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Learning Application for Kids based on Artificial Intelligence

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Abstract: ***In this fast-moving technological era, a child gets access to mobile phones rather than "Toys" in its childhood. This early exposure to technology gives rise to the demand for a mobile phone app that will help the child to learn new things for the upcoming educational phases of their life. Artificial intelligence is making computers "intelligent", which is helping us in pragmatic ways; thus, it will help our descendants similarly. The main objective is to develop an application using artificial intelligence in android for learning purposes. OpenCV library, Android Studio, Numpy and Game Studio have been used by the authors of this paper. Some memory games and free drawing space have also been added to make the learning enjoyable.***
Keywords: ***Artificial Intelligence, OpenCV, Android Studio, Game Studio, CNN.***

I. INTRODUCTION

There is no escape from technology. As technology has become popular, it has been assimilated into the learning environment. There is no denying that kids love to use educational or academic apps. They are stimulating and fun. When talking about educational apps, this learning application is another sort of mobile app that ought to be thought of.

In the English section, we have shown the alphabets from A to Z and additionally the words starting from a particular letter. For this, we have used a java adapter that converts the interface of a class into another interface.

In the Math's section, we have displayed the numbers from 1-100 along with their English form in a list. For this, we have used a number array list and recycler view to display it.

We have also added some math's exercises like addition, subtraction, division and multiplication. In this section, we also have math operations with images, in which users need to select two images and one image will come as a result according to the operation selected.

And many children also develop their interest in art and craft, so we have also included freehand drawing in the app that can help to draw some basic figures and also color those images using the given color palette.

Another thing we gave in the app is the shape detection feature that helps children to learn basic geometric shapes like circle, line, triangle etc. And using this app, they can also detect shapes that are drawn on any piece of paper. One more interesting feature that is digit detection is also given, using which a digit can be detected and drawn by the user.

In this app, we also have a memory game that is implemented using Game Maker Studio. By using this app, kids can practice their English, drawing, mathematical and other interactive educational skills.

II. METHODOLOGY

A. Android Studio

Android Studio [4] is the base of the project. Android Studio is an unified environment where we built our android application. Structured code modules help us in dividing our project into units of specific functionality that we can build, debug and test independently.

B. The AI Process

The Artificial Intelligence (AI) approach is implemented by a feed-forward pass in a CNN ("Convolutional Neural Network") [3,7,8] at the instance of testing, and the MNIST dataset [5,6] is trained for thousands of scanned images. In the MNIST dataset, there are 70,000+ scanned images of handwritten digits, out of which 60,000+ scanned images are used for training while the rest 10,000+ scanned images are for testing. All these scanned images have a size of 28x28 pixels. All these images are converted to grayscale images to extract all the details clearly [1,9,10].

In the shape module, a canny edge detection [2] approach has been used. The scanned image is first converted to a grayscale image, and then that grayscale image has been blurred to pick more details. Then based on the number of contours detected, the respective shape image is predicted.

C. Neural Network

Neural network is a series of algorithms which attempts to seek out existing relationships for a set of knowledge through a process that mimics the way the human brain functions. Neural networks are adaptive and may adapt based on changing input; therefore, the network generates only attainable results without having to revamp the output criteria.

D. Convolutional Neural Network

CNNs - integrated versions of multilayer perceptrons. Multilayer perceptrons means absolutely connected networks: every somatic cell in each layer is connected to any or all or any neurons inside the succeeding layer. The "fully-connectedness" of these networks makes them at risk of over-fitting information. Classical ways of regulation embody by adding some kind of magnitude measurements of weights toward loss operation.

