Obstacle Detection for Blind People

Zannatul. Ferdous, Zamian. Binta Khaleq, Sharmina. Zaman and Iqbalur. Rahman Rokon

Abstract—This project is a step towards making the life of blind people more independent and normal. In this project we have created a simple device that will enable them to overcome their limitation of free movement. Our device is simple and user friendly that will communicate with the blind person through audio which will guide them in their day to day life. The device is equipped to detect any change in the environment in terms of moving objects. The blind person using the device will also be notified whether the obstacle is in motion. All this process will be processed through comparing the picture taken by the device and the picture taken earlier. Any changes in the picture will trigger another block which will detect any obstacle and in the same time will measure the distance, direction and size of the object. It will also use sensors for distance measurement. This paper provides a efficient design of obstacle detection for blind people using Verilog HDL and a possible solution where the user can device by using Field Programmable Array(FPGA) controller to which the devices and sensors are interfaced. We have simulated this design in Verilog HDL using Xilinx and ModelSim. The project is in agreement with our thesis goal and the results are visible through our waveform.

Keywords—Obstacle Detection For Blind People, Simulation, Synthesis and Verilog HDL.

I. INTRODUCTION

VISUAL impairment has troubled a lot in last 25 years or so. According to W.H.O, up to the June 2012; 285 million people are visually impaired in the world: 39 million blind and 246 million have low vision. About 90% of the world visually impaired people lives in developing countries. Also about 65% of all people who are visually impaired are aged above 50 and older; this age group comprise about 20% of world population. 19 million children are

Zannatul. Ferdous is the final year student studying Electrical and Electronics Engineering, Department of Electrical, Electronics and Computer Science, North South University, Block-B, Bashundhara, Baridhara, Dhaka 1229, Bangladesh (e-mail: zannat070@gmail.com)

Zamian. Binte Khaleq, is the final year student studying Electrical and Electronics Engineering, Department of Electrical, Electronics and Computer Science, North South University, Block-B, Bashundhara, Baridhara, Dhaka 1229, Bangladesh (e-mail: zami_an@yahoo.com)

Sharmina Zaman is a Faculty member in North South University, Dhaka, Bangladesh. (e-mail: sharmina.zaman@northsouth.edu)

Iqbalur Rahman Rokon is a Faculty member in North South University, Dhaka, Bangladesh. Former Sr. Engineer, VLSI Chip Research and Development (R&D), Emulex Corporation, California, USA. (Phone: +88-01726246189; e-mail: irahman@northsouth.edu).

visually impaired out of which 1.4 million are irreversibly blind for the rest of their lives. Moderate visual impairment combined with severe visual impairment is grouped under the term "low vision". Low vision taken together with blindness represents all visual impairment. Total blindness is the inability to tell the light from darker or the total inability to see. Visual impairment or low vision is a severe reduction in vision that cannot be corrected with standard glasses or contact lenses and reduces a person's ability to function at certain or the entire tasks. Here we come up with the work which is based on the use of technologies to improve visually impair people mobility.

Our research focuses on obstacle detection in order to reduce navigation difficulties for visually impaired people. Moving through all unknown environment becomes a real challenge when we can't rely on our own eyes. Since dynamic obstacle usually produce sound while moving, blind people develop their sense of hearing to localize them. But in condition where the obstacles are undetectable by blinds, it could be dangerous for them. The technologies which are in use are SONAR technique, infra-red detection, and stereo camera using earphones etc. which are costly. So we are introducing a system for blinds which is cheap, portable, user friendly, light weighted and of moderate range of about 4 feet through which they will be warned when any obstacle comes in front of the gadget. And also provide the distance of the obstacle.

A. Problem

The target of this project is to facilitate the life of any blind person in an affordable price.

B. Objective

The objective of the project is help a blind person to find out whether there is any object in a given distance and whether the object is moving or not.

The academic goal of this project is to develop specific skills in designing, programming, testing and debugging.

