Vision Therapy Application

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Abstract

Amblyopia is a vision deficit state, where vision loss occurs in one or both of the eyes even after Glass or contact lens prescription by an Optometrists. The term Amblyopia is also known as the "Lazy eye state". The application was created to aid ophthalmologists and optometrists in making accurate management of amblyopia & accommodative anomalies, through a variety of application-based activities for rehabilitation.

Keywords: *Vision Therapy Application*

1. INTRODUCTION
1.1 INTRODUCTION OF PROJECT

Amblyopia is produced by certain factors that lead to visual disorder. If detected at an early age, it can be treated with the visual correction Aid or curing the disease that is causing the vision deprivation. In research conducted in Nepal Eye hospital from June 2006 to 2011, it was found, the prevalence of amblyopia is 0.7% in schooling children. Parents can determine if their child has amblyopia. All you got to do is cover a single eye while he/she is watching tv or doing any kinds of stuff and repeat the similar to the other eye. If your child is bothered while you cover the eye, it means he/she has blurred vision in one of the eyes. You probably have covered the good eye which means the other eye can't see properly. It's important to start treatment for lazy eye as soon as possible in childhood, when the complicated connections between the eye and the brain are forming. The best results occur when treatment starts before age 7, although half of children between the ages of 7 and 17 respond to treatment. Lazy eye develops because of abnormal visual experience early in life that changes the nerve pathways between a thin layer of tissue (retina) at the back of the eye and the brain. The weaker eye receives fewer visual signals. Eventually, the eyes' ability to work together decreases, and the brain suppresses or ignores input from the weaker eye. Anything that blurs a child's vision or causes the eyes to cross or turn out can result in lazy eye So, basically we create an application to aid these type of disease in making accurate management of amblyopia & accommodative anomalies, through a variety of application-based activities for rehabilitation like we add 3D visualization treatment in this the screen is move in the circular motion and the user have to wear 3d goggles or glass and start the therapy and read the letters which are showing in the therapy for their treatment . Abnormal results of vision screening tests Activity-based treatments :- such as drawing, doing puzzles or playing computer games are available. So, we create that application by using Flutter Framework & Flutter SDK & Android Studio. Flutter is an open-source UI toolkit for mobile app development. ... Flutter is a framework specifically designed for the frontend. As such, there is no "default" backend for a Flutter application. Backendless was among the first no-code/low-code backend services to support a Flutter frontend. Flutter is Google's open source technology for creating mobile, desktop, and web apps with a single codebase. Unlike other popular solutions, Flutter is not a framework or library; it's a complete SDK – software development kit. Let's briefly clarify it here to make sure we're on the same page. A library is basically a reusable piece of code that you put in your application to perform a certain common function. A framework is a structure that provides you with a skeleton architecture for building software. It's a set of tools that serves as a foundation for your app, requiring you to fill in the blanks with your code to complete the entire structure and get the desired functionality.

1.2 PROBLEM SPECIFICATION

Amblyopia is a vision deficit state, where vision loss occurs in one or both of the eyes even after Glass or contact lens prescription by an Optometrists. The term Amblyopia is also known as the "Lazy eye state". The vision loss can be partial in most cases of Amblyopia. Amblyopia is diagnosed in early childhood or in infants. One eye or both of the eyes are affected by amblyopia resulting in reduced visual acuity. The most critical time for a child to suffer from amblyopia is below the age of 6. It is the leading cause of decreased vision among children.

• An eye that wanders inward or outward
• Eyes that appear to not work together
• Poor depth perception
• Squinting or shutting an eye

1.3 TREATMENT

The treatment for amblyopia should be started as early as possible, a younger child has a better prognosis. Prevention is always better than cure so that earlier eye examination of child may prevent amblyopia. We can treatment of squint eyes by create an android application by adding through a variety of application-based activities for rehabilitation. We also decide the application name as "SQUINTURE" that's means to cure squint eyes.

