

LED Matrix Based Amharic and English Digital Learning Display System for Children with Remote Control

Fetulhak Abdurahman¹

Faculty of Electrical and Computer Engineering, Jimma University Institute of Technology
Corresponding Author: Fetulhak Abdurahman

Abstract— Light Emitting Diodes (LEDs) offer the advantages of long life, low cost, efficiency, brightness and a full range of colours. Due to these properties, they are today widely used for all kinds of displays in electronic devices. In this project a digital learning display has designed especially for the children in rural areas from which they can Amharic and English alphabets and numbers. The display is formed 8×8 dot matrix displays so that the designed character patterns are attractive to the children. The display can be hanged on the wall and children can control the display by remote control. A button in the remote can switch the display one of the modes among Amharic and English alphabets and numbers. After selecting a mode, user can go to next or previous alphabet or number by pressing another two buttons of remote. Each alphabets and numbers has been associated with sound so children could pronounce each alphabets and numbers easily and correctly. The system can also be used as a music player to play music's for Kids. Only 5V DC battery is enough to drive the display. The power consumption of the display is very low. So, schools at the city as well as remote areas where electricity is not available can easily use this display to make the learning more enjoyable to the children. PIC16f877A microcontroller is used to control the display and generating different character patterns. The aim of this study is to develop a digital learning device to display alphabets and characters of both Amharic and English languages using a technology that is easy to obtain and keeping the cost low to make it affordable to any user. The device consists of a PIC16f877A microcontroller, NEC protocol IR remote control, 8x8 LED matrixes, speaker, and SD card.

Keywords— LED matrix, Display, Learning, Children and Microcontroller

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I. Introduction

A. Background

In the contemporary experience of childhood, children use not only traditional, typical toys and materials such as blocks, dolls, balls, puzzles, sand, but also, they interact on a daily basis with technology like digital media. Given the different aspects of children's lives and childhood, it is necessary to re conceptualize young children's play in current society. Young children frequently use digital interactive technologies as one of the dominant activities in their play experiences: these technologies can include objects such as learning displays, mp3 players, iPods, and iPads, game apps, and television-so-called-digital media [1]-[3]. In [2], [3] these young children live in the technology era, and their exposure to and uses of digital media has changed the modality of their current family lives, their ways of communicating, and their methods of learning [4]. As a result, it is critical to reflect how differently young children play, learn and communicate, and what we can do to help them learn best with digital media. A significant body of research compiled over the past couple of decades has found that a well-designed digital media curriculum is effective in enhancing young children's learning (e.g., [5]-[11]). Some research studies [12], [13] have indicated that digital media use supported the development of young children's mathematical and cognitive skills. Moreover, this kind of use of digital media can support enhancements to their attention and concentration levels, consistency, and knowledge expansion and applications [14, 15].

Therefore, this project explores how to design and implement digital learning display to be used in early childhood classrooms for young children's learning to be more effective. It particularly looks closely at the effectiveness of using LED matrix display in early childhood curriculums of low income preschools, and it examines how LED matrix display usage can be helpful for young children's learning in terms of developing their social skills and motivation since Light Emitting Diodes (LEDs) have become ubiquitous as simple displays in various kinds of electronic device and they bring in the advantages of being inexpensive, bright, highly efficient, long lasting and provide the whole spectrum of output colours.

B. Statement of the Problem

Most of Ethiopian children learn Alphabet by traditional manual system using Alphabet written on paper and every time when they try to study, they need the involvement of family and teacher some families may be well informed about language development and bilingualism and have definite language goals for their children. Other families may not have given much thought to language acquisition before enrolling their children in preschool programs. For example, families with children who have identified disabilities may still be far away from school and trying to understand those children problems and helping them to learn with this digital alphabet without the help of other. More over children in remote area they need to be aided with the workings of special education, and the different types of programs available.

C. Objectives

The general objective is to design and implement LED matrix based Amharic and English digital learning display system for children using remote controller.

II. Literature Review

By Interactive multimedia, educators unusually refer to the using of multimedia and Information Communication Technology (ICT) equipment's are to offer an effective dialog between the resource materials-indirectly with the instructor and the students in comparison with traditional methods of teaching which may lack such interactivity [16]. Modern education and communication environments can offer alternative ways in the learning process. Multimedia has been widely used in educational technologies. It is also expected that future will see more of the utilization of such tools in education. Using interactive multimedia in the teaching Process is growing in the present context.

