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Detection of Baudrate in UART Automatically By Using VHDL

Rosamma Antony[1], Manju M S[2]

M Tech Student, (AE&I) , Dept of ECE, Lourdes Matha College Of Science And Technology, Trivandrum, India.[1]

Assistant professor, Dept of ECE, Lourdes Matha College Of Science And Technology, Trivandrum, India[2].

ABSTRACT: This paper concentrates on developing a serial communication protocol (UART) with automatic baud rate detection. Automatic baudrate detection is useful for establishing communication link between two devices.The slaves device will able to detect the baudrate of the master controller and adjust accordingly.UART universal asynchronous receiver transmitter is generally used for better transmission of serial data that is either transmit or receive data serially. It involves designing of basic modules using Very High Speed Integrated Circuit Hardware Description Language (VHDL).

KEYWORDS: UART, Automatic baudrate.

I. INTRODUCTION

Universal Asynchronous Receiver Transmitter (UART) is a peripheral device serial port with fixed baudrate. It is an integrated circuit used for serial communication over a computer or peripheral devices. It consists of a transmitter, receiver, and each clocked separately. It transmit 9600 to 38400 bps for transmitting data bit. UART converts the bytes of data into a single serial bit. It adds a parity bit during the transmission and check the parity bit and discard it, and also it adds start bit during the transmission , in order to alert that receiver that a word of data is about to be send and also it handles interrupt and device management. That co-coordinating the computers speeds of operation with device speeds.

There are two ways of transmitting a byte between two digital devices. That is serial and parallel communication. Parallel communication impulses sending a whole byte of data over multiple wires and each bit has a single wire devoted to it and all bits are transmitted at the same time. On the other hand serial communication is that help us to send data to remote device by sending data bit over a single wire. when UART is operating with fixed baudrate for the transmitter ,as the baudrate of the transmitter changes the receiver cannot adjust with the master automatically it is time consuming and also there is a chance for data loss. So we go for the design of FIFO based UART

With automatic baudrate detection. Automatic detection is useful for establishing communication link between two devices .The slave device will be able to detect the baudrate of the master controller and adjust accordingly.

II. METHODOLOGY

In this section, it describes the method to find automatic baudrate. Basic UART module consist of transmitter, receiver, FIFO ,baudrate generator

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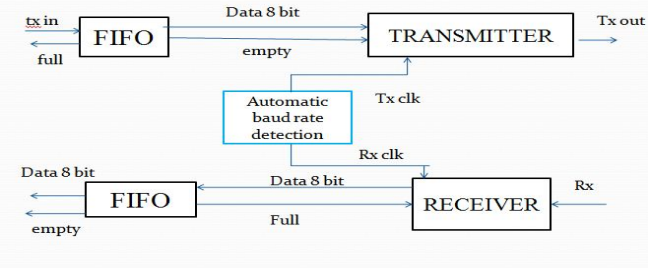

Fig1:Basic block diagram of UART.

A . FIFO

FIFO is a special type of buffer. The name FIFO stands for first in first out and means that the data written into the buffer first comes out of it first. There are other kinds of buffers like the LIFO (last in first out), often called a stack memory, and the shared memory. The choice of buffer architecture depends on the application to be solved. FIFOs can be implemented with software or hardware. The choice between software and a hardware solution depends on the application and the features desired. When requirements change, a software FIFO easily can be adapted to them by modifying its program, while a hardware FIFO may demand a new board layout. Software is more flexible than hardware. The advantage of the hardware FIFOs shows in their speed.

FIFO is implemented as a queue structure and it has a fixed length. If FIFO is empty or is not fully filled then only the data can be written into it .If FIFO is full ,it sends a signal "FULL" to the transmitter and receiver. Otherwise it sends "EMPTY" to both transmitter and receiver end.

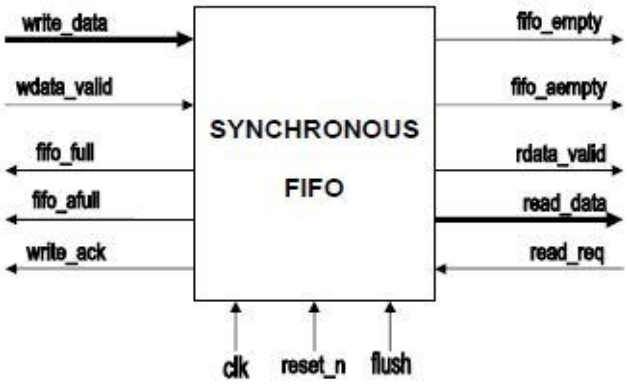

Figure 2: Black-box view of a Synchronous FIFO

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B Transmitter.