2. HISTORY

Traditionally amblyopia has been classified into different subgroups according to the major disorder which is responsible for its occurrence; accordingly, we distinguish among strabismic amblyopia, anisometropic amblyopia, isoametropic amblyopia and deprivation amblyopia. Since strabismus is the most visible disorder leading to amblyopia, the history of strabismus diagnosis can be roughly included in the history of amblyopia in the clinical context. It is known that Hippocrates described strabismus and differentiated it into comitant and non-comitant. Later Paulus of Aegina and Ambroise Pare not only diagnosed the disorder, but also attempted to treat it. One of the first explanations of the amblyopia mechanisms was given by de la Hire who suggested that in strabismus the most sensitive part of the retina is eccentrically displaced to an abnormal position. This idea was later supported by Johannes Muller. The first treatment of amblyopia was attempted in 1743 by George L. de Buffon, who covered the better eye and suggested the use of glasses for the weaker eye. In the 1930s orthoptic programs were introduced and in the 1950s pleoptic techniques began to be used. Finally, the experiments carried out in the 1960s and 1970s by Hubel and Weisel suggested that the neural basis for amblyopia

was related to a massive reduction in the binocular neurons and a shift in the ocular dominance of neural activity towards the unaffected eye.
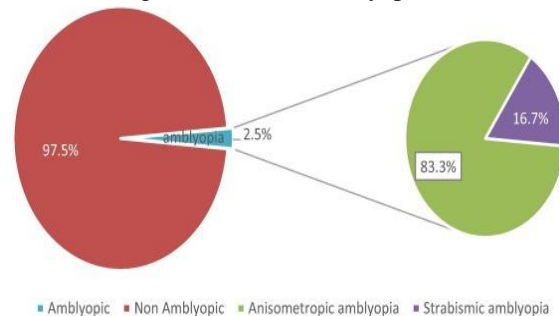
Figure 1: Data of Amblyopia Patient

Figure 2: Amblyopia patient amongs the population

A family history of squint is a strong risk factor in the development of squint, and if there is any doubt the child should be referred. Children with disorders of the central nervous system such as cerebral palsy have a higher incidence of squint than normal children. Problems during birth and retarded development also increase the likelihood of a squint. The parents' visual problems should be ascertained, particularly large refractive errors. The earlier the age of onset the more likely is the need for operation. A constant squint has a worse visual prognosis than one that is intermittent.
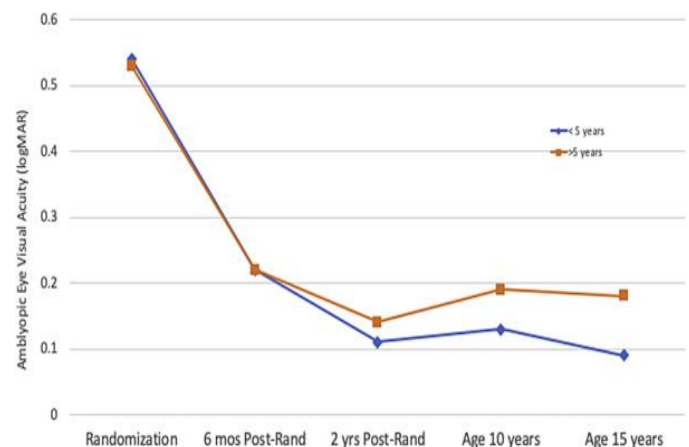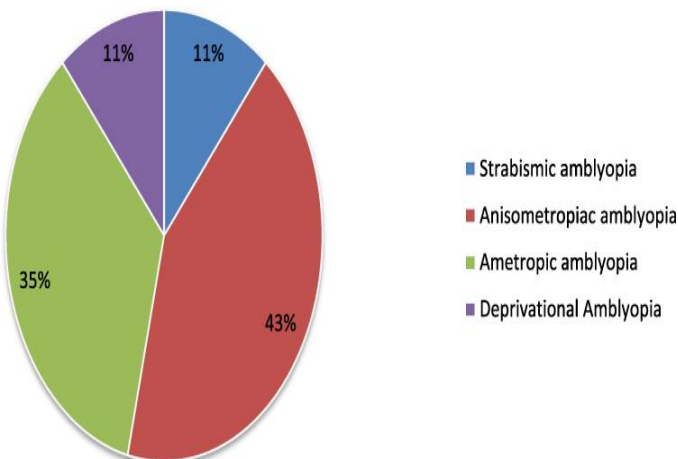

