PrEduSense

Smart Education Kit for Pre-Primary Classes using Intel® Real Sense

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***Abstract*—The education system has evolved from mere chalk and slate teaching methodology to presentations and smart board used in classrooms nowadays. In order to make teaching more interactive and interesting, applications involving slice of augmented reality are also developed. In this paper PrEduSense: Smart Education Kit for Pre-Primary Classes using Intel® Real Sense is introduced which consists of all the educational modules needed by the school teacher to teach pre-primary students. The concept of Human Computer Interaction is also introduced in this application by incorporating the touchless controller module, gesture recognition module and voice synthesis features of Intel Real Sense Camera. These features make the application further interactive and attractive.**

Keyword*—*Intel® Real Sense Camera Module F200, Gesture Recognition, Voice Synthesis

I. INTRODUCTION

The global education has seen dramatic change in the recent years. The trend has shifted from traditional methodologies perceived as "formal", "passive", "direct", and "push" learning environment designed largely for the knowledge consumers to the modern landscape often perceived as "informal", "active", "collaborative", "social", and "pull" learning environment designed not only for the knowledge consumers but also for the knowledge creators[4]. This change has been possible with the introduction of Information and Communication Technology (ICT) in the field of education. It is encouraging young developers to design and develop technologies that could be inculcated in the education system to further enhance the existing system and make learning fun.

Usually a pre-primary school teacher uses a blackboard and chalk to teach children or charts with alphabets or names of animals or birds written on them. The pronunciation, language and culture of the teacher varies from individual to individual and also the sketches on the charts are too small to be interpreted sometimes. With the introduction of smart boards, a lot of improvements have been made.

Incorporating the concept of Human Computer Interaction (HCI) into everyday learning process can make cognitive learning easy as well as interesting. Young children tend to concentrate and remember things that they find attractive and different. Keeping this in mind, a playful method of teaching alphabets, poems and others basic learning materials to nursery and kindergarten school children is presented using the Intel Real Sense 3D Camera and the Intel Real Sense SDK.

The PrEduSense application consists of a complete package consisting of pre-primary syllabus- Alphabets, Poems, Family Tree, Names of Animals and names of common fruits. The application also has an element of human computer interaction and augmented reality. The entire application can be touchlessly controlled by the user and has voice synthesis mechanism. This adds a slice of excitement and fun in the learning sector as the young children will get to see something different and creative. This would make their learning easy and enjoyable.

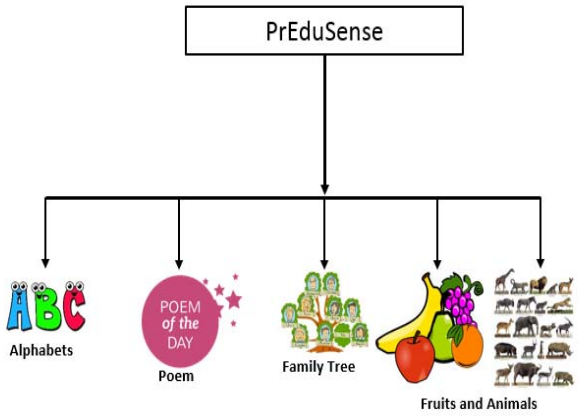

Fig. 1. PrEduSense Application consisting of complete package of pre-primary syllabus such as Alphabets, Poems, Family Tree, Fruits and Animals.

II. RELATED WORK

Applications have previously been developed to enhance the learning ability of the students using smart phones. These smartphones have applications that engage students to complete simple tasks and interconnect stories with tasks. The tasks include alphabet, numeric recognition using 3D animated content. The developers had used Vuforia platform as base to augment reality [1].

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Another application developed is the "The Book of Ellie". It contained two modes- Book Mode and Game Mode. The book mode consists of stories and the game mode consists of answer to the related questions. On touching the screen of the smartphone, Ellie read out the story aloud with her lips synced [2].

Applications developed on augmented reality are mostly based on smartphone applications with little involvement of cameras.

III. BASIC COMPONENTS

The system architecture consists of Intel Real Sense F200 camera connected to the USB 3.0 port of the laptop/desktop. In the system Intel Real Sense SDK needs to be installed.

Fig. 2. Intel Real Sense F200 camera module[8]

Intel Real Sense F200 camera module is a RGB-D camera which can be attached to desktop or laptop. It consists of a conventional camera, an infrared laser projector, an infrared camera, and a microphone array. This can be intended to be used for natural gesture-based interaction, face recognition, immersive, gaming and learning and 3D scanning. For this application, the gesture based interaction, voice synthesis and touchless controller modules are used.

Intel Real Sense SDK has a repository of pre-defined gestures. When the teacher places her palm infront of the camera, the camera scans the gesture and converts it into virtual 3D cube which in turn translates into cursor movement in relation to the screen. There are different gestures which can be used as triggers for UI control. In this application, cursor movement on the screen can be achieved with placing the hand palm in a relaxed position infront of the camera and moving the hand in any particular direction. The UI selection operating can be achieved by tapping the palm ahead.

