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Navigation using FPGA based SOC Architecture for the Visually Impaired

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Abstract: ***The estimated number of people visually impaired in the world is 285 million, 39 million blind and 246 million having low vision; 65% of people visually impaired and 82% of all blind are 50 years and older [1]. Technological advancements have helped the visually impaired overcome the difficulties they face in their surroundings. In this paper the proposed system is designed to help navigate the visually impaired with the help of FPGA and SOC which will be embedded in a stick. The implementation of the system will be done with the help of Ultrasonic sensors, GPS, Microphone, Speaker, Vibration motor and will be designed with FPGA in SoC architecture.***

Keywords: FPGA, ultrasonic sensor, microphone, Bluetooth module, SOC.

I. INTRODUCTION

Visually impaired people have a difficult time avoiding obstacles and navigating in the streets. They often need to take the help of others to navigate and also have many obstacles in their path. There are many systems that have been designed with the help of microcontrollers but they are very complex systems. Field programmable gate arrays (FPGA) are semiconductor devices that can be reprogrammed according to the requirements and the functionalities of the desired device. FPGA is usually more cost effective and has less complexity when compared to microprocessors.

A System on a chip (SoC) is an integrated circuit in which all the components are integrated on a single chip. Due to the use of SOC system the power requirement is reduced, the cost for the end user is reduced, the reliability and performance of the system increases due to increased amount of circuits on the chip and it will occupy less space on the stick.

The ultrasonic sensor detects obstacles in the path of the person and sends a signal to the user through the vibration motor as well as a voice note via the speaker. The GPS module will help in reaching the destination by taking input from the microphone and providing directions through the speaker. The GSM module helps in making calls when the user requests for it using the voice assistant. The stick is going to be compact and light in weight as SoC configuration occupies less space.

II. LITERATURE SURVEY

Many researchers have contributed to this cause through various solutions to help the visually impaired. Some of them include

1) *Shing-Tai Pan, et.all [2]:* In this paper the module is designed through the implementation of artificial neural network (ANN) for speech recognition systems on the embedded platform. FPGA is used as the hardware and SOC as the architecture for the design. This could be implemented to various systems on the embedded platform such as Iot, communication devices and mobile phones to recognize the voice w/ the help of fast fourier transform (FFT) concept. Floating FFTs are replace by integer FFTs for enhances speech recognition without affecting the recognition rate.

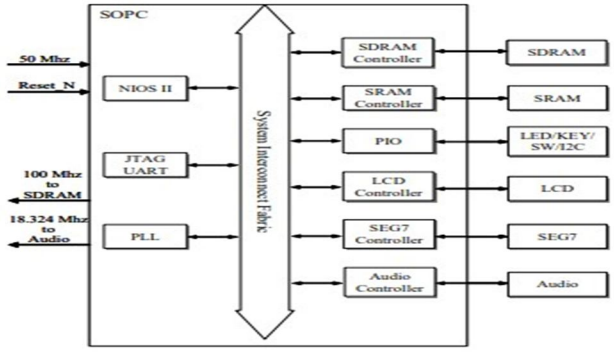

Figure.1 Block diagram of the SOC system.

2) *Prachi Rajarapollu, et.all [3]:* The proposed system designed by them is based Braille technique for the text to be converted to speech sound so the bind could communicate effectively to the outside world. This is implemented on FPGA Spartan 3 kit. The input given by the person will be in braille language which will be converted to english text by the FPGA through decoding the logic in VHDL language. This text will be converted to speech by an algorithm. The blind could therefore share their ideas and thoughts by the module designed by these authors.
3) *Nadia Kanwal, et.all [4]:* The paper discusses about the effective navigation for the blind without encountering with obstacles and to help them reach their destination safely through sensors such as camera and infrared sensor which is based around corners and depth values from Kinect's infrared sensor. Obstacles are identified from a camera using corner detection and the distance between the person and the obstacle is measured using a depth sensor. This model not only identifies barriers between them but a suggests a safe path through directions indicating left and right or stop and move.

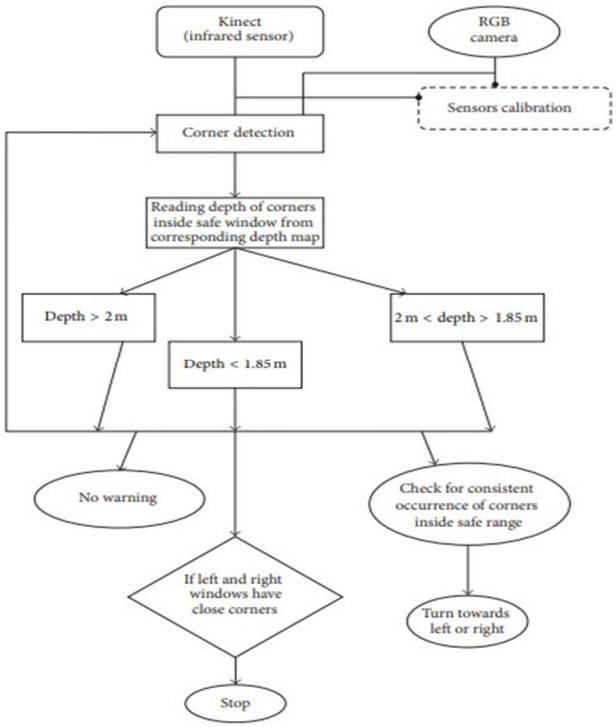

Figure.2 Algorithm describing the conversion of input data into sensible verbal feed.

