



BAHRIA UNIVERSITY, (Karachi Campus)

Department of Software Engineering

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Course Title: Computer Architecture & Logic Design Lab
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PROJECT IDEAS:

Here is a diverse range of project ideas from which you can choose for your project:

MIPS ASSEMBLY LANGUAGE

1. **Basic Arithmetic Calculator:** This project involves creating a simple calculator that performs basic arithmetic operations like addition, subtraction, multiplication, division, factorial, power (like square or cube), root etc. on integers or floating-point numbers.
2. **Matrix Operations:** Implement various matrix operations such as addition, subtraction, multiplication, and finding determinants or inverses in MIPS assembly. This project deals with manipulating matrices based on user inputs.
3. **Simple Game Development:** Create a basic game (e.g., tic-tac-toe, simple puzzle game) using MIPS assembly language. This project involves designing game logic, user interactions, and displaying game elements.
4. **MIPS-Based Text Adventure Game:** Develop a text-based adventure game where users navigate through a story-driven scenario by making choices or inputs. The game progresses based on user decisions, displaying text-based outcomes.
5. **MIPS-based Encryption/Decryption:** Build a program that encrypts and decrypts messages or text using a specific encryption algorithm (e.g., Caesar cipher, substitution cipher) in MIPS assembly language. Users input the text and encryption/decryption keys.
6. **MIPS-Based Morse Code Translator:** Create a program that translates text input by the user into Morse code and vice versa using MIPS assembly language. The program translates alphanumeric characters to their corresponding Morse code representations.
7. **GPA Calculator in MIPS:** Develop a GPA calculator capable of receiving inputs for course credits and grades, computing the GPA according to a specified grading scale, and presenting the final GPA. The calculator should exhibit individual semester outcomes, detailing the grade,

grade points for each subject, and the corresponding GPA. For multiple semesters, the Cumulative Grade Point Average (CGPA) is also necessary to be computed. This project requires proficiency in arithmetic calculations and proficient data management.

8. **Arithmetic Formula Evaluator:** Build a program that evaluates a specific arithmetic formula (e.g., equation solving using quadratic formula, gaussian elimination, matrix inversion or LU decomposition etc.) in MIPS assembly. The program parses the input, performs calculations, and displays the result.
9. **Flashcard-based Q&A System:** Create a flashcard-based question-and-answer system in MIPS assembly. Users input questions and corresponding answers, and the program presents these flashcards for the user to answer.
10. **Multiple Choice Quiz Game:** Develop a multiple-choice quiz game using MIPS assembly language. Users can choose answers from a set of options, and the program evaluates and scores their responses.
11. **Math Quiz Generator:** Implement a program that generates math quizzes (e.g., addition, subtraction, multiplication, division) with varying difficulty levels. Users can attempt these quizzes, and the program assesses their responses.
12. **Conversion Calculator:** Create a program in MIPS assembly that performs various unit conversions (e.g., temperature, length, weight) based on user input & displays converted results.

HARDWARE BASED – LGIC DESIGN

1. **Traffic Light Simulation with Pedestrian Crossing:** This project involves designing a simulated traffic light system that includes pedestrian crossing signals. Utilizing multiplexers and timers, the flow of traffic and pedestrian walk signals are controlled systematically. The traffic light sequences—green, yellow, and red—are managed by multiplexers, which switch between the different states based on preset time intervals. Additionally, when pedestrian crossing signals are activated, the multiplexers allocate a specific duration for safe pedestrian crossing by coordinating with the traffic signal timings.
2. **Digital Dice:** The digital dice project aims to create a random number generator circuit using flip-flops or counters to cycle through different numbers. LEDs are used to display the numbers generated. The circuit simulates rolling a dice, where the LEDs light up sequentially to represent different numbers as the dice is 'rolled.' Flip-flops or counters assist in generating and displaying the random numbers in a sequential manner similar to how a traditional dice displays numbers upon rolling.
3. **Binary Coded Decimal (BCD) Counter:** In this project, a BCD counter is designed using flip-flops to count in decimal digits. LEDs or a seven-segment display is utilized to show the count. The BCD counter increments through decimal numbers in a sequence from 0 to 9,

displaying each count on the LED display. Flip-flops manage the counting sequence and the conversion of binary to BCD for accurate decimal representation.

- 4. Morse Code Generator:** The Morse code generator circuit is built to translate text input into Morse code and display the Morse code using LEDs or another output interface. Flip-flops or logic circuits are employed to convert the text characters into Morse code equivalents. The generated Morse code signals are then displayed using LEDs or another output mechanism to visually represent the input text in Morse code.
- 5. Multiplexer-Based Calculator:** This calculator circuit utilizes a multiplexer to select various arithmetic operations (addition, subtraction, multiplication, division) and operands to perform calculations. The selected operations are then processed using logic gates and arithmetic circuits, and the result is displayed on an output interface, which could be LEDs or a display panel. Multiplexers help in choosing the desired operation and operands for computation.
- 6. Multiplexer-Based Address Decoder:** This project involves constructing an address decoder for memory or I/O devices by utilizing a multiplexer to select specific memory locations or device addresses. The multiplexer assists in decoding the binary address inputs, allowing the system to access the desired memory locations or I/O device addresses efficiently.
- 7. Traffic Light Control with Priority Management:** An advanced traffic light system is designed to prioritize emergency vehicles using a multiplexer to manage traffic light sequences. The multiplexer dynamically alters traffic light sequence based on received priority signals, ensuring a smooth flow of traffic while granting priority to emergency vehicles.
- 8. Digital Game Scorekeeper:** This project focuses on creating a digital scorekeeping system for a game using flip-flops to store and update scores based on user input or game events. Flip-flops are utilized to maintain and modify the game scores, providing a reliable and sequential storage mechanism for the scores achieved during gameplay.
- 9. Digital Clock with Alarm:** The digital clock circuit is designed using flip-flops to store hours, minutes, and seconds. Additionally, an alarm feature is included, controlled by flip-flops, to trigger at a set time. The flip-flops manage the timekeeping function and the alarm setting, ensuring accurate time display and activation of the alarm at the specified time.
- 10. Digital Combination Lock with Keypad:** Create a digital combination lock system using flip-flops and a keypad for input. The system simulates a security lock where users enter a specific combination using the keypad. Flip-flops manage and compare entered combination with the predefined correct code. If the correct combination is entered, the system unlocks, signaling the successful entry. Conversely, incorrect entries prevent the lock from opening.

The End