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SOC DESIGN FOR OBSTACLE AVOIDING ROBOT USING VLSI

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ABSTRACT

The robotic vehicles are special type of machines design to move on the ground, in the air, underwater and in space autonomously without a human on board. They are controlled by various sensors. The robotic vehicles are specially designed to use in conditions where human being are unable to enter such as fire accidents, very high or very temperature. An System on Chip is developed for the same using VLSI Design and a Verilog code [3] is written for the same .The code is simulated on XILINX tool and Altera Quartus II .Also the synthesized output is observed for the desired System on Chip.

KEYWORDS: SoC, sensors, Xilinx.

I. INTRODUCTION

Robotics is a branch of engineering that involves the conception, design, manufacture, and operation of Robots. This field overlaps with electronic, computer science, Artificial intelligence, Nanotechnology.

A Robot is any machine which is completely automatic, i.e. it starts on its own, decides its own way of work and stops on its own. It is actually a replica of human being, which has been designed to ease human burden. It can be controlled pneumatically or using hydraulic ways or using the simple electronic control ways. The first industrial robot was Unimates built by George Devol and Joe Engelberger in the late 50's and early 60's.

The electro-mechanical device or machine used for various purposes and are controlled & operated with the help of programming techniques is called as a robot. The robots are various types based on their applications such as industrial robots, military robots, space robots, domestic robots, walking robots, climbing robots, and so on.

The robotic vehicles are special type of machines designed to move on the ground, in the air, under water and in space autonomously without a human on board. These robotic vehicles are controlled and operated by various sensors based control systems. The robotic vehicles are specially designed to use in conditions where human beings are unable to enter such as fire accidents, very high or very low temperatures, etc.

II. HISTORY OF ROBOT

History of robots is linked to the development of artificial intelligence. In 1941 and 1942, Isaac Asimov formulated the three laws of Robotics, and in the process of doing so, coined the word "robotics". In 1948, Nobert wiener formulated the principles of cybernetics, the basis of practical robotics.

III. DESIGN OF Obstacle Avoiding Robot

A) Block Diagram of SOC for Obstacle Avoiding Robot

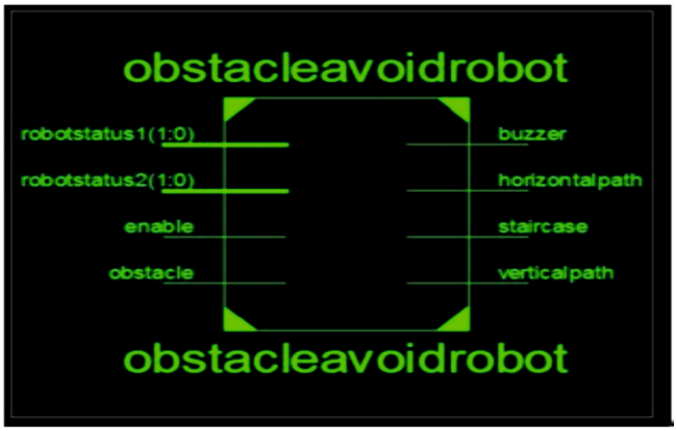

Fig.1 SOC for Obstacle avoiding robot

B) Sensors in Obstacle avoiding robot

An IR sensor is an electronic device that emits and/or detects the infrared radiations in order to sense some aspects of its surrounding.

The IR transmitter and photo diode are used as a photo sensors pair which is used for detecting the specified path for the movement of the robot while walking and climbing.

C) Obstacle Detection

Robot sensors are essential components in creating autonomous robot as they are only means to detect information about itself and its environment. Obstacle detection is an important task for many robot applications.

In robotics, obstacle avoidance is the task of satisfying some control objective subject to non-intersection or non-collision position constraints. In unmanned air vehicles, it is a hot topic. What is critical about obstacle avoidance concept in this area is the growing need of usage of unmanned aerial vehicles in urban areas for especially military application where it can be very useful in city wars.

