

# BRAILLE TO TEXT AND SPEECH FOR CECITY PERSONS

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## Abstract

Visually impaired peoples use braille system for reading and writing. This people are not able to operate computers and other educational software due to this they unable to improve their knowledge. They are comparatively weak than people with clear vision which causes adverse effect on the economic society. One way to improve their knowledge is by introducing a system which can convert braille to word and audio which will improve them to communicate freely with outside world. This system presents the implementation of braille to word and audio converter which is output and word of that particular input. Braille Keypad with different combination of six cells are used an input to system. In this system FPGA kit is used to convert this input to English text and also display it on LCD after decoding English text it converted to audio

**Keywords:** Braille language, blind people, Braille to English word converter.

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## 1. INRODUCTION

The raised dot system now known as Braille. It was established by a Frenchman Louis Braille in 1824. Louise had found 63 ways to use six dot cells in an area no larger than a fingertip. It took 2 years after his death to adopt as official communication language for blind person. Today braille is used throughout the world and is taught the children from early age. Braille is used for reading and writing. The person who read braille will fill the dots under their fingertips. Braille letters are made up of six raised dots arranged in a group called a cell. Like one half of domino. Each letter of the alphabets is made up of different combination of these six dots. Which make up word.

Blindness is considered to be highest among all other disabilities. More than 15 million people in India are blind. Blind people faced tremendous difficulties in accessing information from document. Thus in order to build communication gap between blind person and community's braille system is used.

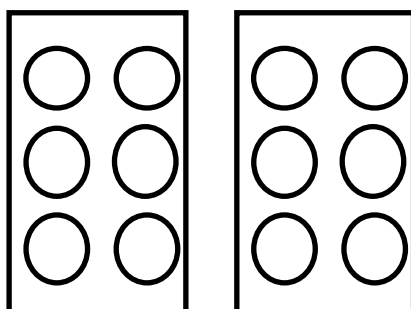


Fig. 1.1 Braille cell

Blind people are very important part of the society. Due to their disabilities they have less access to new technologies like computers and Internet. Overtime Braille system has

been used by blind people for written communication. Different patterns of raised dots are inscribing characters on paper for writing. Blind people can read this by touching the dot instead of vision. It is the way for blind people can acquire knowledge and participate in an educated culture. Braille was first developed in the nineteenth century and became leading tactile alphabet. Its characters are six-dot cells, two wide by three tall as shown in figure 1.1. Any of the six dots may or may not be raised; giving 64 possible characters. This includes 26 English alphabets, punctuations, numbers etc. [1]

## 2. LITURATURE SURVEY

The Braille system has been used by the visually impaired for reading and writing. Method to convert a scanned Braille document to text which can be read out to many through the computer. The Braille cells are segmented and the dots from each cell are extracted and converted into a number sequence. These are mapped to the appropriate alphabets of the language. The converted text is spoken out through a speech synthesizer [1]. A prototype device with a piezoelectric actuator embedded under the touch screen was used to create tactile feedback. The three interaction methods, scan, sweep, and rhythm, enabled users to read Braille characters one at a time either by exploring the characters dot by dot or by sensing a rhythmic pattern presented on the screen [2]

The primary data collection is done in the form of large number of messages as part of Personal communication among natives of Hindi language and Indian speakers of English. The text obtained in raw form based on slangs and unconventional grammar were cleaned using language grammar rules and then tagged and expanded to explain context specific meaning of the words [3].

The system primarily addresses the needs of the Braille libraries, where different texts are needed to be read by different users simultaneously. Moreover, the system can simultaneously cater to different texts written in different languages [4]. Multi-FPGA systems (MFS's) are used as custom computing machines, logic emulators and rapid prototyping vehicles. A key aspect of these systems is their programmable routing architecture which is the manner in which wires, FPGA's and field-programmable interconnect devices (FPID's) are connected [5]. A refreshable Braille cell as a tactile display prototype has been developed based on a  $2 \times 3$  pneumatic micro bubble actuator array and an array of commercial valves. The refreshable Braille cell was also designed to meet the criteria of lightness and compactness to permit portable operation. The design is scalable with respect to the number of tactile actuators while maintaining fabrication simplicity [6].