III.PROJECT TECHNICAL DESCRIPTION

A. Maths Module

1) *Familiar With Numbers:* In this subsection, we display the numbers from one to a hundred along with their English form in a list. So, children have a better understanding of the number system and remember the English form of the number. The example is 1 – one, 2-two, 3- three etc. We used a recycler view to show the list, and a number array list is used to implement this.
2) *Shapes:* In this subsection, some basic shapes and some complex shapes are given for the user to learn about different shapes.
3) *Math Exercise:* In this subsection, children need to do some basic math exercises like addition, subtraction, multiplication, division. Users can choose which math operation they need to practice. That means there will be four blocks for addition, subtraction, multiplication, division, and the user just needs to click any of this operation. And there will be three blank positions. The two positions are for the two numbers on which the operation is done, these numbers will be generated randomly, and another blank space is for entering the answer. The example is like 5 + 8 = ? . If the user successfully enters the value of that operation, then another window of the app is opened and shows the message "congrats", and if they enter the wrong value, then the same thing happens another window opens and shows the message "wrong answer". We implemented this using basic java math functions and libraries that are mainly used to make a calculator. It is similar to calculator programming, but a subtle difference is we validate the user input and check the value that is correct or wrong.
4) *Table:* In this subsection, two separate spaces are given for the input. In one space, users need to input the number to view the table of that number, and in another space, users need to input the range of the table.
5) *Math Operations With Images:* In this subsection, the user needs to do some math operation with graphical representation. It is very similar to the math operation section. The functionality is very simple. All operations are done using images that means if two apples are subtracted from three apples, then the result is only one apple. Then only one image will be shown.

B. English Module

1) *Familiar With Alphabets:* In this subsection, we are displaying alphabets to kids in a manner so that they can easily understand and grasp those alphabets. Displaying alphabets with their real-life examples so they can better understand and memorize them. For example, A- Apple, B-Ball, etc.
2) *Word Building:* In this subsection, we have provided a few alphabets to the user, and the user has to figure out or make a meaningful word from the provided letters. This will help users to learn new words.
3) *Learn With Music:* In this subsection, a theme song of alphabets is given with music. This theme song will help the users to remember the alphabets for a longer time.
4) *Poems:* In this subsection, various poems like "Baba black-sheep", "Twinkle-twinkle little-star", and "Wheels" are given. These poems will entertain the users and also help in learning with fun.

C. Drawing Module: In this section, users can draw anything on the phone screen. A colour palette is also given for colouring their image, which they drew previously. Another functionality is they can adjust the size of the pencil through the size control section, which is also given there for better accuracy.

D. Game Module

In this section, there is a flashcard game or matching game [11,12] in which a child has to make a selection of two images subsequently to progress in the game. There are six levels in the game, i.e. beginner, easy, medium, hard, hardest and master. If a child selects all the images correctly, then the child will be able to play the next level.