Multimedia plays a very important role in assisting students in learning processes [16]. In [16] the authors investigated the possibility of enhancing the early education system with multimedia technologies previously developed to teach students at young age's basic skills. They found the positive impact of the developed program on students' abilities to understand new knowledge or skills. The researchers commented that multimedia education offers an alternative to traditional education that can enhance the current methods and provide an alternative especially in some cases where teaching in educational methods is not applicable. Similarly, another group of researchers [17] developed an English short play as a teaching material to promote children's (second language learners) English learning attitude and interests and was presented to all classmates and evaluated by three professors.

Another study [18] sought to explore the effects of contextual cues and support requirements of multimedia animation on children's English learning. Support requirements for design were put into two categories: no support requirements vs. support through display of key images before listening and English description and the display of key images after listening as well as printing materials.

An animation media can help children expand their English vocabulary and receive higher average score than those who apply the normal one at statistical significance level of 0.01 [19]. The researchers commented that the animation method is a beneficial teaching material to stimulate and support the learners, especially at 5 to 6 years old to enjoy the class with good results.

III. Methodology And System Design

Methodology is a formalized approach to implement the SDLC (System Development Life Cycle). There are many different systems development methodologies, and each one is unique based on the order and focus it places on each SDLC phase. So we selected RAD with Agile Methodology.

RAD methods take iterative ideas to the extreme. Instead of using iterations lasting a year or two, their iterations last a month, a week, or even less. Some RAD techniques also apply iteration to everything, not just to programming. They apply iteration to requirement gathering, requirement validation, and design. Aside from this the proponents consider the following advantages which made them to conclude such methodology. These advantages are the following:

- More accurate requirements
- The ability to track changing requirements
- Frequent customer feedback and involvement
- Reduced development time
- Encourages code reuse
- Possible early releases with limited functionality
- Constant testing promotes high- quality code and eases integration issues
- Risk mitigation
- Greater chance of success

D. Phases of RAD

Requirements planning: During this phase, the entire group members agree on the project’s general goals (objectives) of designing, developing and implementing digital learning display system as well as its requirements. The requirements are specified in a general way so that they don’t restrict later development unnecessarily.

User design: The users and team member’s work together to convert the requirements into a workable design. They use techniques such as focus groups, workshops, prototyping, and brainstorming to come up with a workable design.

IV. Construction:

The team members who are developers go to work building the application. The users continue to review the pieces of the application as the team members (developers) build them to make corrections and suggestions for improvements.

Cutover: On the final day of the project the team members (developers) deliver the finished prototype.

E. Block Diagram of Digital Learning Display System

The central processor for Digital Learning display system is the PIC16F877A microcontroller which controls the alphabet and its pronunciation to be displayed and played via the LED matrix and the speaker devices. When a button is pressed, the transmitter of the remote control transmit appropriate IR command to the receiver and the receiver will receive the command transmitted by the transmitter and give the command to the microcontroller to function.

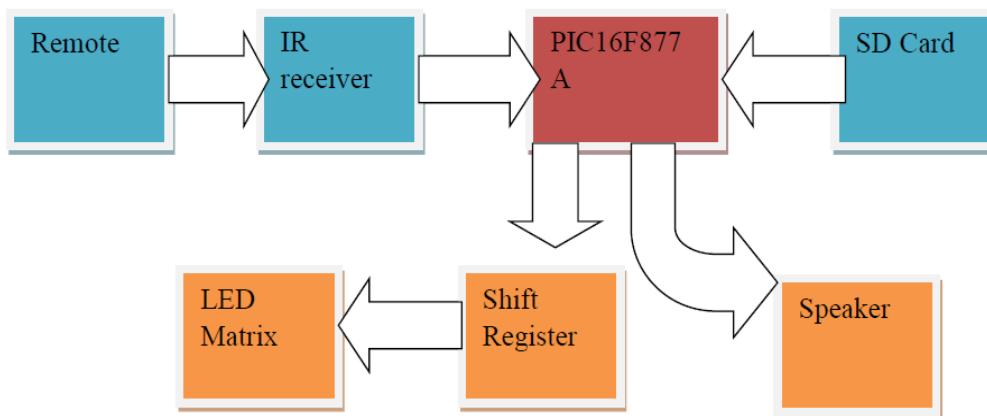


Fig. 1 Block diagram of digital learning display system

F. Flowchart of digital learning display system

When the remote button is pressed the receiver of IR remote control will be initialized and start receiving. After the receiver receives the command it will feed the instruction to the micro controller and then the micro controller will perform operations accordingly. When the next, back, up and down buttons are pressed the alphabets or numbers will be displayed on the led matrix and it sound will be played simultaneously.