Field-programmable gate arrays (FPGAs) have multimillions of gates and future generations of FPGAs will be even more complex. This means that floor planning tools will soon be extremely important for the physical design of FPGAs [7].

An integrated system of OFETs and actuators is proposed, and a Braille sheet display is demonstrated which shows a new application of the large-area electronics using OFETs. Device and process technology of the OFETs and the plastic actuators [8]. The input is given through braille keypad which consists of different combinations of cells. This input goes to the FPGA Spartan3 Kit. FPGA converts the input into corresponding English text through the decoding logic in VHDL language. After decoding, the corresponding alphabet is converted to speech through algorithm. Also it is displayed on the LCD by interfacing the LCD to the Spartan3 kit. [9]

### 3. CONVERSION OF BRAILLE TO ENGLISH

The Spartan-3 family of Field-Programmable Gate Arrays is specifically designed to meet the needs of high volume, cost-sensitive consumer electronic applications. The Spartan-3 family builds on the success of the earlier Spartan-IIe family by increasing the amount of logic resources, the capacity of internal RAM, the total number of I/O, and the overall level of performance as well as by improving clock management functions. [9]

For converting braille to English text, input is taken through braille keyboard. In this conversion method, Braille input is converted to appropriate English text. Input given from keyboard to FPGA is first converted to the number sequence. This combination of number sequence forms corresponding English text. 16X2 LCD display is used for display the English text and also to display message such as "HELLO". A voice output similar to the English text is presented as a response to the user. ICap89021 is used as output IC. In this system, 3x2 matrix keyboards are used to enter the alphabet. [9]

### Block Diagram

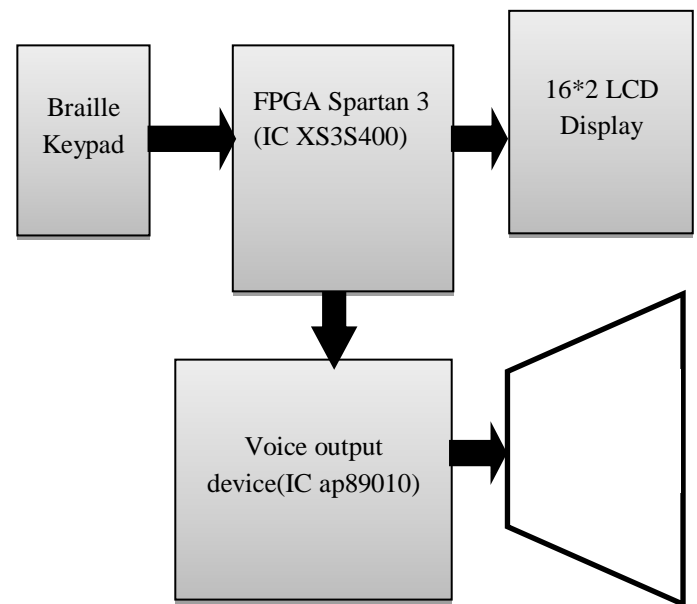


Fig 3.1 block diagram

Block diagram of Braille to English text and speech converter consist of following block

- Braille keypad
- FPGA(IC XS3s400)
- 16\*2 LCD
- Voice output device(IC ap89010)
- Speaker

### Block Diagram Description

Combination of six dot cell from braille keypad s given to FPGA as a input.one push button on braille keypad, after that pressed button combination of dot cell(characters) are taken by software as input. After decoding the input by software it gives output in English text and display on LCD.

In above diagram we are going to used braille keypad as input which is connected FPGA .keypad is use to give i/p in number form to the FPGA (IC XS3S400) which is convert that number into alphabets using the software Xilinx. The voice output device (IC ap89010) will gives o/p for 10 sec. here we are using 16\*2 LCD It is used to display the output.

### Voice Output Device

ap89010 can store voice message up to 10 sec with 4bit AD PCM with sampling rate 6kHz.A user selectable option of 8-bit PCM is also available. Different user interface are facilitated by two trigger mode and parallel CPU trigger mode. It is flexible to various devices due to its user selectable trigger. There are combinations of voice building blocks to extend playback duration. Number of external component is reduced using 8 bit current mode D/A output and built-in resistor.