Figure 2: Graph of amblyopia for different age

2.1 EXAMINATION

Check the visual acuity-I fit does not correct with spectacles or a pinhole ocular disease or amblyopia must be suspected. This is particularly important in children as the amblyopia or ocular problem must be treated immediately if the sight is to be preserved. Visual acuity in infants is difficult to assess. A history from the mother is useful to find out whether the baby looks at her and at objects. If, however, only one eye is affected the visual problem may not be apparent. If the sight is poor in only one eye, covering the good eye may make the child try to push the cover away. In an older child small coloured sweets may be used to get a rough estimate of acuity. The older child may also be able to match letters.

Look at the position of the patient's eyes-Large squints will be

- Strabismic amblyopia
- Anisometropiac amblyopia
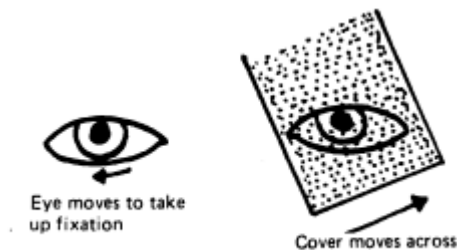- Ametropic amblyopia
- Deprivational Amblyopia

obvious. Wide epicanthic folds may give the impression of a squint (pseudo squint), but children with wide epicanthic folds may still have true squints.
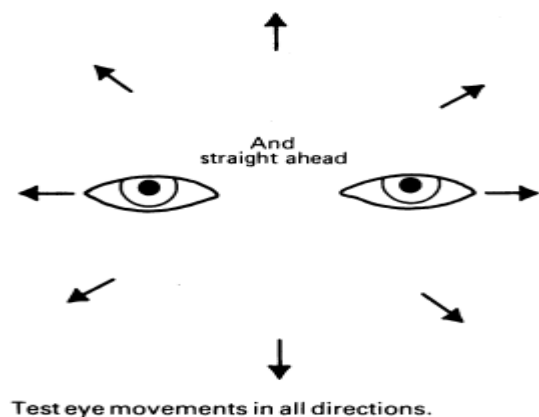
Look at the corneal reflections of a bright light held in front of the eyes. Note the position of the reflections; they should be symmetric. This test gives a rough estimate of the angle of any deviation.

Cover tests-There are two types of cover tests that help to reveal a squint, especially if it is small and the examiner is unsure about the position of the corneal reflections. In the cover/uncover test one eye is covered and the other is observed. If the uncovered eye moves to fix on the object there is a squint that is present all the time, a manifest squint. The test should then be carried out on the other eye. A problem arises when the vision in the squinting eye is reduced, and the eye may not be able to take up fixation. This emphasises the need to test the vision of any patient

with a squint. If the cover/uncover test is normal (indicating no manifest squint) the alternate cover test should be done. In this test the occluder is moved to and fro between the eyes. If the eye that has been uncovered moves then there is a latent squint.

Eye moves to take up fixation
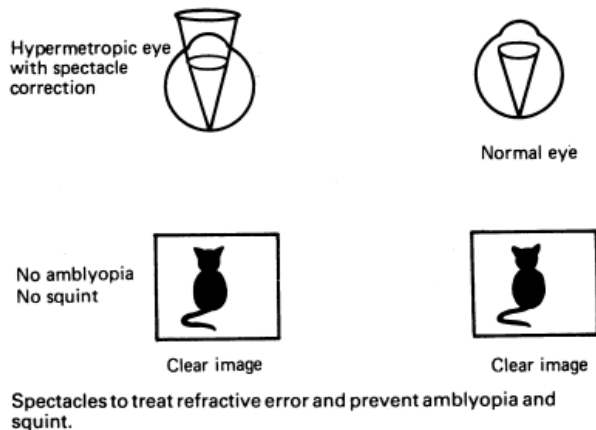
Cover moves across

Test eye movements in nine directions of gaze-If there is a paralytic squint, the angle will vary with the direction of gaze. An adult will often say that the separation of the images varies.