4) *Prof. Swapnil Dravyakar, et.all [5]:* In this paper the author designs an application for the visually impaired where in text and speech inputs/ commands are received from the user and the corresponding action is implemented/ performed. The application which the author mentions is created by a JAVA programming language on an open android studio platform. This application designed by the author will have all features that a smart phone has including custom messaging feature text to speech and vise versa, web browsing and navigation feature. This custom app will perform the actions thorough a voice assistant which will take inputs from the person and provide information to the user
5) *Mounir Bousbia-Salah, et.all [6]:* In their paper the author proposes a navigation system will the help of micro processors for blind pedestrains. This would provide the visually impaired to move in environments without the need of assistant guides. Their navigation system is based on a microcontroller with coded sound output. The disstance is measured using an accelerometer followed by two integrators.

III. CONCLUSION

The stick will act as a smart aiding device which will help the visually impaired to be safe and will help them in navigation. The voice assistant makes it easier for the user to interact with the device and will help them in using the functionalities such voice calling, providing directions to the user , prompting when an obstacle is in their path
This SoC system offers a power efficient, easily portable, light weight and a reliable solution for visually impaired people.

IV. ACKNOWLEDGEMENT

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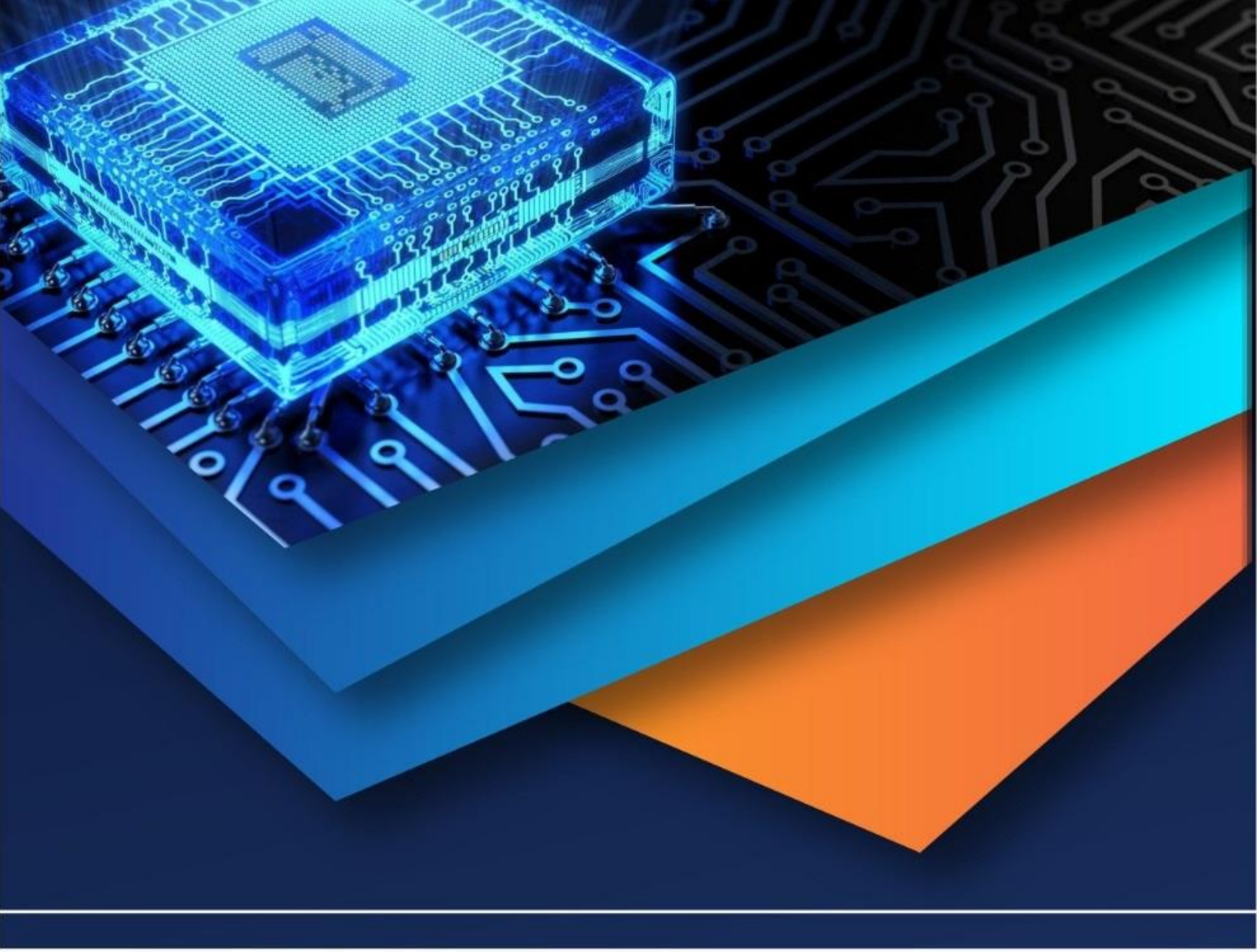

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