C. Project Scope

Our system uses laser and image comparator for performing its task. Our system can also be used in robotics or any other sensor related devices.

D.Assumption

We constructed an image comparator for detecting moving objects. Due to the limitation of the time constraints and also due to the hardware inaccessibility and expense, we used laser for detecting any object.

II. APPROACH

We have taken a demo image in the form of binary digits. At first the laser works and finds out whether there is any obstacle within a given range. If there is any obstacle, the other block which is the image comparator is initiated. This gives signals whether the object is moving or not.

A. Block Diagram

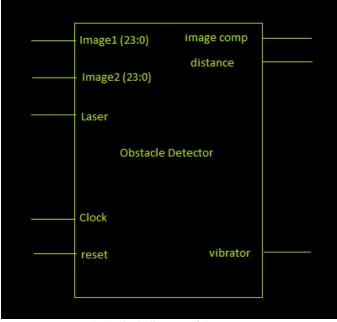


Fig.1 Block diagram of the system

The input signals are-

Image1[23:0]: it is the first image that is to be compared with another image.

Image2[23:0]: it is the second image that is to be compared with another image.

Laser: used for distance measurement.

Clock= Clock

Reset = reset

The output signals are-

Image comp: gives output after comparing the image.

Distance: gives the distance of the object.

Vibrator: gives output to the person using the system.

The next state after the block diagram is to create the hierarchy and state diagram which explains diagram showing the different states and condition. The design is for every module, which includes the states, the devices, the conditions and the required action.

B. Hierarchy

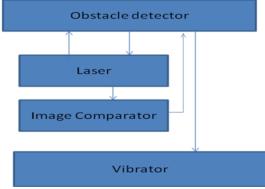


Fig.2 hierarchy of the system

Obstacle detector: This block takes all the input and gives the output as a vibration signal.

Laser: The laser is used to detect any object which is in the close proximity. The distance can be changed by the user for his convenience.

Image comparator: This block compares two consecutive images and checks whether the images are same. If the images are same, it means that the object is still otherwise the object is moving.

Vibrator: This is the output of the system. The vibrator gives signals for objects in close proximity and moving objects. The vibrator can be replaced by speakers for sound output and also by LED displays for visible outputs in other systems for any future use.

C. State Diagram

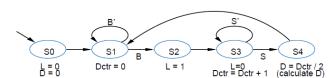


Fig.3 state diagram of laser module

S0: Initialize laser to off (L=0) and initialize displayed distance to $0\ (D=0)$

S1: B'- stay in S1, keep waiting and B- go to a new state S2

S2: turn on the laser.

S3: Turn off the laser. Stay in S3 until sense reflection. Start timer, wait to sense reflection. Increment *Dctr* each cycle in

S3. Once reflection detected (S), go to new state S4.

S4: Calculate distance. Assuming clock frequency is 3x108, *Dctr* holds number of meters, so D=Dctr/2.

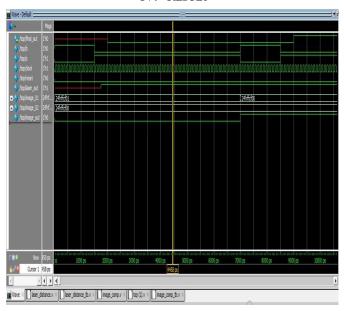
III. THEORY

A. Verilog HDL

In the semiconductor and electronic device industry, Verilog is a hardware descriptive language used to model electronic systems. Along with VHDL, Verilog HDL is another most commonly used language in the design, verification and implementation of digital logic chips at the

resister transfer level of abstraction. It is also used in the verification of analog and mixed signal circuit. A Verilog design contains of a hierarchy of modules which are later on joined and works as a complete system [3], [4].

IV. RESULT



If the laser sensor is high the device will work or else the entire system is off .At every positive edge of the clock values from the laser sensor is checked .Here b is bit input, from button to begin measurement S is bit input, senses laser reflection and out is 1 if distance is within 10cm, otherwise always 0. Image comparator is initially low during the period when s senses the laser and when s get low image_out get high . After that when laser and image comparator both become high final_out became high which we consider a vibration .