And straight ahead

Test eye movements in all directions.

2.2 MANAGEMENT

Spectacles-There are two main indications for prescribing spectacles. Firstly, they should be given to the child who is hypermetropic (longsighted) and has a convergent squint. Normally when the ciliary muscle contracts the lens becomes more globular to allow the eye to focus on close objects (accommodation). This is linked to convergence so that both eyes can fix on the close object. If the child is hypermetropic the ciliary muscle has to contract strongly for the child to be able to focus on a near object. This excessive accommodation may cause overconvergence so that a squint occurs. This is termed an accommodative convergent squint. The use of hypermetropic glasses in this case relaxes the ciliary muscles and removes the drive to over converge. Occasionally long acting drops that contract the ciliary muscle (such as ecothiopate iodide) may be used. These may, however, cause iris cysts and they should always be stopped before a general anaesthetic as they may impair recovery from muscle relaxants. Secondly, spectacles are suitable for the child who has a refractive error, particularly if this is unilateral. As a
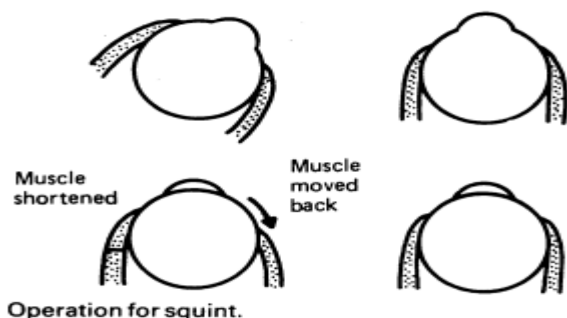
consequence the image on the retina will be indistinct. The visual pathways will then not develop properly (resulting in amblyopia). Such children may not develop a squint until the vision is poor in one eye. This point emphasises the need to check the visual acuity. The use of glasses may therefore prevent severe visual loss in an otherwise "normal" eye-hence the need to refract every child with a squint or impaired vision.

Spectacles to treat refractive error and prevent amblyopia and squint.

Occlusion-This is the familiar patching of one eye to encourage the development of the visual pathway of the "bad" eye. If the development of one pathway has been retarded by a squint or a refractive error this pathway can be stimulated if the "good" eye is patched. This can, however, only be done for a limited period, and there is a danger of the good eye itself becoming amblyopic. The underlying problem must, of course, be corrected in the meantime. The vision of the good eye may also be "blurred" with drops such as atropine.

Orthoptic treatment-A series of visual exercises may encourage the simultaneous use of both eyes.

Operation-The ocular muscles can be repositioned to straighten the eyes. Spectacles are prescribed and occlusion performed before operation because an eye is more likely to stay straight if the vision is good. The effectiveness of treatment in reversing amblyopia decreases as the child gets older. Once the child is about 8 or 9 years old the visual system is no longer flexible and amblyopia cannot be reversed. The child may, however, still need glasses to correct refractive errors, and an operation may be required if there is a cosmetic problem.

Operation for squint.

3. DEVELOPMENT ENVIRONMENT

We create that application by using Flutter Framework & Flutter SDK & Android Studio.

3.1 THE PROCESS

Flutter is an open-source UI toolkit for mobile app development. Flutter is a framework specifically designed for the frontend. As such, there is no "default" backend for a Flutter application. Backendless was among the first no-code/low-code backend services to support a Flutter frontend. Flutter is Google's open source technology for creating mobile, desktop, and web apps with a single codebase. Unlike other popular solutions, Flutter is not a framework or library; it's a complete SDK – software development kit. Let's briefly clarify it here to make sure we're on the same page. A library is basically a reusable piece of code that you put in your application to perform a certain common function. A framework is a structure that provides you with a skeleton architecture for building software. It's a set of tools that serves as a foundation for your app, requiring you to fill in the blanks with your code to complete the entire structure and get the desired functionality.

