Chipions’26 phase 1 final project:

Universal asynchronous receiver / transmitter (U A R T)

First of all what is the UART?

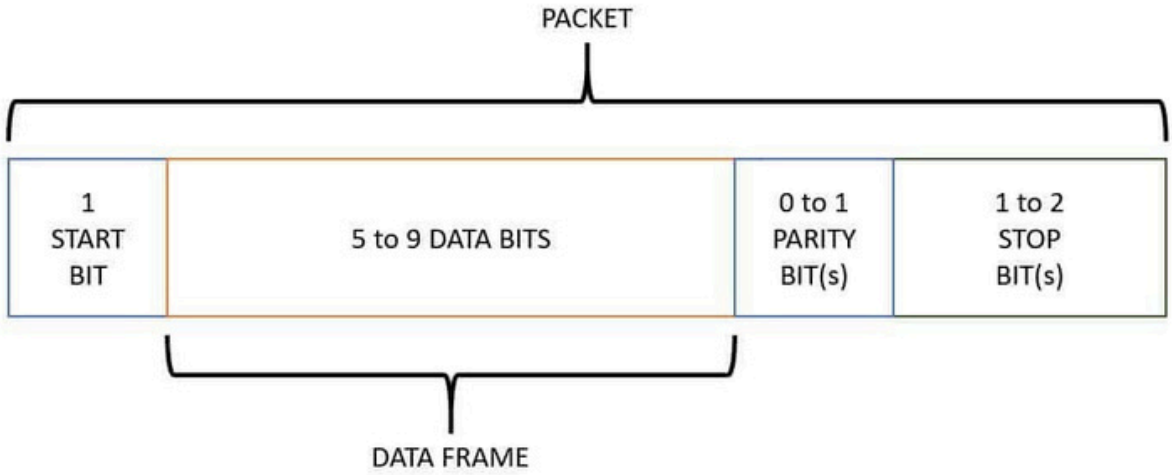
UART stands for Universal Asynchronous Receiver/Transmitter. It is a hardware communication protocol used for serial communication between devices.

How Does UART Work?

UART transmits data bit by bit at a specified baud rate. It does not require a clock signal; instead, it uses start and stop bits to synchronize data transmission between the sender and receiver.

Data Frame Structure:

1. Start Bit: Indicates the beginning of data transmission. It is usually a (0).
2. Data Bits: The actual data being transmitted, typically 5 to 9 bits long.
3. Optional Parity Bit: Used for error checking. Can be odd or even.
4. Stop Bit(s): Indicates the end of the data frame. It can be one or more (1) bits.



Common Uses of UART:

-Communication between microcontrollers and peripheral devices.

-Serial communication in embedded systems.

-Connecting computers to external devices like GPS modules, Bluetooth modules, and more.

Advantages of UART:

-Simple and easy to use.

-Requires only two wires for communication (TX for transmission and RX for reception).

Limitations of UART:

-Limited to short-distance communication due to lack of a differential signaling mechanism.

-Lower data transfer speeds compared to other protocols like SPI or I2C.

Typical UART Configuration Parameters:

- Baud Rate: Speed of communication, e.g., 9600, 115200 bps.

- Data Bits: Number of bits in each data frame, commonly 8 bits.

- Parity Bit: Even, odd, or none.

- Stop Bits: Number of stop bits, usually 1 or 2.

Second the Project Plan

Initial Project Planning, tasks and timeline:

-Defining project scope and objectives using the given data and searching the internet to analyze the whole devise.

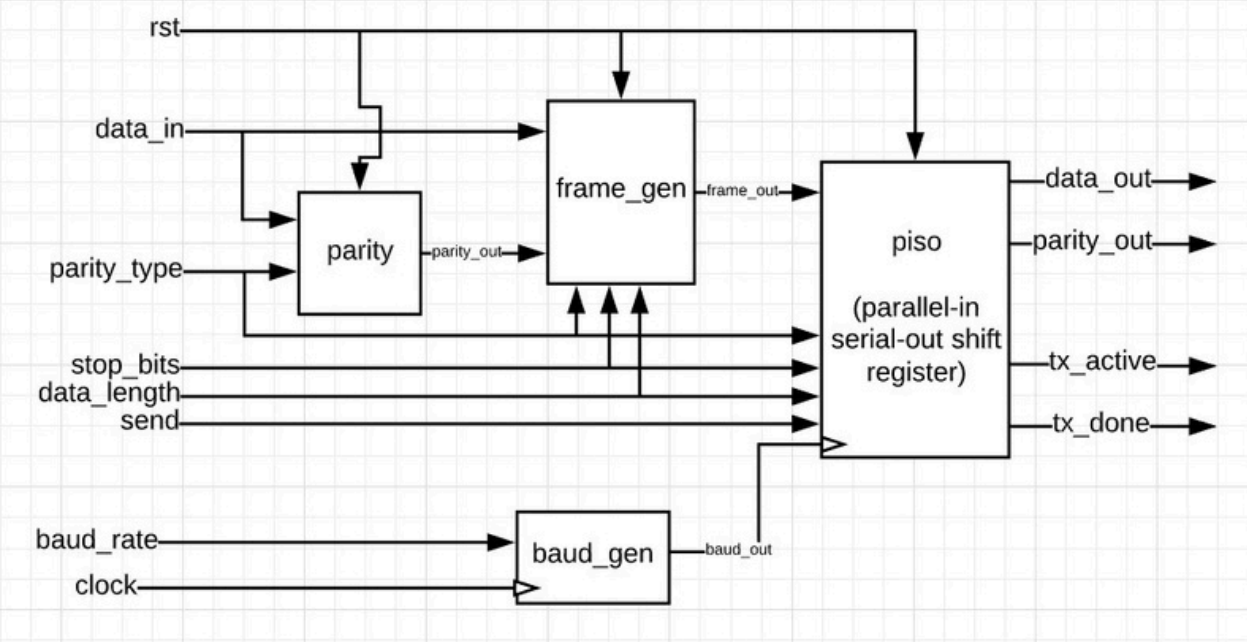
- First two days.

-Organizing a meeting to distribute the tasks and to identify the key components and requirements.

- In the third day.

-Finally, testing the final project and deliver it.

- The last day.



Design Steps

Step 1: Understanding UART Protocol

-Basics of UART communication

-Data frame structure (start bit, data bits, parity bit, stop bit)

Step 2: Specifications and Requirements

-Baud rate selection

-Data frame format selection

Step 3: Writing the Verilog Code

-Initial setup and module creation

-Writing the core logic (FSM - Finite State Machine)

-Implementing the transmitter logic

Step 4: Simulation and Testing

-Testbench creation

-Simulation results and debugging

-Timing analysis and optimizations