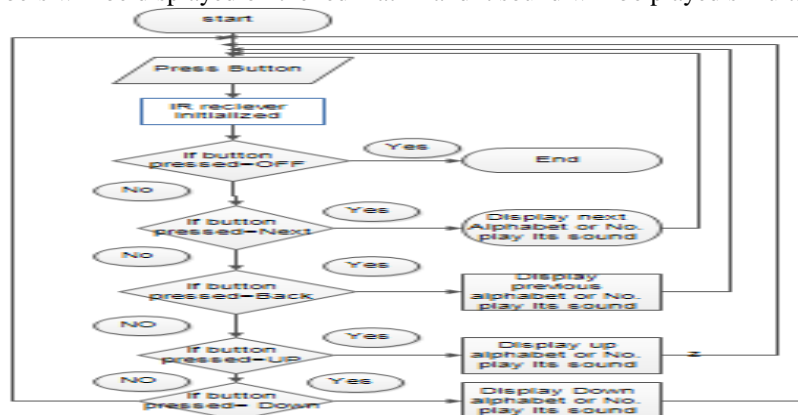


Fig. 2 Flowchart of digital learning display system

G. Circuit Design of Digital Learning Display System

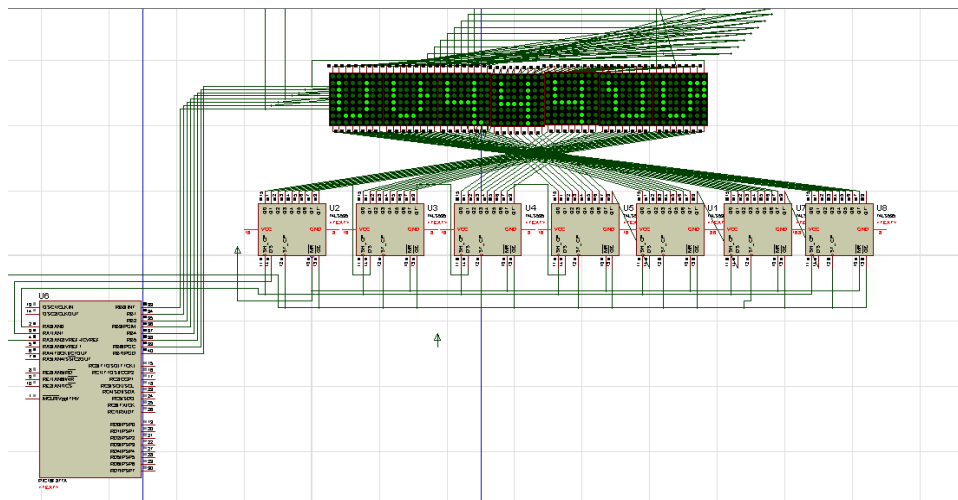


Fig. 3 Circuit design of digital learning display

V. Result And Discussion

A digital learning display system is a system used to teach the alphabet and numbers with sound for kid using LED matrix. A very important aspect is that the digital learning display System is it plays a great role for teaching learning process by entertaining the kid simultaneously. Also it helps the kid for self study without any helper.

The overall functionality of the system can be classified as follow

- Display Amharic and English alphabets using LED matrix Display
- Display Amharic and English numbers using led matrix
- Pronounce corresponding sounds for each Amharic and English letters and numbers via the speaker
- Controlling the display unit by using the microcontroller and shift registers to monitoring the sequencing

The system generally has a high reliability due to the use of shift register The main circuit of each stage of the high-reliability shift register circuit is composed of transistors, and the turn-on time for the four transistors are small pulse time within one frame time. Every digital learning display must have quick response as long as we use the remote control we get the alphabet display and the pronunciation at the same time .And also it display the next letter and number by the time of our given delay time.

H. Simulation Results

- 1) When ON button of the remote control is pressed the IR receiver will receive and by default for such condition the Amharic alphabet letter” ” will be displayed.