The three main architectural layers are:

Figure 1: Architecture

1. An Embedder that uses a platform-specific language and makes the app run on any OS

2. An Engine written in C/C++ that provides low-level implementation of the Flutter's core APIs. That includes graphics (through Skia 2D graphics library), text layout, file and network I/O, accessibility support, plugin architecture, and a Dart runtime and compile toolchain.

3. Framework based on the Dart programming language. Its implementation is optional, but it provides a rich set of libraries that can be divided into layers: basic foundational classes, rendering layer, widget layer, and Material/Cupertino libraries.
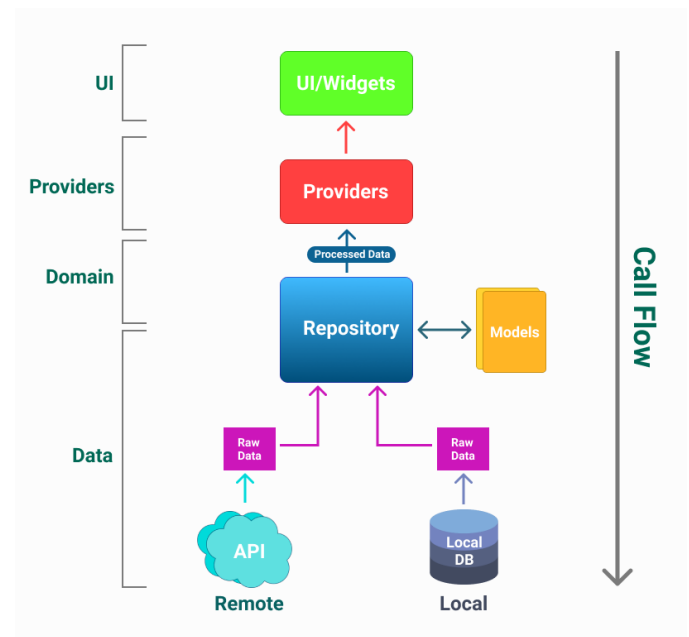
3.2 SYSTEM ANALYSIS

Flutter Framework Working

Figure 1: Data Flow Diagram

A breakdown of the architecture is as follows:

1. UI: It is the section which the user interacts with. This section takes input from the user and sends it to the Provider. Validation of the data can be done here.
2. Provider: This section consists of any state management that you want to use. In the above diagram, I have used the provider package.
3. Repository(Domain): The repository in the domain layer is an abstract class containing all the methods that the Provider requires.
4. Repository(Data): The repository in the data layer is the implementation of the abstraction. This layer decides whether the data required by the user should be fetched from the server or the local cache.
5. Remote: As the name suggests, it handles all the server requests.
6. Local: This manages all the tasks related to storing data offline and fetching data from the local database whenever required.

3.3 SOFTWARE & HARDWARE REQUIREMENT

Software:

For Creating the Android Application just used:

Flutter Framework : A framework is a structure that provides you with a skeleton architecture for building software. It's a set

of tools that serves as a foundation for your app, requiring you to fill in the blanks with your code to complete the entire structure and get the desired functionality.

Flutter SDK: Since Flutter is a full-fledged SDK, it includes a rendering engine, ready-made widgets, testing and integration APIs, etc. Let's talk about the main components and the way it works in general..

Android Studio : Android Studio is the official integrated development environment for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development.