### 4. ARCHITECTURE OF FPGA

A FPGA is a programmable logic device which carry out relatively large logic circuit. The building blocks of FPGA are:

- Configurable logic blocks (CLBs)
- I/O blocks
- Digital clock manager (DCM)

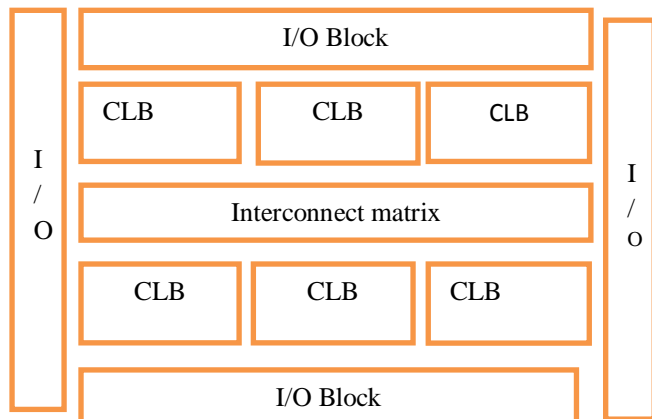


Fig4.1. Architecture of FPGA

#### 4.1 CLB

The six dot cell representation of Braille character could be numbered from 1 to 6 starting from top left to bottom right in the order left to right and top to bottom. The numbers 7,4,1,8,5,2 of Keypad are mapped to the dots 1,2,3,4,5,6 respectively[1]. With the number pad the number sequences of the Braille characters are typed and used for further conversion. The number sequences of the English Braille alphabets are listed in Table 4.1.

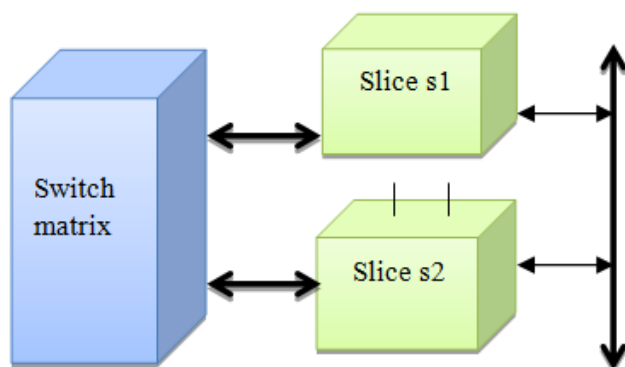


Fig 4.2 Configurable Logic Blocks (CLBs)

#### 4.2 I/O Blocks

Logic cells (LC) are grouped into configurable logic block. Each and every logic block has smaller number of input and output in FPGA. LUT (lookup table) is the most commonly used logic block, which contain storage cell used to implement logic function. They are available in different sizes varied by number of input. A single logic value i.e. 0 or 1 is the holding capability of each cell

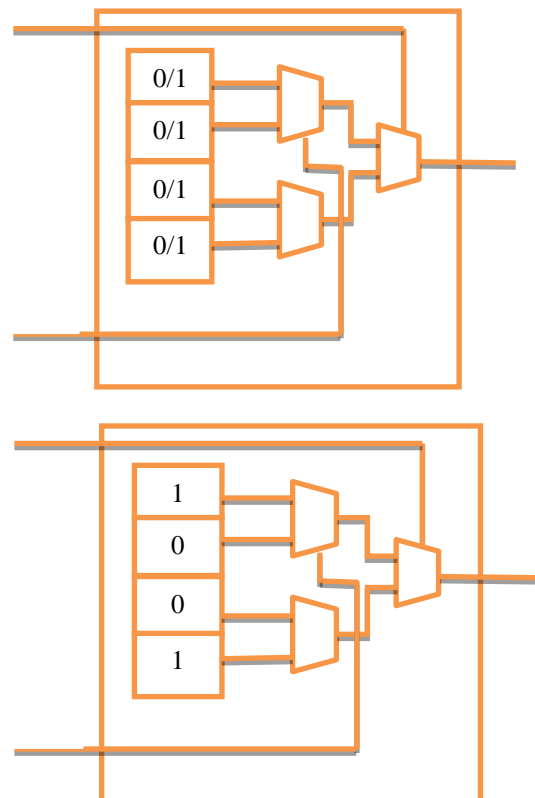


Fig 4.3 circuit for two input LUT.

