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FPGA Realization of RFID Tag Data Reading Enhancement Mechanism by Using Parallel Processing

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Abstract: Radio Frequency Identification systems are used for automated identification in various applications such as automobiles, healthcare and security. It is also called as the automated data collection technology. RFID readers are placed in any area to scan large number of tags to cover a wide distance. The placement of the RFID elements may result in several types of collisions. A major challenge in RFID system is collision avoidance. In the previous works the collision was avoided by using algorithms such as ALOHA and tree algorithm. This work proposes collision reduction and increased throughput through reading enhancement method with tree algorithm. The reading enhancement is done by improving interrogation procedure and increasing the data handling capacity of RFID reader with parallel processing. The work is simulated using Xilinx ISE 14.5 verilog language. By implementing this in the RFID system, we can able to achieve high throughput and avoid collision in the reader at a same instant of time. The overall system efficiency will be increased by implementing this.

Key words: Tag · Reader · Antenna · Data management system · Anti collision protocols · Throughput · Reading Enhancement

INTRODUCTION

Radio Frequency Identification (RFID) is a technology by which radio frequency RF communication stores and retrieves data through a RF compatible integrated circuit. Radio Frequency Identification is an automatic identification method which is used for tracking and tagging system for various products chain management system. Object identification problem identifies multiple objects at the same time reliably. It is a silicon chip based transponder that communicates via radio waves and the chip is preprogrammed with a tag identifier which has a unique serial number assigned by the chip manufacture and includes a memory bank to store the items. At present RFID becomes a standard for various products chain management systems [1]. Due to the huge potential and robustness, RFID systems are used in a variety of applications to uniquely identify the physical objects. The basic organization of RFID systems contains a reader, tags and host computer for networking. RFID reader (also called an interrogator) communicates with the tag (also called a transponder). RFID technology is similar to barcode system. However, tag does not have to be scanned directly, nor does it require line of sight to a reader, provided that RFID tag must be within the range of an RFID reader, which ranges from 3 to 300 feet in order to be read. RFID technology allows several items to be quickly scanned and enables other items [1]. RFID tags have not replaced bar codes because of their cost and the need to individually identify every item. RFID technology has the capability to both greatly enhance and protect the lives of consumers and also revolutionize the way companies do business. As the most flexible auto identification technology, RFID can be used to track and monitor the physical world automatically and with accuracy. RFID tag can tell what an object is, where it is and even its condition, automatically sensing what is happening, sharing related data and responding.

When a transponder or tag enter the read zone, its data is captured by the reader and can then be transferred through standard interfaces to a host computer or printer or programmable logic controller for storage or action. When an RFID tag passes through the electromagnetic zone, it detects the reader activation signal. The reader decodes the data encoded in the tags IC and the data is passed to the host computer for processing.

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RFID compared to bar codes is support tool to automate processes and to improve operations management, reduces labor, eliminates human errors, puts a wealth of data at your fingertips. Tags can be embedded and hidden with no need for line-of-sight. They can be read through wood, plastic, cardboard, any material except metal. Applicable in harsh environments such as outdoors, around chemicals, moisture.

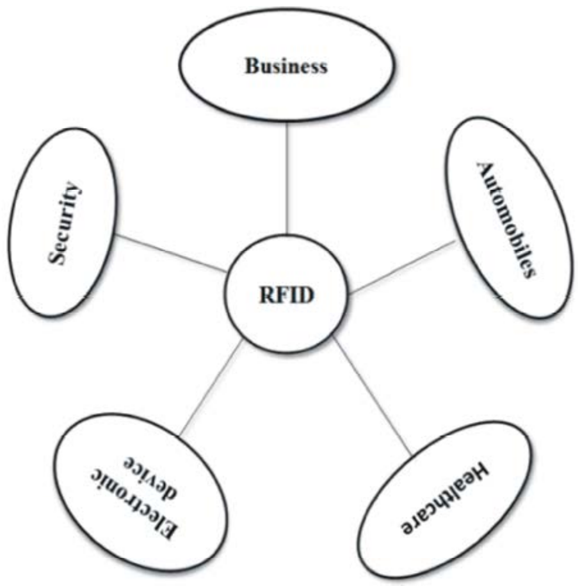


Fig. 1: Application of RFID

RFID System: The Radio frequency identification system is always made up of three crucial components that are[2]:

- Transponder
- Interrogator
- Data management system

The transponder or tag represents the actual data carrying device of an RFID system. The power required to activate the transponder is supplied to the transponder through a coupling unit (contactless) of the reader [3]. The transponder communicates with the reader, thus the reader can get the data stored in the transponder [4]. If there are many tags within the interrogation zone and reader communicate at the same time.

The above Figure 2 is RFID system which shows the concept of working model of RFID system. Initially the tag sends a ID and wait for certain time for ID acknowledgement, if the acknowledgement is not received, it will consider that the tag IDs are collided. So the tag again sends the ID.

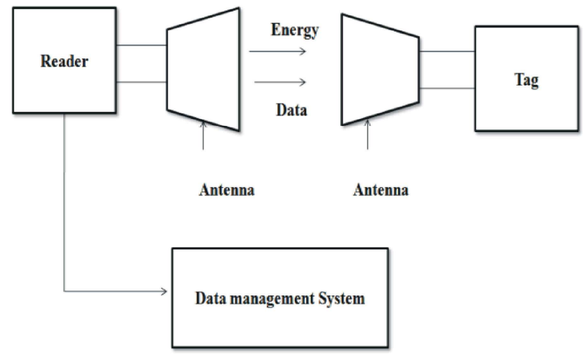


Fig. 2: RFID System

Parallel Processing of RFID Reader Having IC: Figure 3. shows the concept of Parallel processing of RFID Reader [5]. Reader IC sends a signal to oscillator, which creates a alternating current in the reader coil. That current in turn generates an alternating magnetic field that serve as a power source for the tag. The alternating magnetic field interact coil in the tag [6]. which induce a current that charge to flow into a capacitor, where it is trapped by diode. Charge accumulates in the capacitor the voltage across it increases and activate the tags IC which then transmit a identifier code and the identifier code is the form of ask modulation in communication and then A to D covertor are used to convert anaog signal in to digital. This paper proposes parallel processing for reading enhancement. The below operation are performed in the IC of Reader.

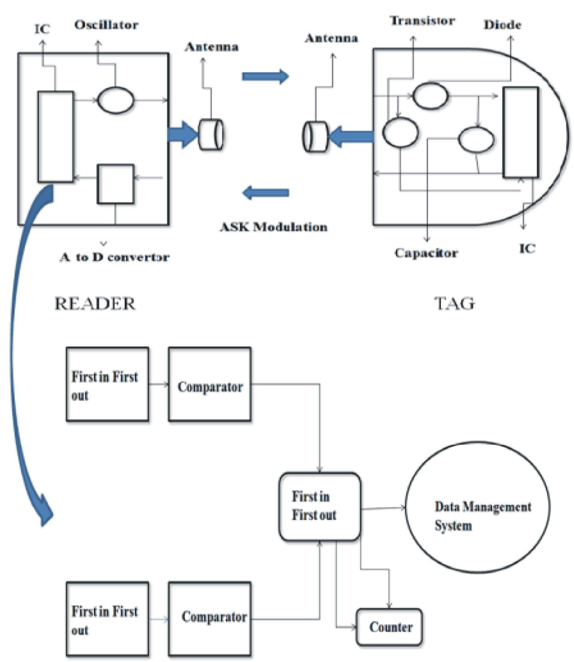


Fig. 3: Parallel processing of RFID Reader

Every tag ids having the sending time and reach time it is useful for FIFO [7]. The tree algorithm gives odd and even inputs. odd inputs are through the bottom FIFO and even input through the top FIFO [8]. The first in first out input trough the comparator it compare reference and coming input [9]. Finally , it through FIFO with counter. The output are through the data management system [10].