V.CONCLUSION

Verilog allows use of RTL description that provides designer advantages while debugging, as the RTL description can be readily edited by the designer and implemented again with small cost of time [5].

The wave form is obtained as desired. Therefore we can conclude that the project was successfully done and is ready for implementation.

ACKNOWLEDGMENT

The work offered in this paper was carried out at the Department of EECS at North South University, Dhaka, Bangladesh. The thesis is regarded as a part of obtaining B.S. Degree in Electrical and Electronic Engineering at the University.

First of all, we acknowledge the praise to the Almighty Allah, Who gave strength and permitted us to accomplish the work. We would like to thank our respective faculty advisor Mr. Iqbalur Rahman Rokon for his essential guidance, precious advice. Finally, we would like to show our appreciation to our family and beloved parents for their inestimable support during these years of our study.

REFERENCES

- Vahid. F. (2011). Digital design, with RTL design, VHDL, and Verilog (2nd ed.). Hoboken, NJ:Wiley.
- [2] Finite State Machine, Wikipedia the free encyclopedia.
- [3] Palnitkar, S. (2008). Verilog HDL (2nded.). Pearson Education.
- [4] Verilog. Wikipedia, the free encyclopedia. Retrieved March 23, 2012.
- [5] Thomas L. Floyd, "Digital Fundamentals: Eighth edition", Pearson Education Limited, 2003



Mr. Iqbalur Rahman Rokon received his BSc degree in Electrical and Electronic Engineering from Bangladesh Institute of

from Bangladesh Institute of Technology, Rajshahi,

Bangladesh 1991 and MS degree in Electrical and

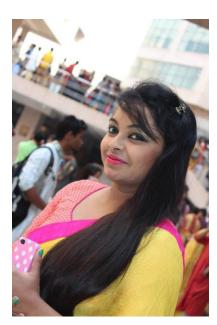
Computer Engineering from California University, Northridge, USA in 1997. During his MS study in US, he also worked as System Engineer at National Telecom, Santa Ana, California, USA from 1994 to

1997. Then he started his career at High-Tech Chip Companies in USA and served as Design Engineer, Chip (ASIC/FPGA/CPLD) Development, R&D, Emulex Corporation, Costa Mesa, USA from 1997 to 2003. Then he joined North South University, Dhaka and has been teaching there as a Faculty Member of Electrical Engineering and Computer Science Department since 2004. He also served as Proctor of the University from 2007 to 2009. In addition to his current teaching profession at NSU, Iqbalur Rahman Rokon is also continuing his high-tech involvement with industry and serving as consultant of ASIC/FPGA Development at Power IC Limited – a Chip Design Company at Dhaka, Bangladesh.



Sharmina Zaman is a lecturer in the department of Electrical and Computer Engineering in North Dhaka, South University, Bangladesh. She did her BS in Civil Engineering from Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh. Later she completed the undergraduate certification in Computer science from the Massachusetts, University of Lowell, MA, USA. She also completed her MS in Computer Science from the University of Massachusetts, Lowell, MA, USA. She is a Microsoft Certified

Professional (MCP). She has worked as an adjunct faculty in the University of Massachusetts, Lowell, MA, USA from 2011 to 2013. She also taught in American International University of Bangladesh (AIUB) in the Department of Computer science. She has taught in BRAC University, Dhaka, Bangladesh on a part-time basis. In addition to her academic duties, currently she also serves as the Faculty Advisor of North South University Computer and Engineering Club (NSUCEC).



Zamian Binta Khaleq is a final year student from the Department of Electrical Engineering and Computer Science at North South University. Her major is in VLSI.



Zannatul Ferdous is a final year student from the Department of Electrical Engineering and Computer Science at North South University. Her major is in VLSI.