Universal Smart Car Kit

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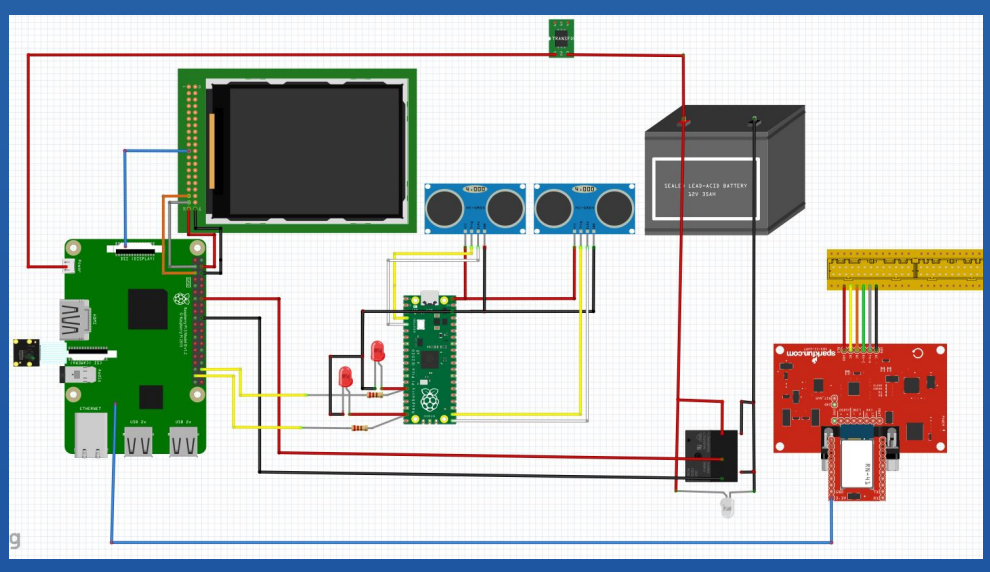
Abstract:

In 2019, a study done by the National Highway Traffic Safety Administration concluded that 94% of the serious vehicle accidents that occurred in 2018 were due to human error. They believe that with the incorporation of autonomous vehicles in American society we can save the lives of the nearly 36,560 people that died in 2018 [1]. That is why the aim of this project was to advance, develop, and deploy autonomous vehicle components and instruments in an older vehicle to assist in the modernization and progress of the autonomous/smart vehicle. In this project, you will see that it is possible to implement these similar autonomous vehicle components into a 2002 Lexus Is300, which has very limited technology and resources. The significance of this study was to show that as we wait for a society filled with autonomous cars we can build and install kits into our very own personal cars to assist in a safer transportation experience. These kits consist of blind-spot monitoring, backup camera, and engine monitoring. Using a Raspberry Pi and a microcontroller we can implement all these features onto an interactive screen to display to the driver.

Full System Wiring Diagram:

This diagram shows how the system is wired and designed.



Background:

Smart car kits are available online from retailers such as Amazon.com. However theses kits are often very expensive, dificult to integrate into an existing vehicle, and do not have all the features a user wants and needs for a safer driving experience.

Results:

The prototype is able to run a backup camera, blindspot monitroing system and live data module while outputting all of this to the user through a real time GUI.

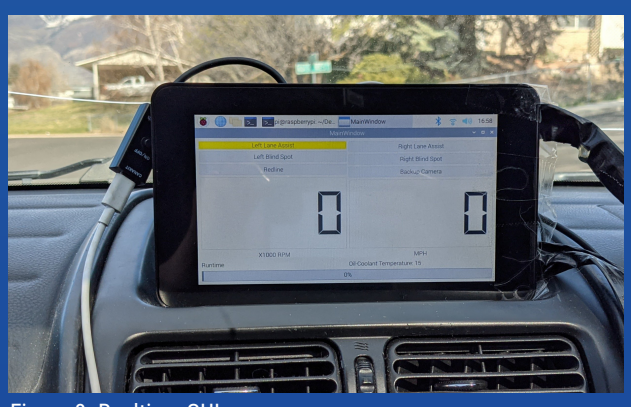


Figure 8. Realtime GUI

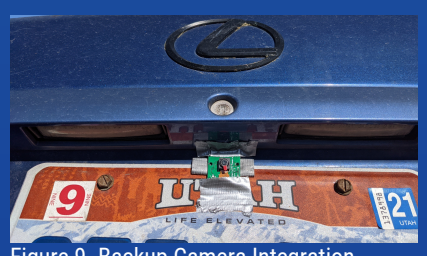


Figure 9. Backup Camera Integration

Figure 10. Ultrasonic Sensor Integration

Methods And Materials:

The smart car kit design incorporates two microcontrollers, one for managing the blind spot mointoirng system and one for getting live data from the car's Engine Control Unit, a Raspberry Pi that acts as the driver for the GUI and the entire system. It also contains a touchscreen for IO, a camera for the backup camera, a relay to trigger the backup camera and two ultrasonic sensors used for blindspot detection.
The system works by communicating with the Engine Control Module Using an ELM327 microcontroller and an OBD2 python library the data is queried and output to the screen. The system is also checking if the car is in revers by checking for voltage on the reverse light bulbs that were tapped into with the relay. Lastly the ultrasonic sensors are always chcking if an object is within 6 feet of the vehcile, if so the microcontroller emits a singal telling the GUI to light up what side the vehicle is detected on.

Figure 1. ELM327 Microcontroller

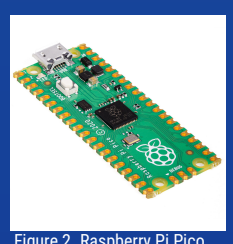


Figure 2. Raspberry Pi Pico

Figure 3. Raspberry Pi 4 (4Gb)

Figure 4. Raspberry Pi 7" Touchscreen

Figure 5. Raspberry Pi Camera

Figure 6. 12V DC Relay

Figure 7. HC-SR04 Ultrasonic Sensor

Conclusion:

The Universal Smart Car Kit prototype works as designed and expected. It provides the driver with a fully functional backup camera, blindspot monitroing system, live data from the cars Engine Control Unit and a stylish GUI.

Figure 11. Gui With Live Data

REFERENCES:
[1] NHTSA 2019, National Highway Transportation Safety Administration, accessed 28 January 2021, https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety