Designing Of Ram In Vhdl Using Modelsim

Abenayasri.S[1], Kavin sitharthan. S[2]
[1, 2] Dept of ECE
[1, 2] Periyar Maniammai Institute of Sciences and Technology,
Vallam, Tamilnadu, India

Abstract- *This workRandom Access Memory (RAM) is a mandatory component of digital system. The RAM design aims to produce faster, smaller and economical system. A work on this topic enable better understanding of real time implementation on electronic system. This project focuses on designing a Random Access Memory (RAM) module using VHDL and validating its functionality through simulation with Model Sim. The objective is to develop a synchronous RAM with specified data and address widths, implement it in VHDL, and verify its operation through a comprehensive test bench.*

Keywords- IOT module, Car Accident, Arduino Microcontroller, Emergency Messages, Multi Sensor

I. INTRODUCTION

To Modalism is a simulation and debugging tool widely used for simulating hardware designs. It's often employed alongside Hardware Description Languages (HDLs) like VHDL, Verilog, and System Verilog to test and validate digital circuits before physical implementation. It's commonly used in FPGA or ASIC development workflows. HDL Simulation: Supports mixed-language simulation for Verilog, VHDL, and System Verilog.Waveform Analysis: rovides a waveform viewer to analyse signal behaviour over time.Testbench Support: Allows users to write and simulate testbenches to validate designs.Debugging Tools: Includes features like breakpoints, watch windows, and time-based stepping for efficient debugging.Integration: Works seamlessly with FPGA tools like Xilinx Vivado or Intel Quartus.

II. LITERATURE SURVEY

RELATED WORK

2.1 In this paper I had developed a system to provide the necessary to accident information to the vehicle. For today's world, safety and security plays an important role, hence we move towards to provide a good safety and intelligent security system while travelling. Vehicles are important in today's fast-paced society. Hence, having a vehicle now a days is considered a necessity, compared to the past where it was considered a luxury. In this thriving society, more and more vehicles are produced to meet the increasing demands of people and businesses from all of the world. Hence it is necessary to provide better safety and security features to them. Hence this project aims to design an embedded system for avoiding accident.To save data and instructions, memory is required. Memory is divided into cells, and they are stored in the storage space present in the computer. Every cell has its unique location/address. Memory is essential for a computer as this is the way it becomes somewhat more similar to a human brain.

In human brains, there are different ways of keeping a memory, like short-term memory, long-term memory, implicit memory, etc. Likewise, in computers, there are different types of memories or different ways of saving memories. They are cache memory, primary memory/main memory, and secondary memoryThere are three types of memories. Cache memory helps speed up the CPU as it is a high-speed memory, It consumes less time but is very expensive. The next type is the main memory or primary memory which is used to store or hold the current data, It consists of RAM and ROM, RAM is a volatile memory while ROM is non-volatile [1]. The third type is Secondary memory, which is non-volatile, it is used to store data permanently in a computer.

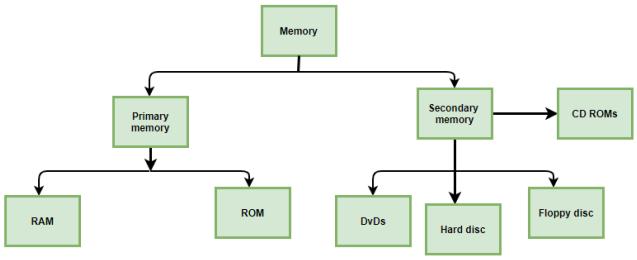


Figure 1.1 TYPES OF COMPUTER MEMORY

III. ANALYSIS SYSTEM

Our Random Access Memory (RAM) is a type of computer memory that stores data temporarily while a computer is running. It's called "random access" because the computer can access any part of the memory directly and quickly. RAM (Random Access Memory) is very similar to memory in the Human Brain. The human brain's memory is the most essential part played by the brain. Memory helps in remembering things, and people remember their past due to

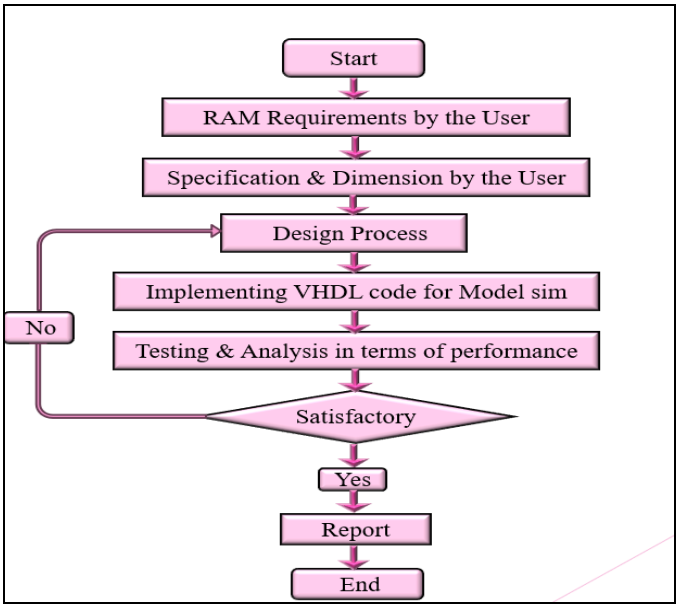
the memory present in the brain, similarly, computers have memory too.

RAM helps your computer run programs and process information quickly. When you turn off your computer, the data in RAM is lost, unlike data on your hard drive which is stored permanently. In this article, we are going to discuss about RAM and types of RAM in detail.It is one of the parts of the Main memory, also famously known as Read Write Memory. Random Access memory is present on the motherboard and the computer's data is temporarily stored in RAM. As the name says, RAM can help in both Read and write. RAM is a volatile memory, which means, it is present as long as the computer is in the ON state, as soon as the computer turns OFF, the memory is erased.

IV. PROPOSED SYSTEM

The Designing RAM in VHDL and simulating it in ModelSim involves creating a VHDL code for the RAM, defining the architecture (read and write operations), and then testing it using a testbench.Random Access Memory (RAM) is a critical component in digital systems, used for temporary storage and retrieval of data. In digital design, implementing and simulating RAM is essential for validating memory behavior before integrating it into larger systems.This document introduces the designing and simulation of RAM using VHDL (VHSIC Hardware Description Language) and ModelSim.The RAM design simulates the behavior of a memory block with defined data width and address range. This simulation helps test how data can be written to and read from specific memory addresses under various conditions

BLOCK DIAGRAM



V. SYSTEM REQUIREMENTS

5.1 RAM

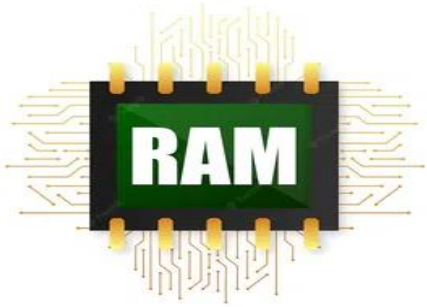


Fig 5.1 RAM

Random Access: Any memory location can be accessed directly using its address.Volatile Storage: The data is lost when power is turned off.Read/Write Operations: RAM supports both writing data into memory and reading data out.

5.2 FEATURES OF RAM

It's a vlsi, RAM modules come with various features that influence their performance and compatibility with different systems. Some of the key features include capacity, speed, latency, and voltage. RAM capacity refers to the amount of data that can be stored and accessed. It is commonly measured in gigabytes (GB) or terabytes (TB). Higher RAM capacity allows the system to handle more data simultaneously, which is particularly important for tasks such as video editing, gaming, and virtualization. Example: A computer with 16GB of RAM can handle multiple applications running concurrently without experiencing significant slowdowns. RAM speed, also known as frequency, determines how quickly data can be read from or written to the memory. It is measured in megahertz (MHz) or gigahertz (GHz). Higher RAM speeds lead to faster data transfer between the RAM and the CPU, resulting in improved system responsiveness. Example: DDR4 RAM modules commonly come in speeds such as 2400MHz, 3200MHz, and 3600MHz, with higher speeds offering better performance.LatencyRAM latency is the delay between a request for data and the actual retrieval of that data. Lower latency values indicate faster data access. Latency is often specified as a series of four numbers (e.g., CL16-18-18-38), with the first number representing the CAS (Column Address Strobe) latency. Smaller CAS latency values generally result in better performance.Example: A RAM module with a CAS latency of 16 will retrieve requested data more quickly than a module with a CAS latency of 18. •VoltageRAM modules operate at a specific voltage, which can have implications for power consumption and compatibility with the motherboard. Common RAM voltages

include 1.2V for DDR4 and 1.35V for some higher-performance variants. It's essential to ensure that the RAM voltage is compatible with the motherboard's specifications.Example: DDR3 RAM typically operates at 1.5V, while DDR4 RAM operates at lower voltages like 1.2V, contributing to energy efficiency-to-DC connector.

5.3 RAM FUNCTIONALITY

The VHDL is a powerful hardware description language used to model digital circuits. It allows for:

Describing the RAM behavior at a high level.

Easy simulation and verification using tools like ModelSim.

Scalability to modify data width or address range. Capacitors are used to divide the 12V DC Diode Bridge result.The Global Positioning System GPS aids with navigation as well as following. Global positioning systems are used to track the car without the driver's assistance. Nevertheless, a route framework instructs the driver to reach the destination with minimal delays. Following and route both make use of the same design. As an accident occurs, the following stem identifies the awkward car, and an SMS message is sent to the salvage group.

5.5 APPLICATIONS

LCD Define Specifications: Set data width, address range, and control signals like Write Enable (WE).

