Assignment 2: Traffic Signal Simulation for Embedded Systems

Group 20:

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Github Repository: https://github.com/mandarc64/CS692_001_G20

Objective: The goal of this project is to simulate a traffic signal system using two sets of red, yellow, and green LEDs, which will be implemented on a BeagleBone board. The simulation aims to emulate a simple intersection with opposing traffic lights, incorporating user-configurable timing and standard transition cues.

Development Tools and Environment:

- **SciTools Understand:** Used for checking compliance against coding standards.
- **QEMU Emulator:** For initial implementation and testing of the simulated traffic signal system.
- **BeagleBone Board:** The target hardware for deploying the final code.

Implementation Details:

- **LED Simulation:** The system simulates two sets of traffic lights using red, yellow, and green LEDs. Each set represents the lights for one direction of the intersection.
- **User Input:** The program prompts the user to input the duration (in minutes or fractions of a minute) for the green light. This input is used to configure the timing of the traffic lights.
- **Light Transition:** The transition from green to red includes a 5-second yellow signal. After the red light is activated in one direction, there is a 2-second delay before the green light is activated in the opposing direction. During this delay, both the yellow and red lights are illuminated.
- **GPIO Pin Configuration:** The user is prompted to input the GPIO pins being used for the LED outputs. These pins are then used in the code to control the LEDs.
- **Modularity:** The code is modularized to allow for future expansion, such as the integration of different traffic signal devices or the addition of sensors for more intelligent signal control.

Testing and Validation:

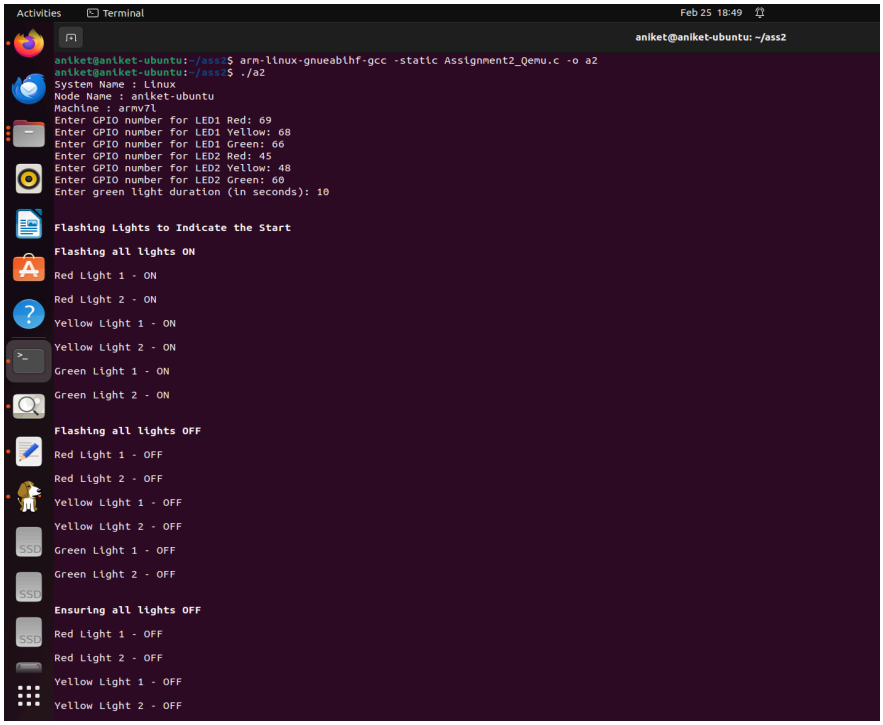
- **Emulation Testing:** The initial implementation is tested using the QEMU emulator. The actual GPIO output is stubbed out, and the light colors are printed to stdout for verification.
- **Hardware Deployment:** After successful testing in the emulator, the software is finalized and deployed on the BeagleBone board. The LEDs are connected to the specified GPIO pins to simulate the traffic lights.