In FPGA, I/O standards are supported by individually configured banks. An I/O block helps FPGA to work with devices using multiple I/O standards. Interfacing between I/O standard is possible using FPGA. Nowadays signal output of FPGA has fast edge rate, which requires termination to prevent reflection and maintenance of signal integrity. Accommodation of external termination registers are not possible using high pin count package. Thus we use digitally controlled impedance (DCI), which eliminates need for external register and improves signal integer.

#### 4.3 Multiplier

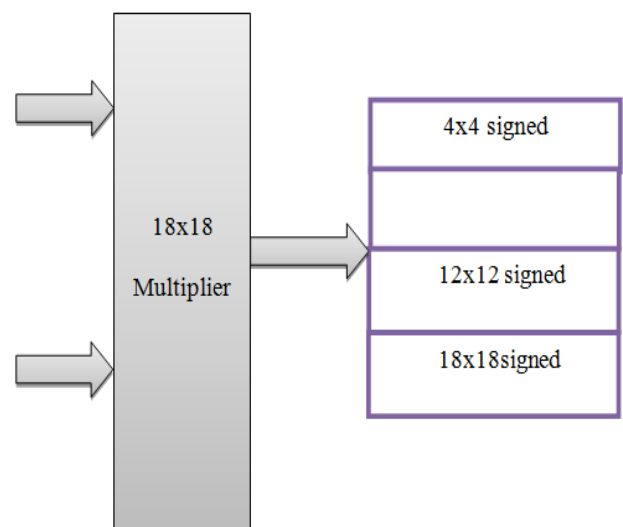


Fig 4.4 Digital clock manager

18 bit binary number input is accepted by multiplier block to calculate product. DCM provides multiplying, dividing, phase shifting, delay and many more function. Multiplier is associated with each column, which is made up of 18 Kbit RAM blocks

**BRAILLE WORD INTERPRETATION**

The world’s first binary encoding device corresponding to writing alphabet by braille language. These interpretations are used for different things like mathematics and music etc., which have different meanings supported by the setting. There are vertical and horizontal dots on braille keypad, containing six dots. The dots are listed 1, 2, 3 from top of leftward column and 4, 5, and 6 from rightward column  
3X2 matrix number pad is used to provide input to the FPGA there are different number sequence English alphabet. For example if alphabet “b” is to be pressed, then number

sequence 7&4 are used on number pad. Similarly for every English alphabet we have different number sequence

