Embedded Systems Project

Report

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Team 19

Imagination Station

Brief description about your project idea and approach:

1) Automatic Emergency Braking (AEB), which had 2 main approaches.
First, it should alert the driver to an imminent crash with audible warnings.
Second, it should (independently) brake and thus, stop the car.
2) General Purpose Display and Automatic Headlights
Our dashboard (LCD) displays certain information in real time on the LCD display.
This information includes:
a) Date and Time.
b) Temperature.
c) Current Gear.
d) Night Detection with Automatic Headlights. (It turns on the car's headlights when it is dark)
3) Keyless Entry.
Which is responsible for two functionalities:
a) Lock and Unlock your car without a physical key.
b) Start/Stop Engine button.

The components used in your project and their functionalities:

All requirements are done on a physical car.
The current date and time are reflected on an LCD.
The temperature is measured using a temperature sensor, and displayed in degrees Celsius also on LCD.
The current gear reflect one of the four automatic gears (P,D,N,R) on the LCD and is controlled by the joystick on our phones using a Bluetooth module.
The night detection is detected using a light sensor.
Car's headlights are represented as LEDs.
The keyless entry mechanism is implemented using an RFID reader/writer.
The car's start and stop actions are controlled via a Start/Stop Engine button.

The project full circuit using Fritzing https://fritzing.org/home/:
Attached.

The names of the libraries used and their functions:

LiquidCrystal(writing characters on LCD). Wire. Bluetooth module library. Semphr (for semaphores) DS3231. RemoteXY (for joystick). MFRC522 (for rfid reader).

How do you take and handle the inputs?
Digital/Analog read. Library used for more complicated hardware (like Bluetooth module)
Ultrasonic/light sensors: we used the appropriate functions to get the distance/amount of light sensed.
Digital read was used for buttons.
Analog read was for temperature and light sensors and PWM.

How do you configure and handle the outputs?
Pin mode: input./output.
Digital write (HIGH/LOW)

Explain how the features were prioritized and divided into tasks using freeRTOS
Start task: gives semaphores to everything so that the system could start. Has the highest priority. Used by keyless entry and start engine.
Motor task: Takes readings from global variable in Bluetooth module P,N,D,R, left(starts left engine only) and right(starts right engine only). Used by ultrasonic sensor and PWM.
Light Task: If luminance passes a certain threshold the led will be turned on. Has the lowest priority. Used by light sensor.
LCD task: Used by joystick, Temperature sensor, lcd.
Task for Bluetooth module.

The problems or limitations faced during the implementation of your project.
Synchronization between all tasks and prioritizing them.

Using : Task delay until and wake up time.

Semaphores.

Using and referencing datasheet for pins, how to operate, operating voltages, etc.

How did you divide the work among the team members?

We all were working together almost all the time on the project. Scheduling was done by Hatem only.