Speed Comparision of RFID TAG

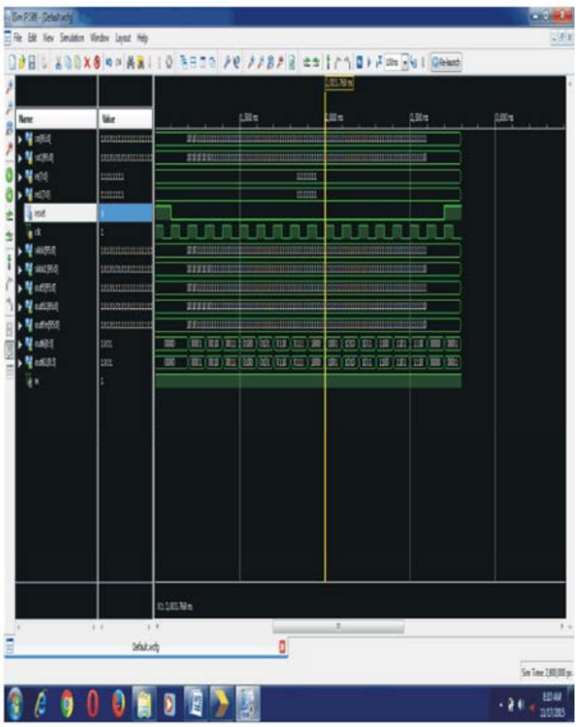


Fig. 4: Simulation of Two Tag Id with 96 Bit

Figure 4 shows the FPGA 96 bit output. Two set of 3 bit inputs are given then compare the input and then again FIFO after through data management system.

Existing Method:

Reader having one cycle Time is 70 to 120 milliseconds [11].

1 micro second = 1 tag

2 micro second = 2 tag

50 micro second = 50 tag

Proposed Method:

1000 nano seconds = 1 micro second

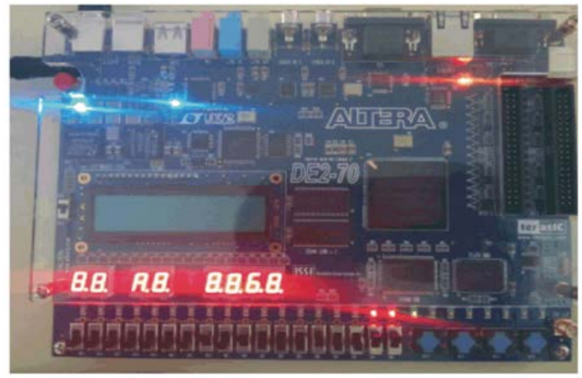
1000 micro seconds = 2000 tags

Every tag having one cycle time is

1 micros = 2 tag are send

2 micros = 4 tags are send

FPGA Implementation of Parallel Processing



FPGA 3 BIT OUTPUT

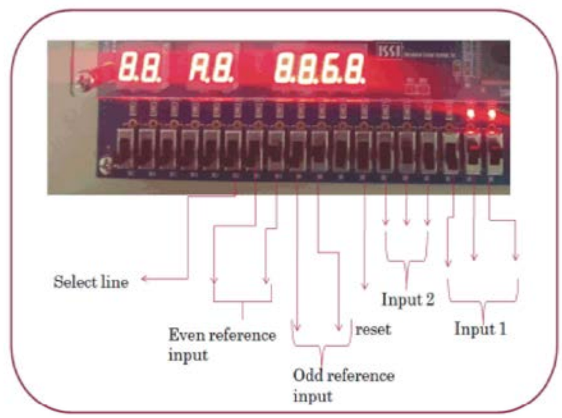


Fig. 5.1: FPGA 3 bit output

Figure 5.1 shows the FPGA 3 bit output. Two set of 3 bit inputs are given then compare the input and then again FIFO after through data management system.

Figure 5.2 shows the FPGA 3 bit output. Two set of 3 bit inputs are given then compare the input and then again FIFO after through data management system.

Figure 5.3 shows the FPGA 4 bit output. Two Two set of 4 bit inputs are given then compare the input and then again FIFO after through data management system.

Figure 5.4 shows the FPGA 4 bit output. Two Two set of 4 bit inputs are given then compare the input and then again FIFO after through data management system.