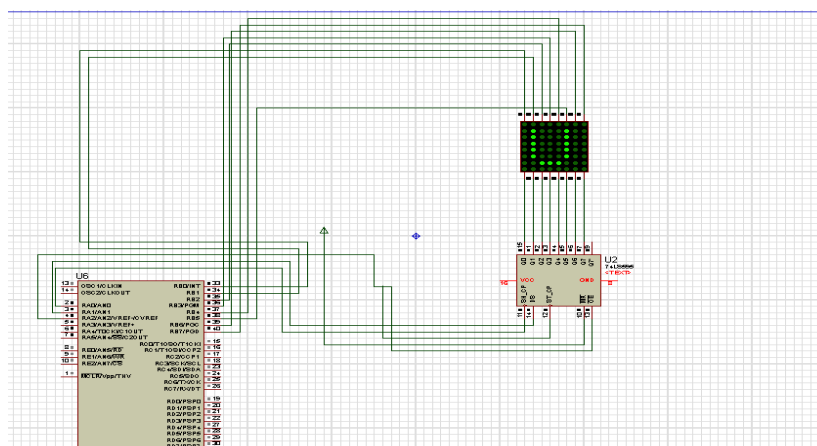


Fig. 4 Simulation result when ON button pressed for the first time

For Amharic alphabet letters, when Next button is pressed, the Amharic alphabet on the right side (next to) will be displayed, when back button is pressed the Amharic alphabet on the left side (the previous one) will be displayed. When Up button is pressed the Amharic alphabet first letter before (next to) will be displayed. Taking the Amharic letter in fig. 5 as reference, the simulation result for controlling the system using the remote control will look like on the consecutive figures shown below.

a) When it displayed on any default alphabet letter

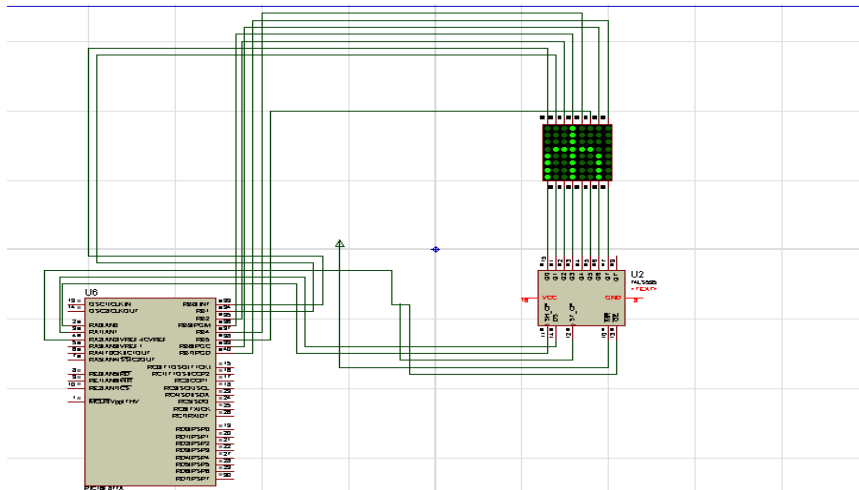


Fig. 5 when it is displayed at any alphabet letter

2) When Down button is pressed the following next Amharic alphabet letter will be displayed