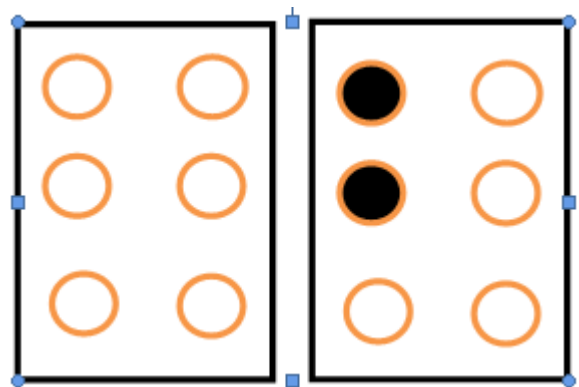


Fig 4.5 Braille word interpretation

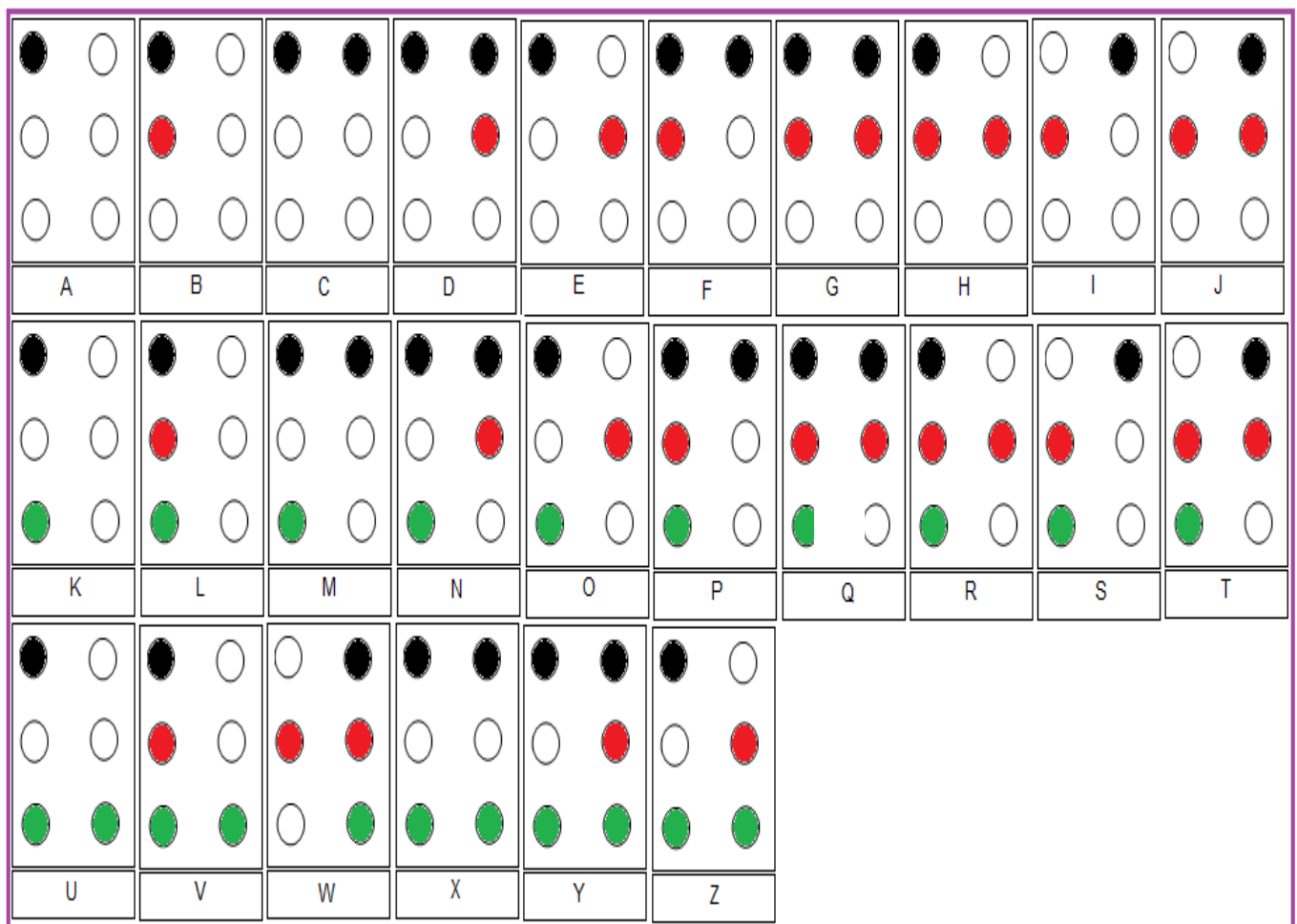


Fig.4.6 Keypad

The number pad consist different combination for 26 English alphabets. Pressed dots represent certain pattern, which correlate to a letter. This can be typed using number Pad. This keyboard is then interfaced to FPGA. Braille system converts this input to Standard English alphabet on LCD.

Table 4.1 Mapping of alphabets

CHARACTER	REPRESENTATION	CHARACTER	REPRESENTATION
A	7	Q	78451
B	74	R	7451

C	78	S	841
D	785	T	8451
E	75	U	712
F	784	V	7412
G	7845	W	8452
H	745	X	7812
I	84	Y	78512
J	845	Z	7512
K	71		
L	741		
M	781		
N	7851		
O	751		
P	7841		

## 5. SOFTWARE OVERVIEW

Spartan-3 FPGA's are suitable for wide range of consumer electronics application. Which are television equipment and broadband.sparten-3 FPGA consist of block RAM, digital clock manager and multiplier. Density of spartan-3 ranges from 50,000 to 500,000 gates which depend upon size of system. MATLAB is abbreviation of matrix library.in MATLAB everything is represented in the form of arrays or matrix. Algorithm design and development is the main use of matlab.in software development. Matlab developed code called active object from higher level language.

Matlab is extensively used in education and industry because of it mathematical programming environment. In Matlab is declared in different form like identified matrix, random matrix, scalar matrix, vector matrix etc. different type of arithmetical operation can be perform on matlab like addition, subtraction multiplication, division. Using matlab we can transpose our matrix to another regular matrix and complete row or columns addressing. Loading and saving of information and defining different function is convenient in Matlab.

