Project 2 Code

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Description of the System

The Automatic Headlight Control System in Project 2 is designed to enhance driving safety and convenience by automating the activation and deactivation of headlights based on external conditions. The system integrates various components, including a driver seat occupancy sensor (a push button), an ignition push button (user push button), a blue indicator LED (in the NUCLEO board), a headlight mode selector (a potentiometer), a light sensor (an analog Light Dependent Resistor), and left and right low beam lamps (two LEDs). The ignition subsystem ensures the engine starts, which means the blue LED turns ON, when the driver's seat is occupied, and the ignition button is pressed and released, with the engine continuing to run even if the driver exits the vehicle. If the driver isn’t seated and the ignition button is pressed, the engine won’t start. When the ignition button is pressed and released while the engine is running, it turns off the car. The headlight subsystem operates in three modes: ON, OFF, and AUTO that can be setup using the potentiometer (less than 0.33 for OFF, between 0.33 and 0.66 for AUTO, over 0.66 for ON). The ON mode turns on the headlights (LEDs) while the OFF mode turns off the headlight. In AUTO mode, the headlights respond to ambient light levels, turning off after a 2 seconds when it's sufficiently bright and turning on after a 1 second when it's dark. If there is ambient light level, the headlights state doesn’t change.

Testing results

System behavior tested	Results (Pass/Fail)
Ignition Subsystem	
Engine (blue LED ON) start after ignition and driver seat buttons pressed	Pass
Engine doesn't start (blue LED OFF) if ignition button is pressed while driver seat button isn't pressed	Pass
Engine keeps running (blue LED ON) even if the driver isn't seated anymore	Pass
Engine stops running (blue LED OFF) when ignition button is pressed and engine is running	Pass
Headlights Subsystem	
When setup to OFF mode (potentiometer less than 0.33), the headlights turns OFF (LEDs OFF)	Pass
When setup to ON mode (potentiometer over 0.66), the headlights turns ON (LEDs ON)	Pass
When setup to AUTO mode (potentiometer between 0.33 and 0.66) and the light sensor detects brightness, the headlights turns OFF (LEDs OFF) after 2 seconds	Pass
When setup to AUTO mode (potentiometer between 0.33 and 0.66) and the light sensor detects darkness, the headlights turns ON (LEDs ON) after 1 second	Pass
When setup to AUTO mode (potentiometer between 0.33 and 0.66) and the light sensor detects ambient light level, the headlights keep their current state	Pass