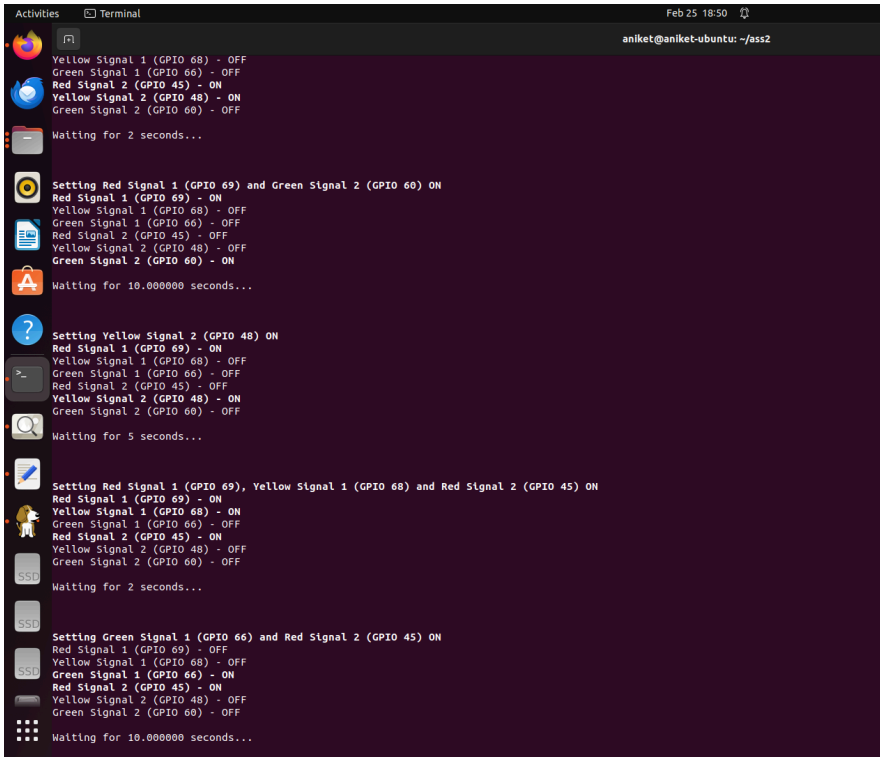
Project Outcomes:

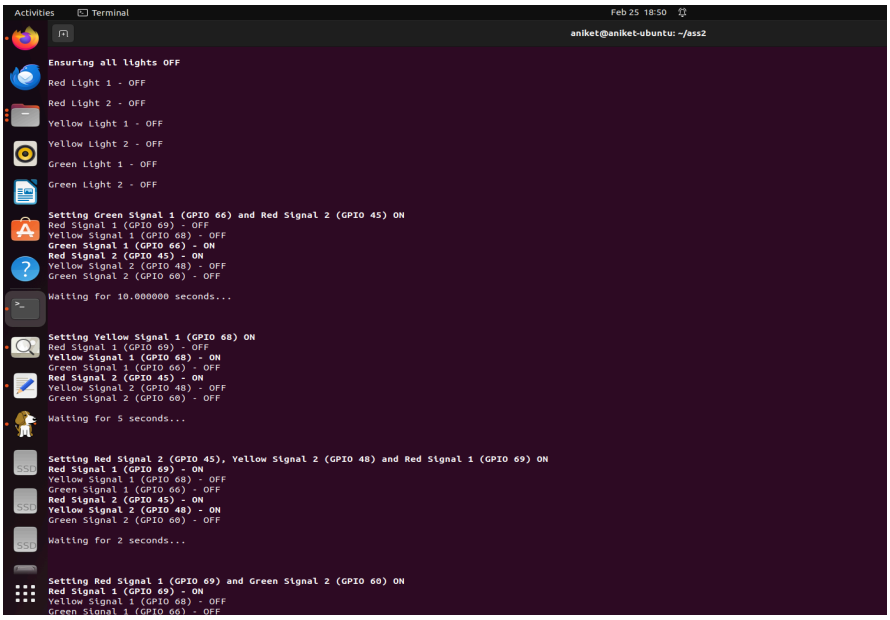
- A functional traffic signal simulation that can be controlled via user input.
- Modular code that adheres to coding standards..
- Successful implementation and testing on both an emulator and BeagleBone board.

Supporting Materials:

- **Screenshot of Emulator Output:** A screenshot showing the output of the code executed on the emulator, demonstrating the simulated traffic light transitions.







Video of Hardware Execution: A video showing the execution of the simulation running on the BeagleBone board, with the LEDs representing the traffic lights.

Upon execution of the code, an indication of the program's operational status is provided through a series of five blinking cycles of all the LEDs. This feature serves as a visual confirmation to the user that the code is running and functioning as intended. These blinking cycles are integrated into the code to facilitate quick verification of program execution.

- https://drive.google.com/file/d/1dPexqVN7Yn-xrppt4SLF2B5m2U5p0MWN/view?usp=sharing