Fig. 3. Cursor movement gesture; cursor select gesture[9]

The voice synthesis module processes the information and speaks out aloud that information. The parameters to be considered for this module includes language, pitch, volume etc.

IV. IMPLEMENTATION

The basic requirement for the running the developed application is Intel Real Sense 3D camera F200 and Intel Real Sense SDK. The application was coded in Visual Studio 2010 IDE and C# programming language was used.

One of the main features of PrEduSense is that all the educational modules are integrated in a single package and the user can select any of the desired module through the gesture of hovering his hand near the camera and pushing it forward to select that particular module.

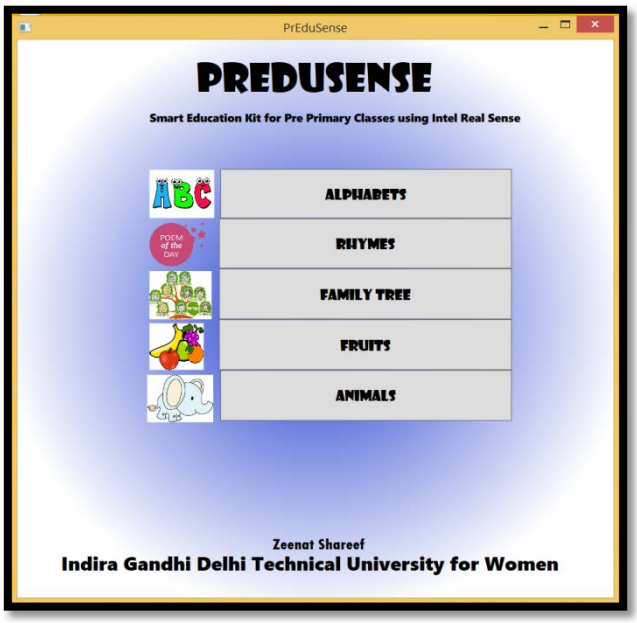

Fig. 4. The first screen of PrEduSense. The different modules such as Alphabets, Rhymes, Family Tree, Fruits, Animals along with their images is present on the first screen itself.

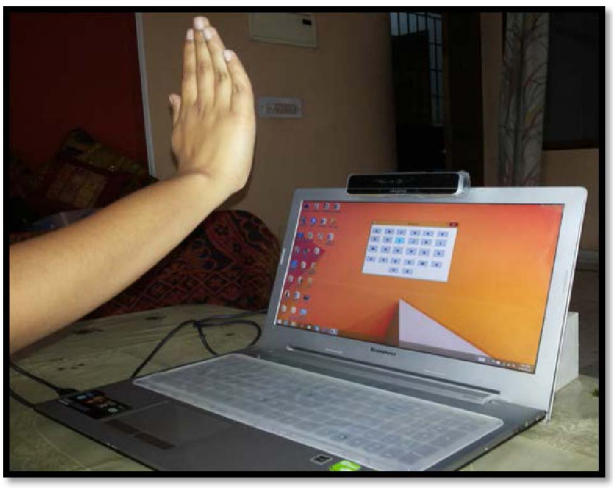

Fig. 5. User controlling the application using hand gestures.

Brief introduction to the different educational modules is described below:

1. The first module is the **Alphabet Module**. When the user select this option, a new window opens up with all the

English alphabets from A to Z. On selecting a particular alphabet, another window opens up which has voice synthesis element. It first speaks the alphabet name and shows two words beginning with that alphabet along with their images. For example, on selecting the alphabet 'A', a window opens up which images of 'ant' and 'apple'. On selecting 'apple', the word 'apple' is spoken aloud.

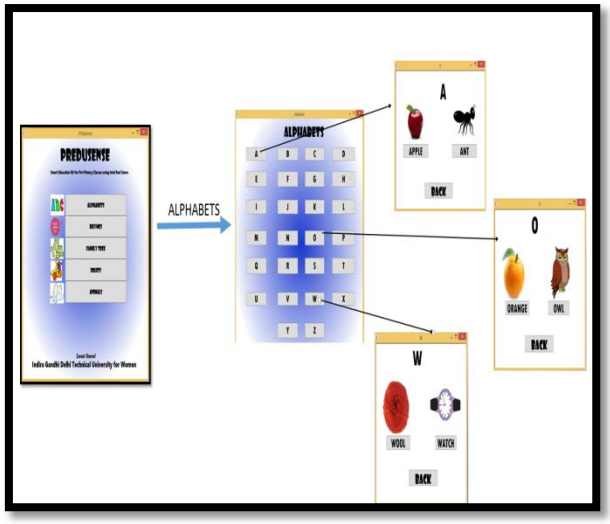

Fig. 6. Alphabet Module

2. The second module in the list is **Rhymes**. When the user select this option, a list of rhymes appear in the other window. Three poems have been included so far- 'Johney Johney, yes papa', 'Baba Black Sheep' and 'Twinkle Twinkle, little star'. On selecting any of these poems through gestures, another window opens up which consists of wordings of the poem and an image to make it look attractive. Using the voice synthesis module, the entire poem is read out very clearly. Also a replay button is included to listen to that poem again. Similar is the case with other poem modules. This eliminates any pronunciation problem, and the students can learn the poem in a very clear and interesting manner.