Transmitter is used to transmit data from one medium to another. If the start bit is detected, then the transmitter was able to send the data with baudrateTransmitter works on the basis of state machine .

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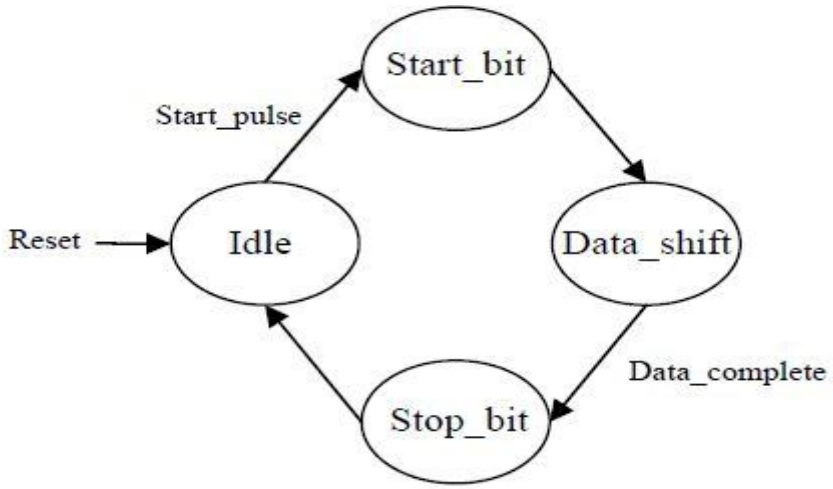

Figure 3 State diagram of a transmitter unit.

By detecting the start_pulse, sending operation is started. First of all, start bit is transmitted and then the main data and parity bit (if enabled) and stop bits, are sent, respectively. Figure 3. State diagram of a transmitter unit. At the end, the state machine goes to the idle state and waits for next transmission. Shift register converts theparallel data in to serial form and sends it on transmission line.Number of bits which are transmitted, counts by Bit-counter and number of cycles of clock signal which is equal to 16*baud_rate, is counted by event-counter.

C Receiver.

Receiver unit receives data from destination in serial bits and changes it to parallel form. Different parts of the receiver unit are the same as the transmitter unit. By the state machine, receiver controls the operation of other parts.

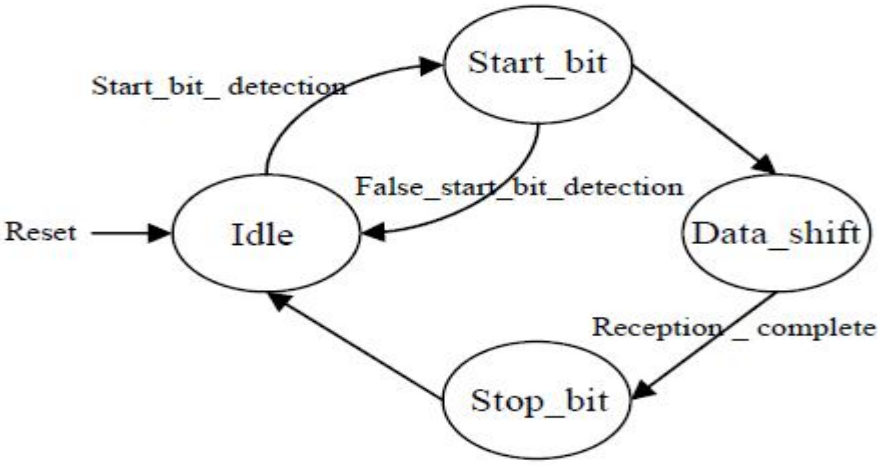

Figure 4 State diagram of a receiver unit.

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After reception of data and stop bit, state machine goes to the idle state and wait for next reception.

D: Automatic baudrate generator

` UART is operating with fixed baudrate for the transmitter. As the baudrate of the transmitter (master) changes the receiver (slave) cannot adjust with the master automatically. It is also time consuming..Automatic detection is useful for establishing communication link between two devices. The slave device will be able to detect he baud rate of the master controller and adjust accordingly.