Write VHDL Code: Implement RAM functionality, including storage array, read/write logic, and control signal behavior.

Create Testbench: Develop a VHDL testbench to simulate and validate RAM operations.

Simulate in ModelSim:
Compile the VHDL design and testbench.
Run the simulation and analyze the waveform outputs.
Debug and Verify: Ensure the RAM performs correctly under various inputs and control signals.
RAM Architecture

Input Signals:
Clock (clk): Synchronizes operations.
Write Enable (WE): Controls whether data is written.
Address (addr): Specifies the memory location to access.
Data Input (data_in): Data to be stored in RAM.

Output Signal:
Data Output (data_out): Data read from RAM.
Storage: An array of memory cells, each capable of holding data..

5.6SRAM

Fig 5.6 SRAM

A device

- SRAM is used as the Cache memory inside the computer.
- SRAM is known to be the fastest among all memories.
- SRAM is costlier.
- SRAM has a lower density (number of memory cells per unit area).
- The power consumption of SRAM is less but when it is operated at higher frequencies, the power consumption of SRAM is compatible with DRAM

5.7 DRAM (Dynamic Random Access memory)

Dynamic Random Access Memory (DRAM) is a widely used type of volatile memory that stores each bit of data in a tiny capacitor within an integrated circuit. Unlike Static RAM (SRAM), DRAM requires periodic refreshing of data to maintain its contents, as the charge in the capacitors leaks over time.

5.8 Dynamic Memory Allocations

The dynamically configured multi-port SRAM achieves low power consumption and area efficiency ,Critical memory operations ("read miss," "write miss," and "write bypass") are successfully performeda variety of sensor types. Despite the lack of direct vibration sensors, vibrations can be approximated indirectly by calculating values from representative mechanical or optical quantities. Certain highlights are contrasted by these sensors. They can be isolated based on latent and dynamic conduct in addition to other factors. Some sensors act in an outright manner, while others act relative to other things. Recurrence range, signal

components, and the type of estimation information are additional noteworthy aspects. The auxiliary sensors that are on show here were initially arranged in two groups: one for reaching and the other for non-reaching objects. Within these groups, the sub-objects were speed and speed increase measurement.

5.9 Parameter distance analysis

Another way to describe a temperature sensor is as a straightforward device that gauges temperature in degrees and converts it to a readable unit. To measure the temperature of the earth, large concrete dams, buildings, and boreholes, specialized temperature sensors are employed.

ATmega328 Pins			
Pin Number	Pin Name	Pin Number	Pin Name
1	PC6	15	PB1
2	PD0	16	PB2
3	PD1	17	PB3
4	PD2	18	PB4
5	PD3	19	PB5
6	PD4	20	AVCC
7	Vcc	21	Aref
8	GND	22	GND
9	PB6	23	PC0
10	PB7	24	PC1
11	PD5	25	PC2
12	PD6	26	PC3
13	PD7	27	PC4
14	PB0	28	PC5

ModelSim

A proprietary software tool suite called Proteus Design Suite is mainly used for electronic design automation. Electronic design engineers and technicians use the software primarily to create electronic prints and schematics for printed circuit board manufacturing.

VI. CONCLUSION

Our This project focuses on the purpose of this paper Each memory cell in DRAM consists of a capacitor and a transistor. A charged capacitor represents a binary 1, while a discharged capacitor represents a binary 0.The stored charge is sensed by the read circuitry. However, reading a DRAM cell is destructive; the data must be refreshed after each read operation.imary Memory (RAM):

Used in computers, smartphones, and gaming consoles. Graphics Memory:DRAM variants like GDDR (Graphics DDR) are used in GPUs.Embedded Systems:Found in automotive electronics, IoT devices, and more

REFERENCES

[1] S. P. Bhumkar, V. V. Deotare, R. V. Babar “Intelligent Car System for Accident Prevention Using ARM-7”, International Journal of Emerging Technology and Advanced Engineering Volume: 2, Issue: 4, April 2024.

[2] M. H Mohamad, Mohd Amin Bin Hasanuddin, MohdHafizzie Bin Ramli “Automobile Accident Prevention System Embedded with Alcohol Detector”, International Journal of Review in Electronics &Communication Engineering (IJRECE) Volume: 1 – Issue: 4 October 2023.

[3] JyotikaKapur “Accident Prevention via Bluetooth”, International Journal of Engineering Science and Innovative Technology (IJESIT) Volume: 2, Issue: 4, July 2023.

[4] Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer, “Biomedical Instrumentation and measurements”, 2nd Edition, Printice Hall India Pvt. Ltd., 2024

[5] Grace R. 2001, “Drowsy driver monitor and warning system”, International driving symposium on human factors in driver assessment, training and vehicle design, Aspen, CO; pp. 201–208. Citeseer, Bangladesh, 26–27 November 2016; pp. 66–69.