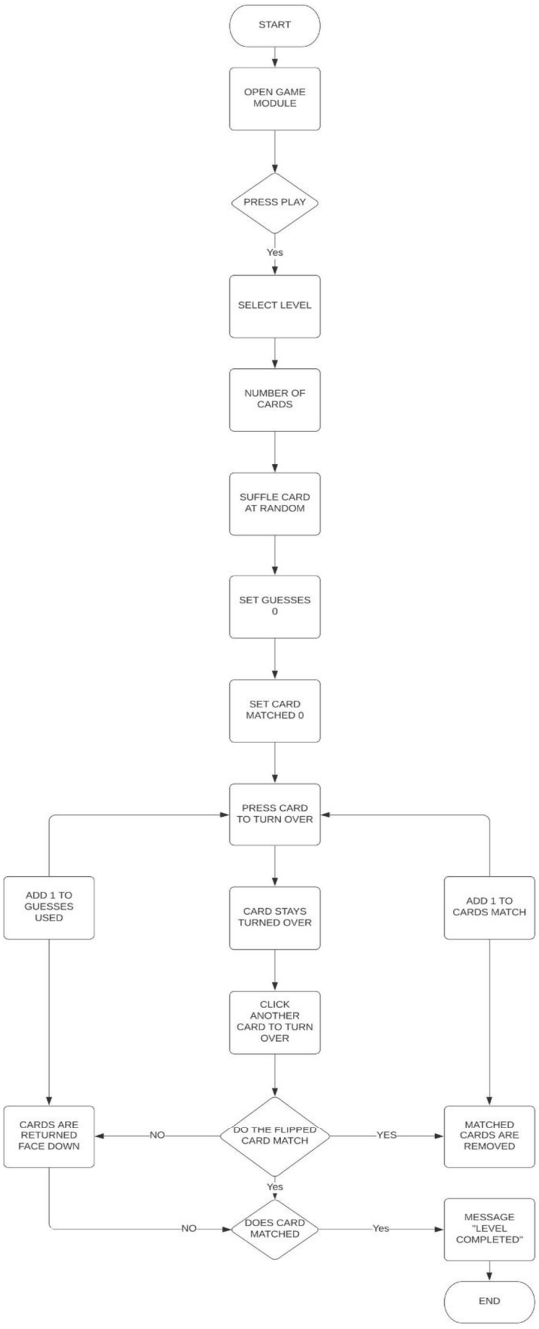


Fig. 1 Flow chart of game module

E. Detection Module

1) *Digit Detection:* In this subsection, white space is given where the users can draw any digit from 0 to 9. After that, the app detects which digit has been drawn by the user.
2) *Shape Detection:* In this subsection, users can scan their hand-drawn paper image with their mobile phone camera. Only some basic geometric shapes like circle, triangle, and rectangle can be detected through this app. It helps them to remember the geometric shapes and also improves their drawing accuracy.

IV.RESULTS

The app consists of five sections, and each section further contains different subsections. Learning can take place in each subsection. Users can learn through audios and images. English section is available to learn english alphabets, alphabets with images, world building and rhymes. The Math section is available to learn countings, tables, basic shapes and complex shapes and math operations like addition, subtraction, multiplication and division. Drawing section is also available with white screen on which users can draw any image of their choice by choosing colours from the palette. Users can also play games for sharpening memory. Digit detection and shape detection is also available to check the correctness of digits and shapes drawn by the user.

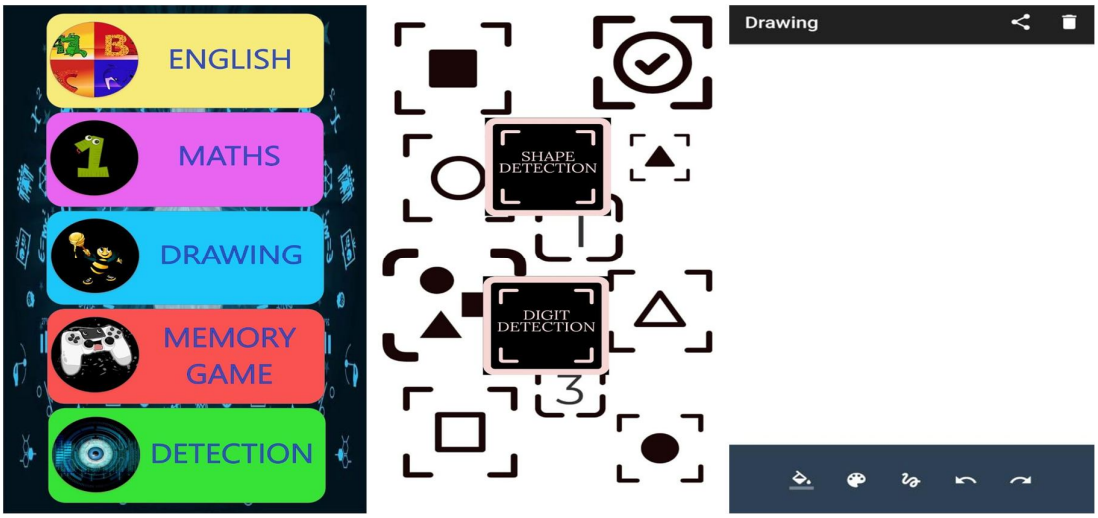


Fig. 2 Overview of interface of the App

V. CONCLUSIONS

In this work, we have developed an android application for children to gain basic skills. The proposed system consists of six major modules namely:

(i) Math (ii) English
(iii) Drawing (iv) Memory game
(v) Detection

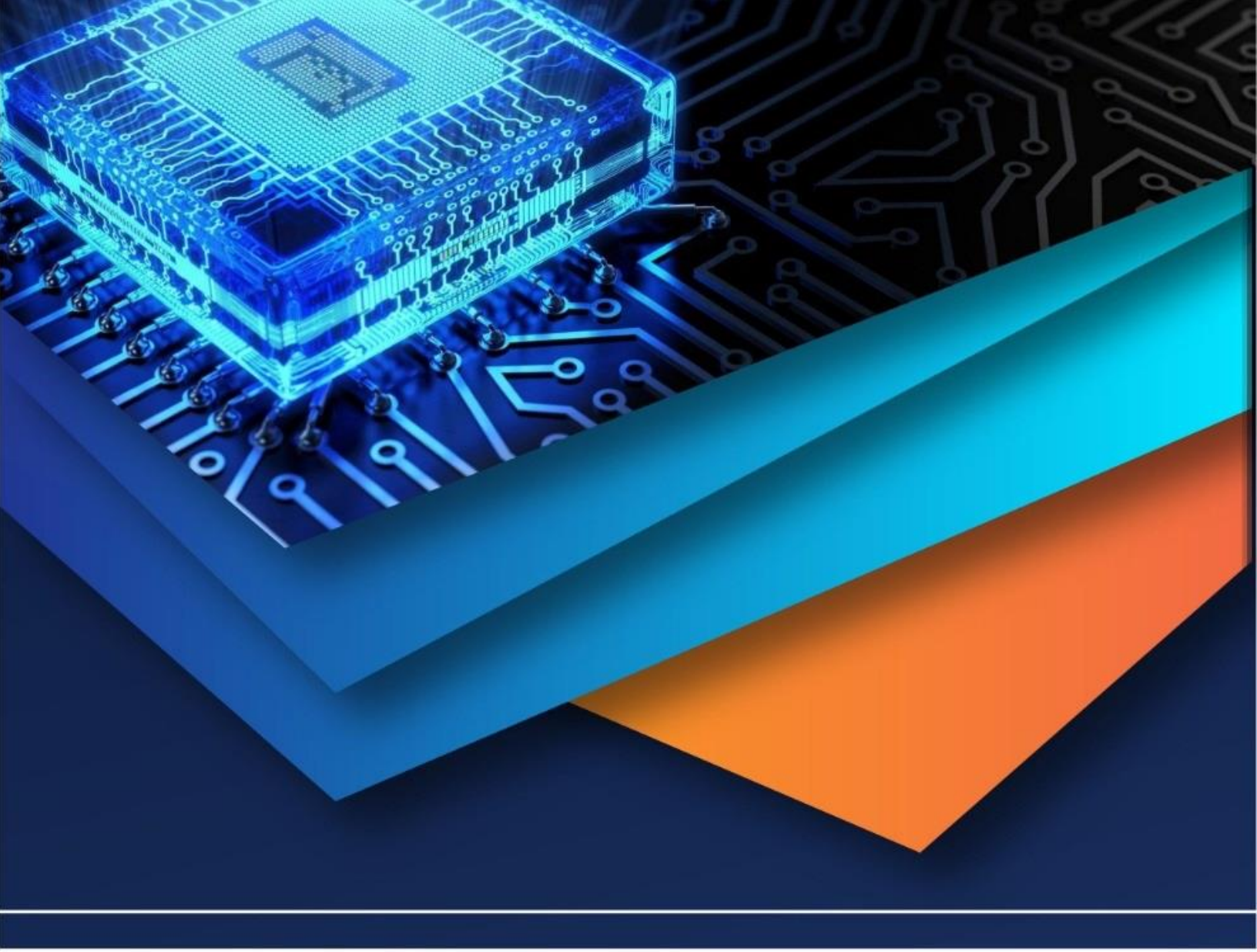
In Android Studio, java and android libraries are used along with some special java functions like java swing, java FX and special android gesture functions.

OpenCV library helped to implement image processing and rendering base works in the app.

CNN algorithm is implemented for higher accuracy in shape and digit detection.

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