Hardware:

We just require a PC/Laptop with 2GB RAM, 256Mb free disk space to run this.
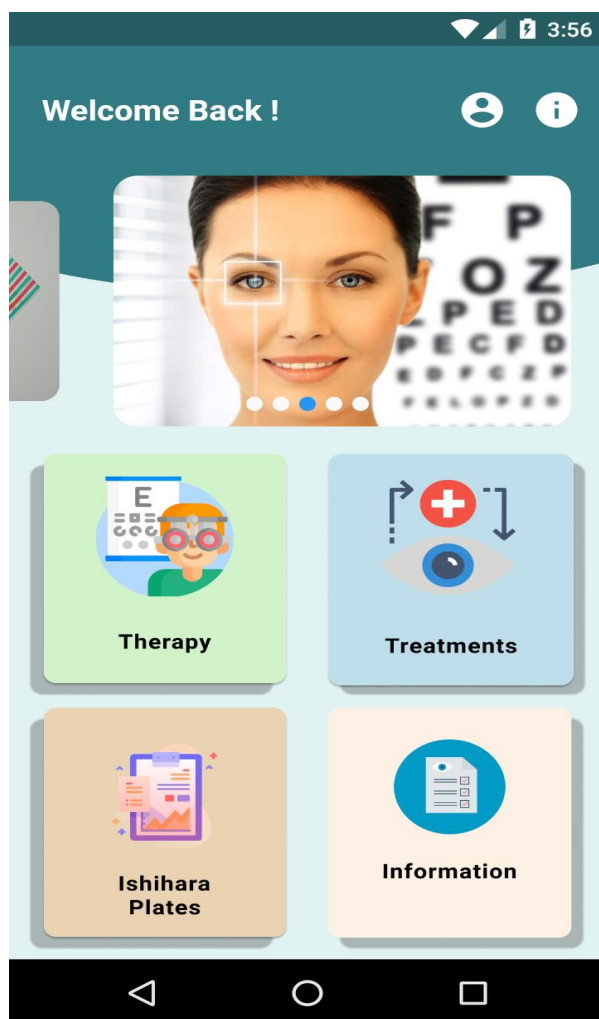
3.4 SYSTEM DESIGN

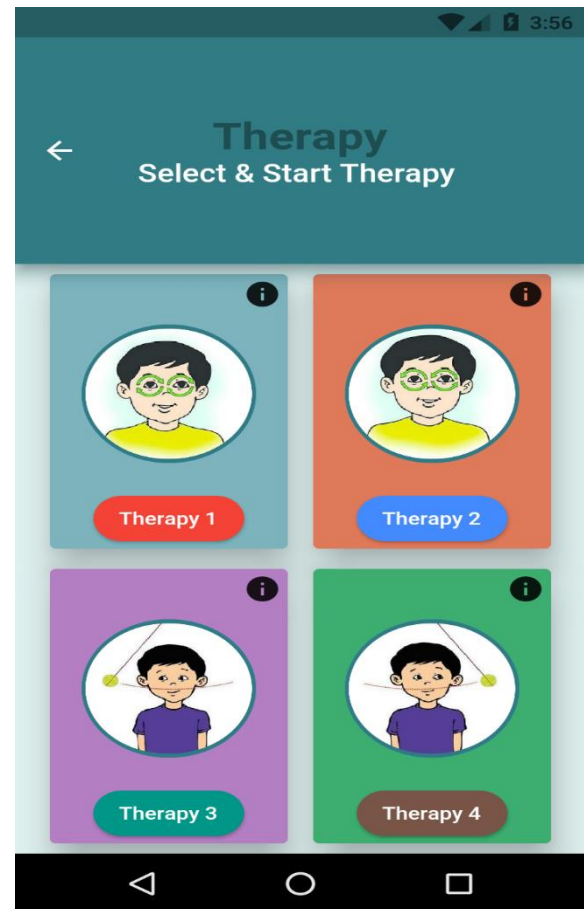
Figure 1: Interface of Application
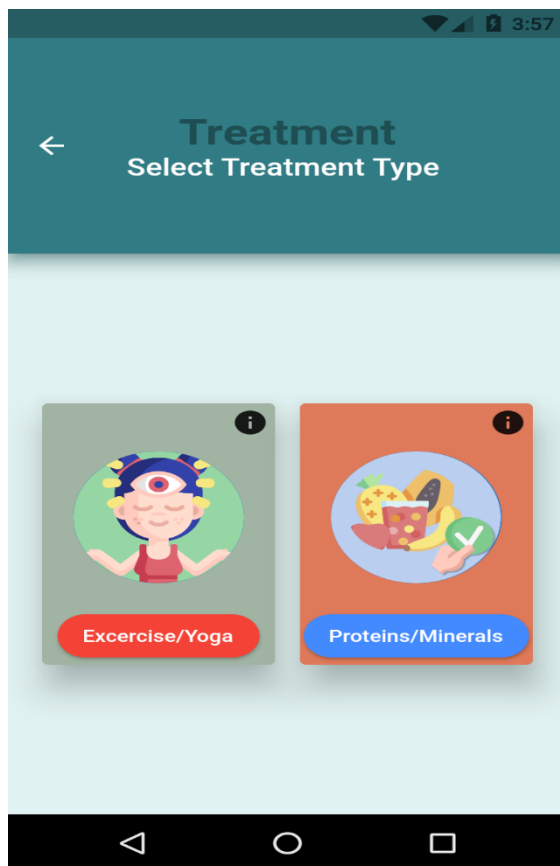