III. ROLE OF AUTOMATIC BAUDRATE DETECTION

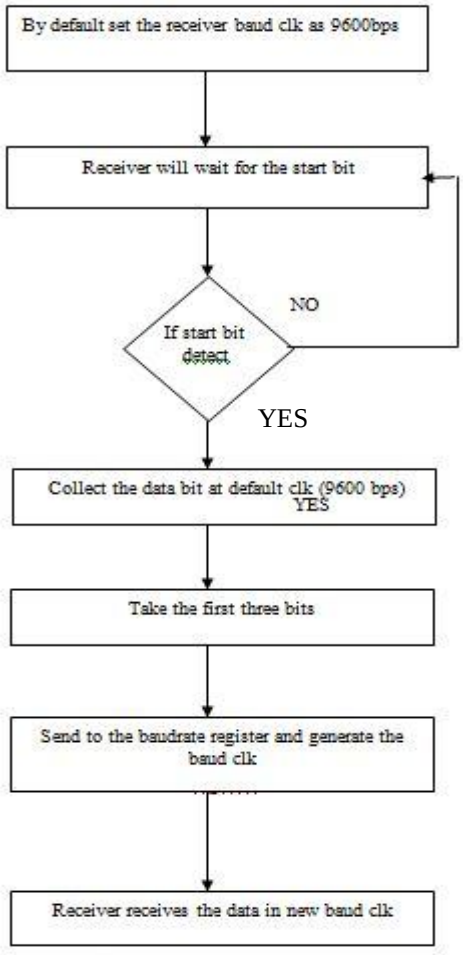

Figure 5 :Flow chart for automatic detection

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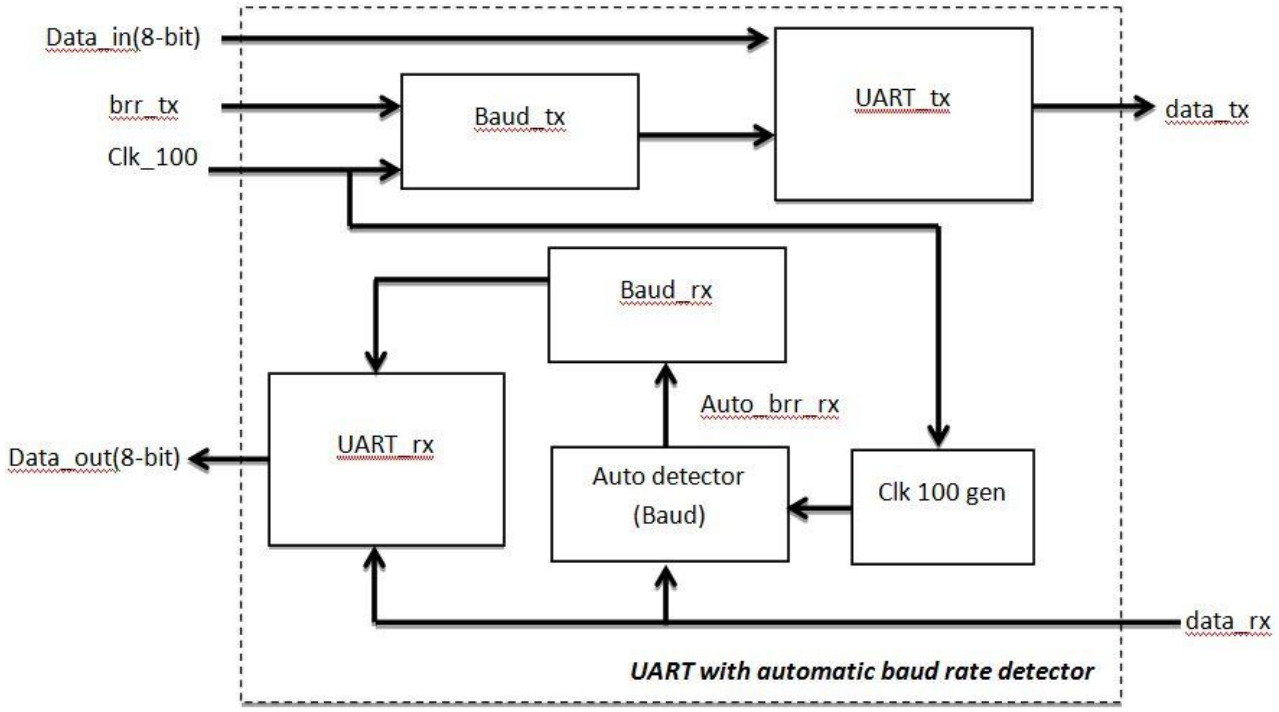

