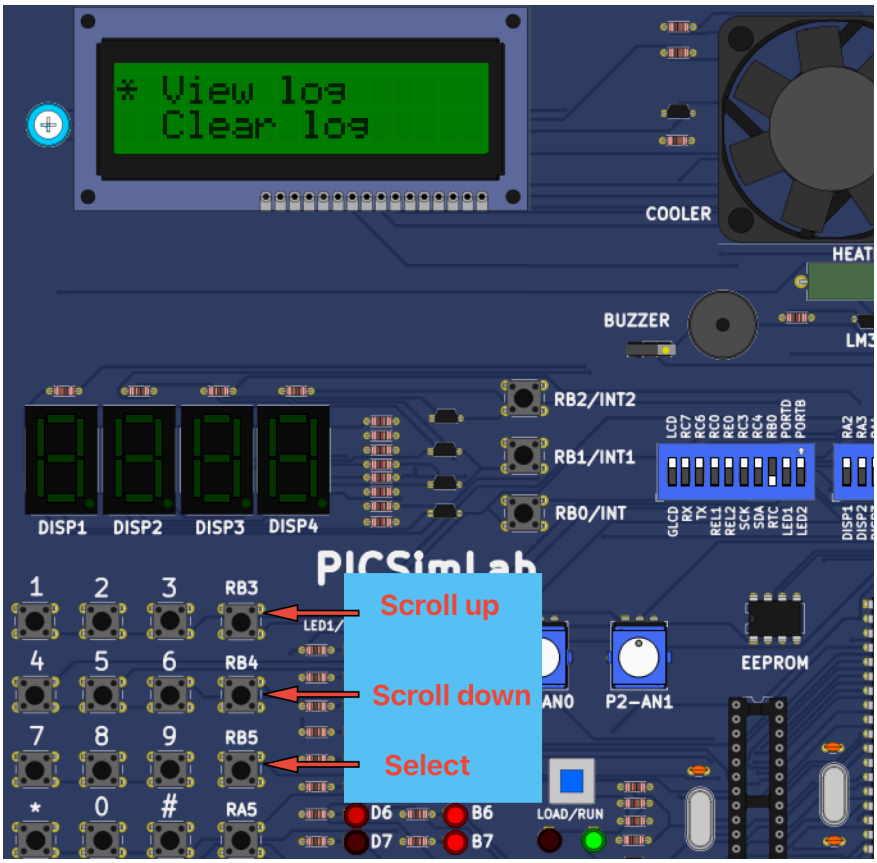
The screen will revert back to the dashboard if no activity is detected in 5 seconds.

You will have 3 attempts at a time to enter the password, if you fail to enter the right password in all three attempts you will be locked for 60 seconds.

Login Menu screen

Once you have logged in successfully you will enter the login menu screen, where you have option to access certain features of this system like:

- View Log
- Clear log
- Download Log
- Set Time
- Change Password



To scroll through the menu we can use **RB3 (to scroll up)** and **RB4 (to scroll down)** switches. In order to select one of these features we can click the RB5 switch.

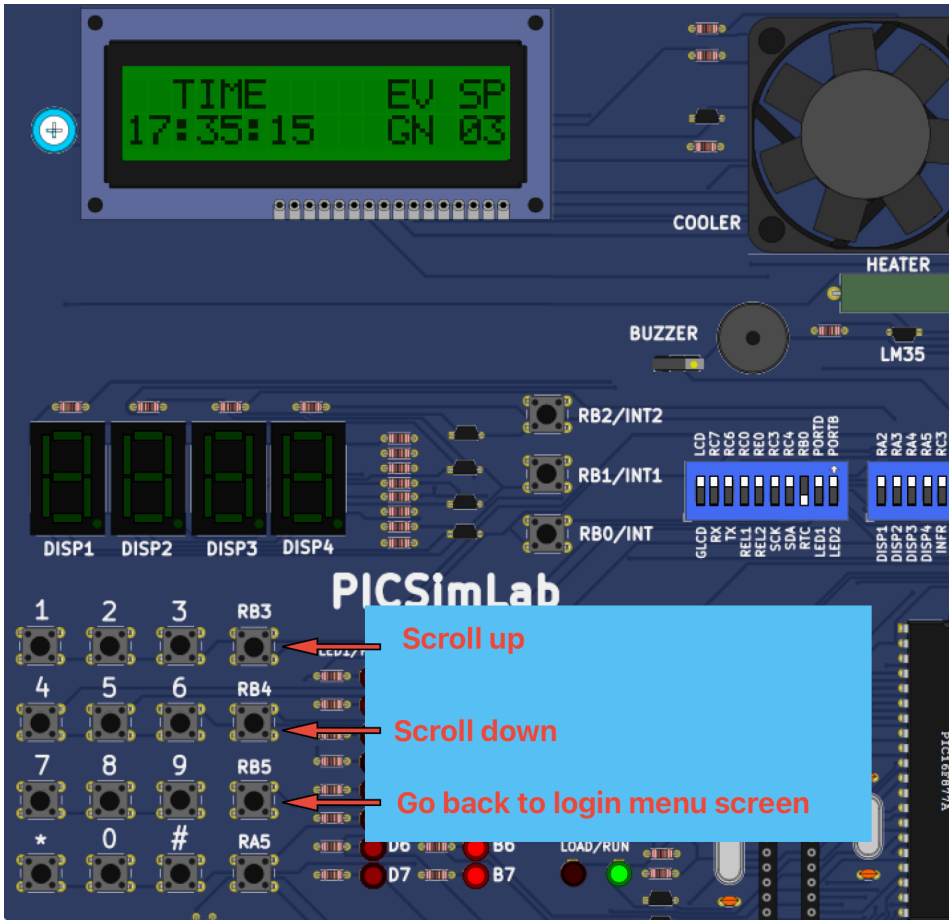
View Log

Here you can view the events that occurred, while making changes in the gear and speed in the dashboard screen. This window will only display the latest 10 events that has been stored in the EEPROM.

In order to scroll through the menu you can make use of **RB3 (to scroll up)** and **RB4 (to scroll down)** switch just like in the login menu screen.

In order to go back to the login menu screen you can press **RB5** switch as showing the image below.

If there is not data present in the EEPROM (if you have cleared it from the clear log option) then it will display “NO DATA”.



Clear Log

When you open this window it will immediately delete all the event logs from the EEPROM and it will display “LOG CLEARED” on the LCD.