Matlab is an integrated technical computing environment that combines numeric computation, advanced graphics and visualisation and a high level programming language. Nowadays lots of engineers and scientist use matlab. In this system input from input device (Braille keypad) is taken by software. Input is in the form of combination of dot cell. Using coding in software, it decodes the input and convert it to the appropriate output on hardware.Thatswhy matlab is widely used in academic and research institutions as well as industrial enterprises. It has structure data type which includes number of functions for data analysis and visualisation.

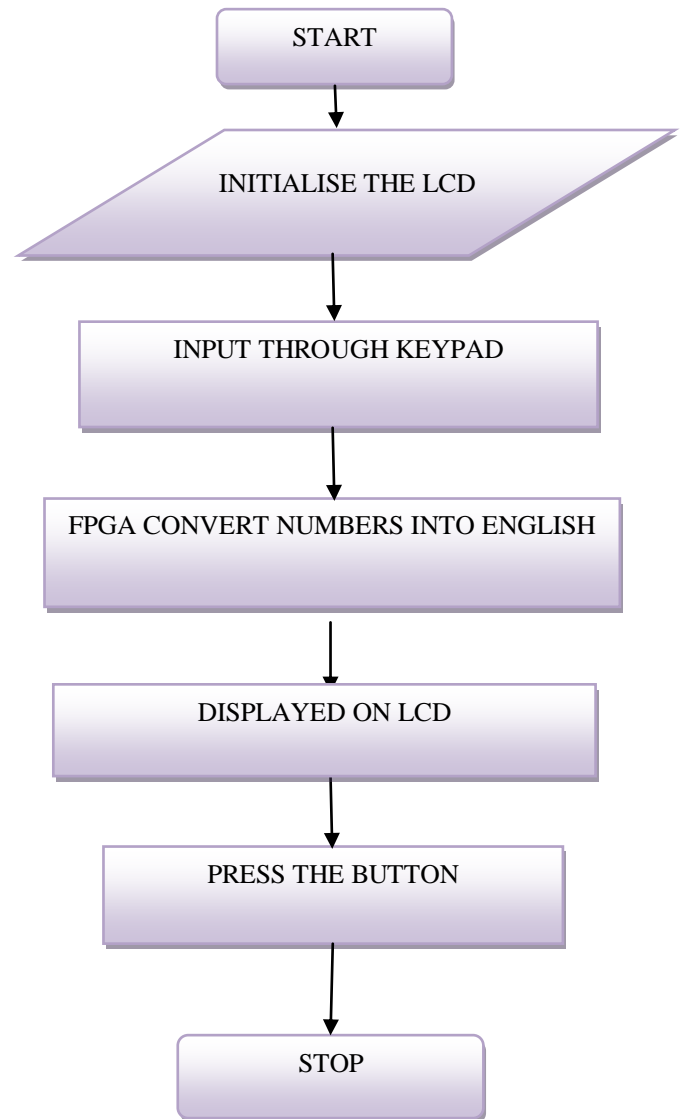


Fig 5.1 Flowchart

## 6. ADVANTAGE AND DISADVANTAGE:-

### 6.1 Advantages:

1. Hardware used is less complex and suitable for blind user.
2. Multiple character information can be transmitted.
3. High accuracy.
4. Words are read instead of individual character

### 6.2 Disadvantages:

1. System support only English language.
2. The text to speech system does not contain changing the volume of speech and rate of speech
3. Resuming and pausing of speech is not possible

## 7. CONCLUSION

Implementation of FPGA based Braille to English text and speech converter has been presented, we developed a specific hardware called Braille to text converter using FPGA. FPGA play important role in this system. We have

researched a new system for converting Braille language into English text and speech (audio) for blind people. Main feature of this system is, we can write or read a English word instead of only alphabets. An extended version of project can be develop by including more and more function and command in code. The code can be written some programming language such as embedded, VHDL etc. Depending on requirement of application FPGA Spartan 3 IC xc3s400 is a very fast, low power consuming and efficient IC. One main advantage of Spartan 3 IC is we can adjust the internal hardware circuitry according to the software coding.

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