Normally obstacle avoidance is considered to be distinct from path planning in that one is usually implemented as a reactive control law while the other involves the pre-computation of an obstacle-free path which a controller will then guide a robot along.

IV. SIMULATION RESULTS

In order to experimentally verify the proposed scheme, the desired System on Chip components are is implemented in Xilinx 14.7 and Altera Quartus II Software's. The algorithm is described in Verilog code. The code is tested for data input of 8 bits and synthesized for SPARTAN 6 FPGA[3] Devices and Spartan 6 FPGA[3] Devices and on Cadence Tool.

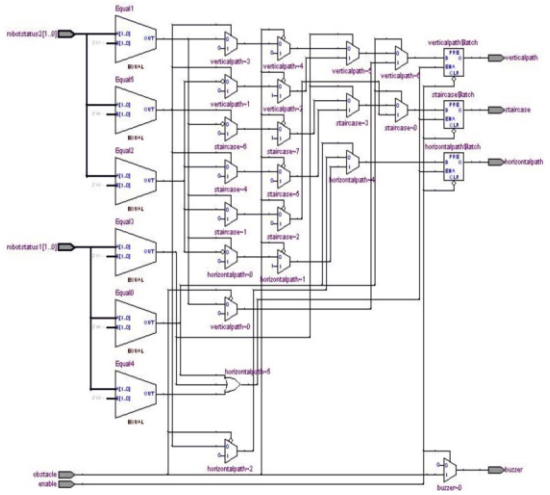

Fig .2 Top level Entity for Obstacle avoiding robot SOC

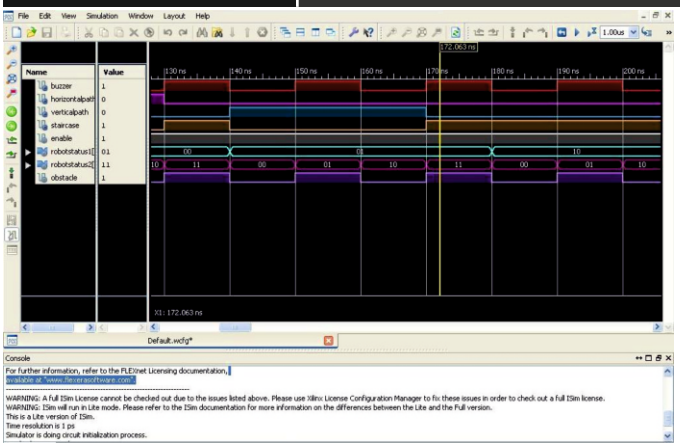

Fig.3 Simulation result of Top level RTL

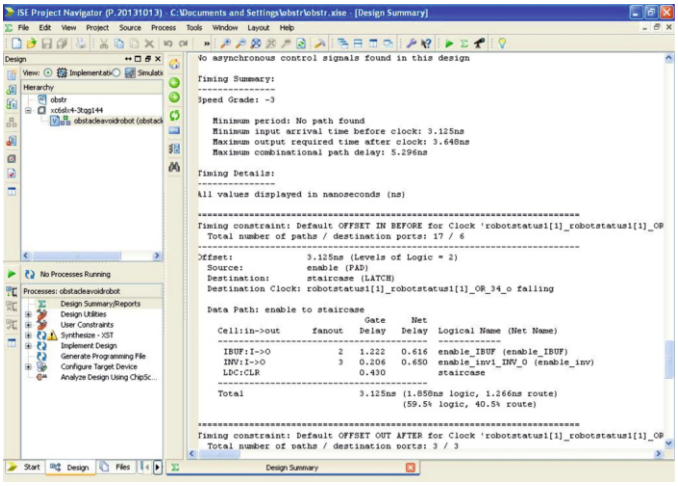

Fig.4 Timing Report1

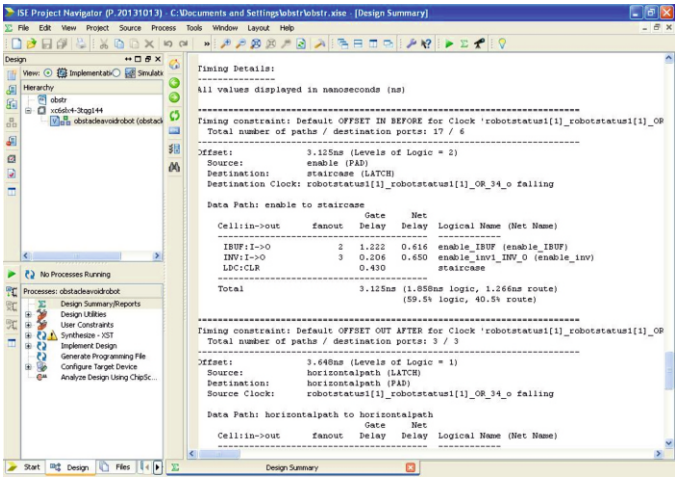

Fig.5 Timing Report2