Figure 2: Interface after clicking on Therapy

Figure 3: Interface after clicking on treatments
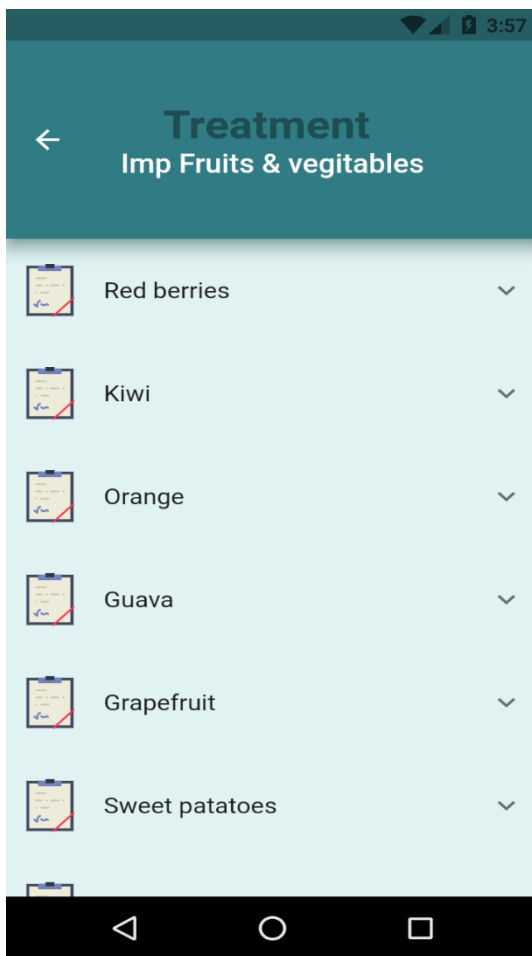

Figure 4: Interface of Treatments

Figure 4: Interface of Imp Nutrients

4. CONCLUSION

Conclusions and Future Work Through much time and effort, We have successfully created a working android application based on flutter framework android studio and animation tool for visualizing and a simple user interface. Even with its memoryoverhead, it received overall positive feedback from the students who explored it. Iam not surprised that there was not a significant difference in learning the material, which reflects what I found in my previous research. There remains, however, a strong mindset to research and create animations like these to improve learning in the classroom, which I agree with completely. Learning how to code on a web platform was challenging, and I thank the tutorials on W3Schools.com for getting me there. I had a previous internship where I develop lots of android application but it was much more concise and did not involve database & these types visualizations.The good news is that flutter framework is still one that we can develop theapplication as in android and also apple istore both and also by minor changes we can also develop the website. So I am not too worried about another big refactor soon for a language update. This would also

present some new challenges. Even though the animation tool works locally, I have unintentionally avoided the issue of concurrency, where a server can handle multiple requests to the application by different users.

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