Fig 6 Complete architecture with automatic baud rate detector

The most commonly used number of data bits of a serial connection is eight, which corresponds to a byte. When a regular ASCII code is used in communication, only seven LSBs are used and the MSB is 0.If the UART is configured as 8 data bits,1 stopbit,and no parity bit ,the received data is in the form of 0-dddd-ddd-0-1, in which d is a data bit and can be 0 or 1. Assume that there is sufficient time between the first word and subsequent transmissions. In this scheme, the transmitting system first sends an ASCII code for rate detection and then resumes normal operation afterward. The receiving subsystem uses the first word to determine a baud rate and then uses this rate for the baud rate generator for the remaining transmission. Assume that the UART configuration is 8 data bits, 1 stop bit, and no parity bit, and the baud rate can be 4800, 9600, or 19,200 baud. The revised UART receiver should have two operation modes. It is initially in the "detection mode" and waits for the first word. After the word is received and the baud rate is determined, the receiver enters "normal mode" and the UART operates in a regular fashion

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IV .SIMULATION RESULT

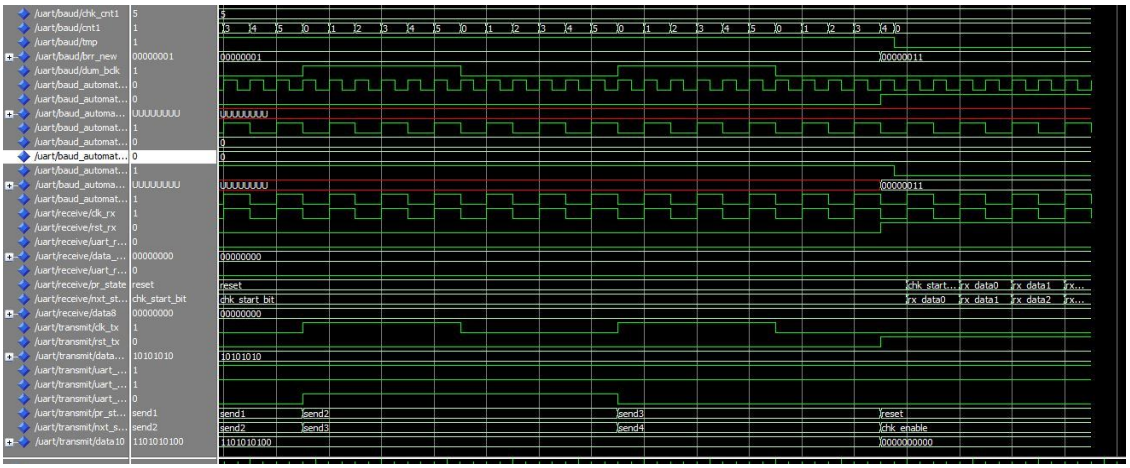

Fig 7 simulation result of automatic baudrate detection

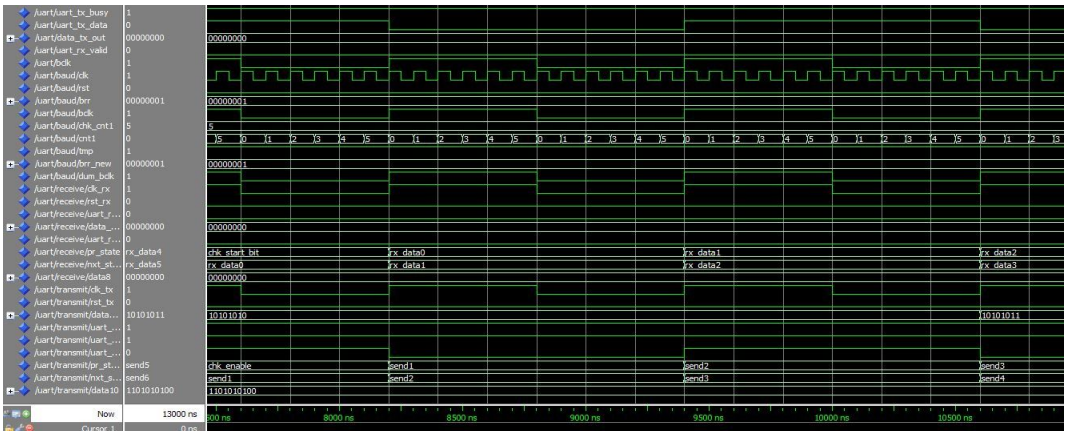

Fig 8 simulation result of fixed baudrate

V. CONCLUSION

Universal asynchronous receiver transmitter, (UART) is an integrated circuit used for serial communication over a computer or peripheral device serial port with fixed baud rate. Here we introduce the concept of automatic baud rate detection. so when the transmitter changes the baud rate the receiver can adjust automatically and it reduces the delay for the reception of data than the fixed baud rate.

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