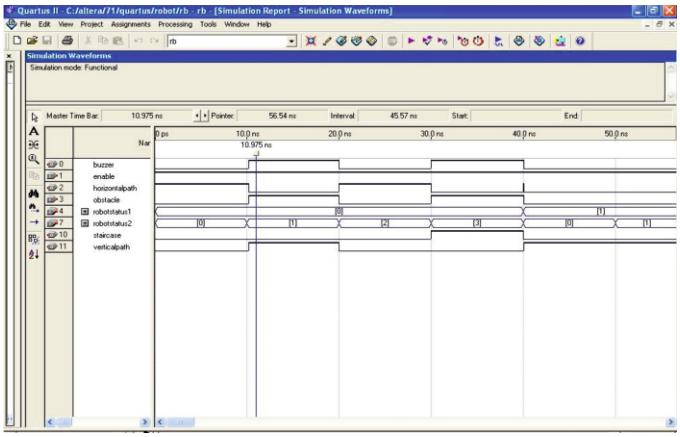

Fig.6 Simulation Results of Obstacle avoiding robot in Quartus II

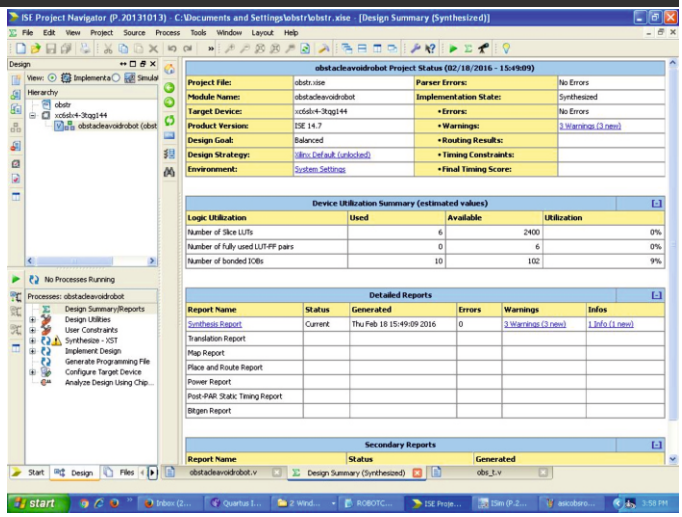

Fig .7 Spartan 6 device utilization summary for sOC

IV. CONCLUSIONS

Mask is used to calculate various addresses and the Integrity of Data is achieved using a Parity Checker. Checking the integration between various components is the chief focus in SoC verification. The role of the SoC designer is to integrate different components onto a single chip to implement complex functions instead of implementing each of these components separately. The simulation of each system is done separately and then integrated to produce final output.

Power report is generated using Cadence Tool for Addresses and Design Summary is generated for Parity generator and Checker Xilinx Software and Synthesized on Spartan 6 FPGA.

ACKNOWLEDGMENT

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