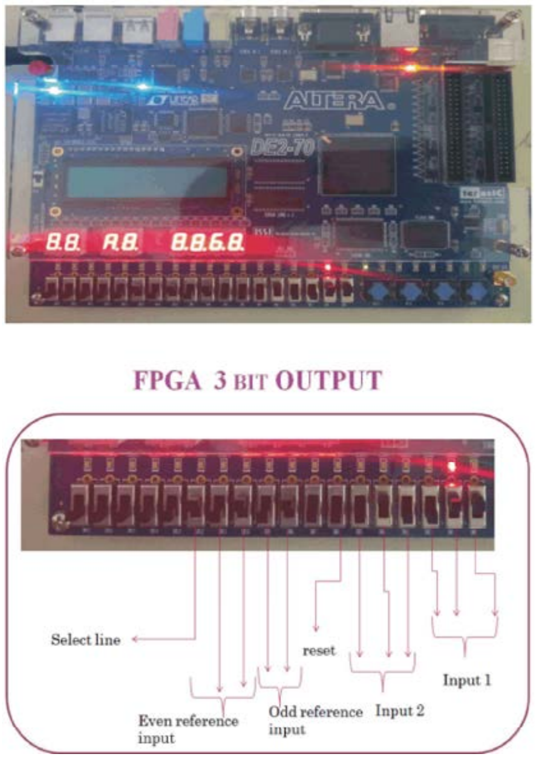


Fig. 5.2: FPGA 3 bit output

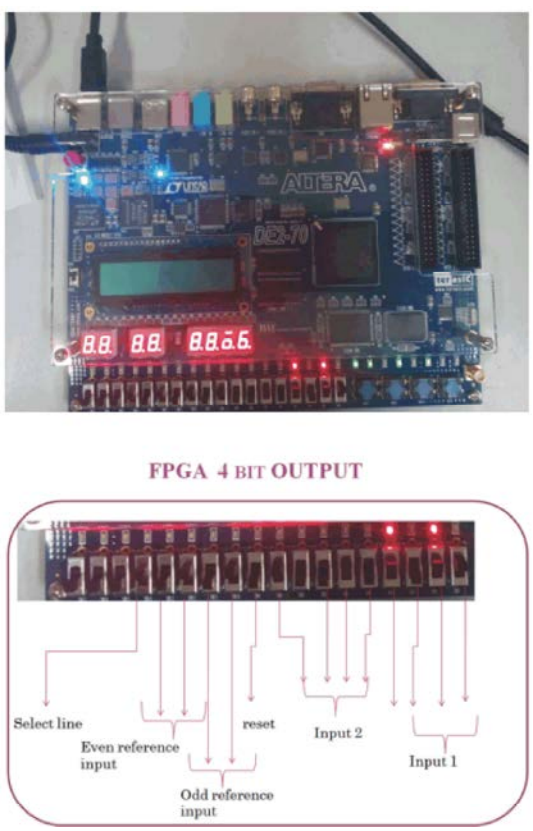


Fig. 5.3: FPGA 4 bit output

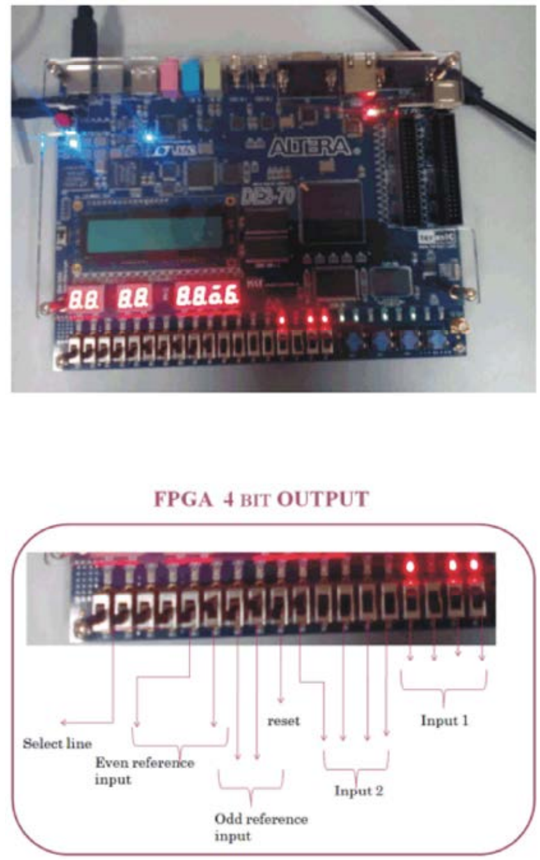


Fig. 5.4: FPGA 4 bit output

CONCLUSION

In this phase the reading enhancement is developed using the design of the parallel processing. Here, the parallel processing concept is designed using shift register, comparator, counter and multiplexer. After implementation, the simulation results and the comparison shows the improved reading enhancement. When compare to existing system work, Here double the amount of throughput is achieved.

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