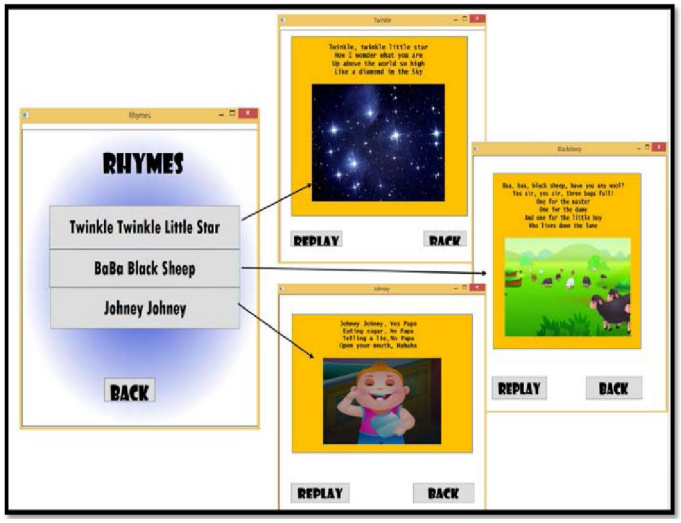

Fig.7. Rhymes Module

3. The third module, **Family Tree** consists of a story of a little child names 'Sunny' who desires to know about his family members. An introduction is provided by every family member to Sunny when respective button is clicked through gestures. This provides a very fun loving manner to learn and remember.

Fig. 8. Family Tree Module

4. To teach the names of common fruits, a window opens up when selecting the **Fruits** option which consists of names of fruits along with their images. On selecting a particular fruits, the name of that particular fruit is read out aloud using the voice synthesis module of Intel Real Sense.

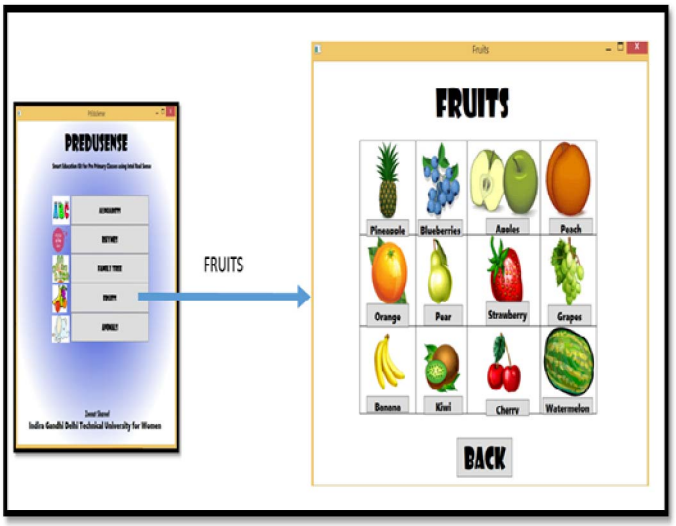

Fig. 9. Fruits Module

5. The final module is **Animals** modules which categorizes the animals into herbivores, carnivores and omnivores. On selecting any of these, a window opens up which first explains the definition of the terms- herbivore, carnivore or omnivore and displays the names of animals belonging to that category. On selecting a particular animal name, the name of that animal is read out aloud.

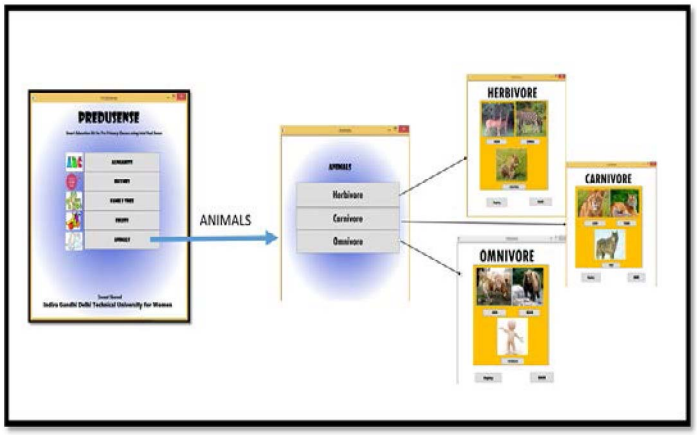

Fig 10: Animals Module

V. CONCLUSION

PrEduSense is thus a complete module in the hands of the pre-primary teachers to teach children the basics of pre-primary education.

The advantages of this application include:

1. It would act as an enhancement to the existing pre-primary teaching structure with lots of excitement and enjoyment for the young pre-primary children.
2. It is a cost effective solution as one device can be used to teach 30 or more students in a class.
3. There are no issues of language barriers or pronunciation problems.
4. A lot of resources like chalks, papers, markers, boards are saved.
5. The teacher would just need a camera and laptop with Intel Real Sense SDK and an application. Flexibility is offered to the teacher now as there would be no need to stand up and teach on the board. The teacher can have the control of the board through gestures even while seated at her desk.

Thus PrEduSense application incorporates the concept of human computer interaction and as well as makes learning interesting, efficient and exciting.

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