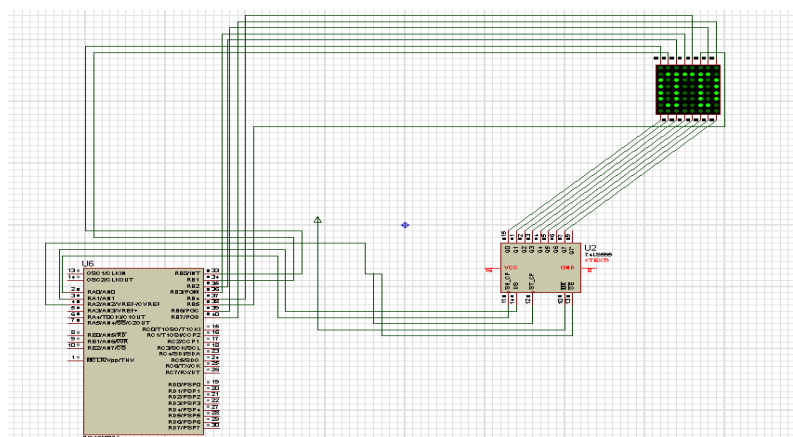


Fig. 6 Output when Next button is pressed

3) When Back button is pressed the previous Amharic alphabet letter is pressed

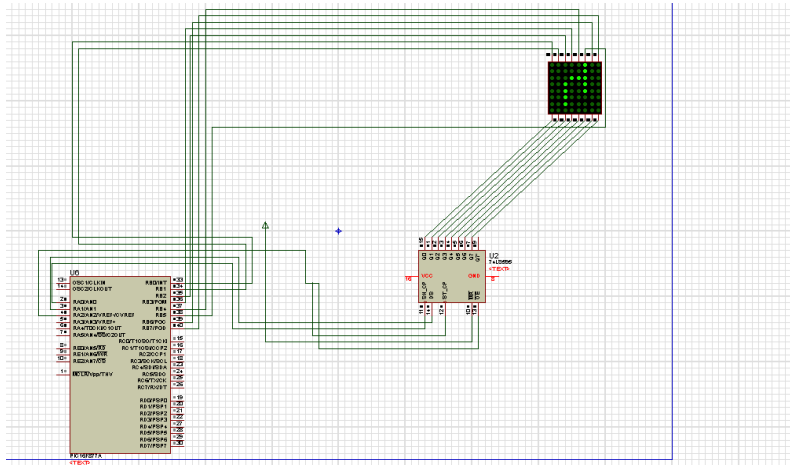


Fig. 7 output when back button is pressed

d) When Next button is pressed the next Amharic alphabet letter which is family of the base character will be displayed

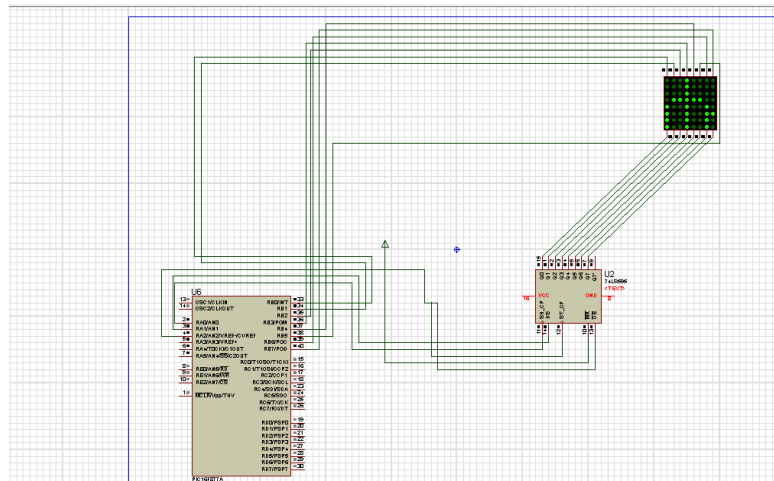


Fig. 8 output of system when next button is pressed

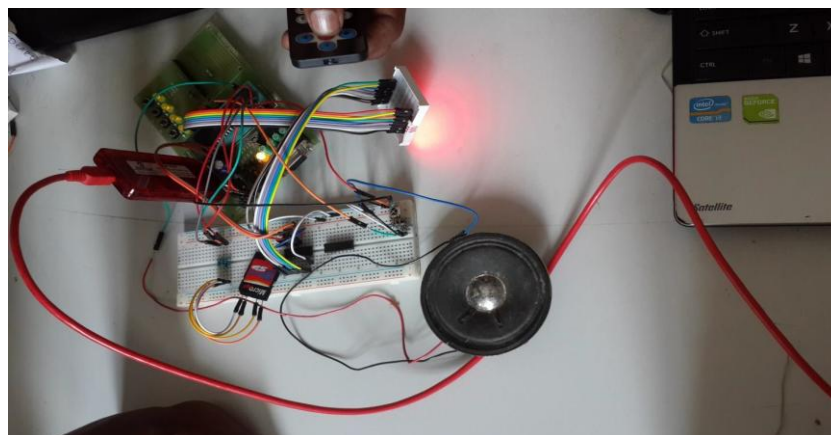


Fig. 9 Prototype of the system implementation

VI. Conclusions

In this study, I developed two interactive learning materials for kindergarten and play level school children in Ethiopia. I am noticed that the impact of interactive learning materials is exclusively high to improve their learning skills and adaptation. Although my method is showing the improvement of kindergarten children

learning skills, I have no intention the replacement of traditional education system. Just I wanted to show a method to enhance the skill and quick adaptation with their learning. The display can make the learning more interesting and enjoyable to the kids and children. Adding some extra feature like sound, animation, mathematical quiz, English and Amharic word learning and games I can make the display more effective for learning.

To improve on the effectiveness and efficiency of the system it is possible in the future to integrate the led matrix with game controller to make student more excited on learning the alphabet and implementing the system with RGB led matrix in order to make it very attractive and make the children identify each alphabet with different color.

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