University of Mumbai.

BE PROJECT REPORT ON

Age-Related Macular Degeneration Home Monitoring System.

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE DEGREE OF BACHELOR OF ENGINEERING IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING

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C E R T I F I C A T E

This is to certify that the Dissertation Report entitled

"ARMD Home Monitoring System"

Submitted by

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is a bonafide work carried out under the supervision of Prof Pranali Hatode and Dr. Radhika Kotecha and it is submitted towards the partial fulfillment of the requirement of University of Mumbai for the award of the degree of Bachelor of Engineering(Electronics and Telecommunication Engineering).

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PROJECT APPROVAL FOR B. E.

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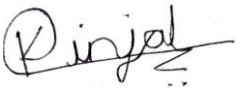

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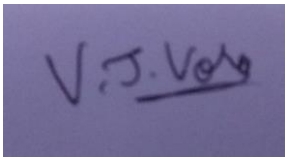

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ABSTRACT

The increasing prevalence of age-related eye diseases, particularly age-related macular degeneration, places a growing burden on health care providers. As new therapies emerge, it is necessary to develop methods that can reliably diagnose patients' disease status and differentiate the risk of progression. The presence of drusen in the retina indicates an important first factor when size, number, and morphology are thought to be strongly associated with the risk of retardation in age-related macular degeneration. Handcrafting of corpses in color-coded images is powerful and is where automated computer detection can help patients care. Aging-related macular degeneration (ARMD) is a leading cause of blindness in adults over the age of 50 and suffers from more than 1.75 million people in the United States. ARMD is an eye condition caused by macular degeneration, the central part of the retina, which contains a very high number of photoreceptors. Damage to macular effects on blurring and distortion focuses on the center of human vision and dark spots that may become larger over time. Although ARMD does not lead to complete blindness it can make it
difficult for people to do daily activities such as driving, reading, writing, cooking and facial expressions. There is currently no cure for ARMD, so it is important that there are ways to detect the first symptoms of an eye condition and follow the appropriate treatment options to minimize the damage.

Current techniques used to detect and monitor ARMD include the Amsler Grid, Preferential Hyperacuity Perimeter (PHP). These tests examine a person's ability to distinguish the alignment of lines (or a series of dots) at various points in their field of view. Tests can be performed on a computer or external device (e.g. ForseeHome). We suggest other flexible, software-based approaches to current ARMD tests such as Amsler's Grid, Preferential Hyperacuity Perimeter (PHP), Reading speed calculations, Near Vision chart, platforms that can be used on mobile devices such as mobile phones or tablets easily accessible to users. To perform the various tests as listed above we will build the Android app using Android App Development, once the test is done we will be using Advanced Reading on data obtained to predict Scotoma difficulty and size. Based on the previous data and the predicted data we would be comparing and showing the progression or decline of the patient's state of health. An important issue with current diagnostic platforms is that they are not available for home use sales and do not allow widespread user data analysis. Our proposed system will not only provide patient flexibility but will also provide a database, which can allow user results to be continuously monitored and analyzed as well as the source of Big Data analysis in clinical research. They will be used with an advanced platform and their ability to complete ARMD tests at a fast and efficient rate will be tested.

Contents

List of Abbreviations

ARMD- Age-Related Macular Degeneration

PHP- Preferential Hyperacuity Perimeter

OCT-Optical Coherence Tomography

List of Figures

Chapter 1

INTRODUCTION

1. 1 Introduction

Macular mutations are the leading cause of vision loss, affecting more than 10 million Americans - more than acne and glaucoma combined. ARMD currently affects six million people in the UK alone and is estimated to have cost the world economy £ 155 million in 2011. By 2040, the number of people affected worldwide by the disease is expected to be 288 million. Currently, Macular Degeneration is considered a chronic eye disease. There are two basic types of Macular Degeneration: “dry” and “wet. ”About 85% to 90% of cases of Macular Degeneration are“ atrophic ”, and 10-15% are“ exudative ”. Stargardt disease is a form of macular degeneration that occurs in young people, caused by heredity. Macular deformity is caused by the degeneration of the central part of the retina, the inside the back layer that records the images we see and transmits them via the optic nerve from eye to brain. The central part of the retina, known as the macula, is responsible for concentrating the central vision of the eye, and it controls our ability to read, drive, see faces or colors, and see things in detail. As longevity, age-related disorders increase the burden placed on health care providers. In particular, age-related macular degeneration (ARMD) is one of the leading causes of vision loss in the elderly. The first stage of ARMD is considered to be the presence of drusen (asymptomatic) macular, commonly found in fundus testing or teaching. Drusen is a small amount of lipid, acellular debris that collects between the retinal pigment epithelium and the Bruch membrane. People with macular degeneration associated with "middle age"; they may not see fully, but they are certainly blind and will never be again. Although the discovery of small drusen is not in itself the diagnosis of ARMD, as drusen often occurs in normal aging, increasing the amount and size of drusen increases the risk of further progression in visual ARMD. Recent symptoms of ARMD, such as changes in the color of the retinal pigment epithelium that occur prior to the development of local atrophy (so-called dry ARMD) and abnormal exudative (so-called wet ARMD) enable more established grading and separation of ARMD . It was not possible for patients to visit a hospital or doctor's office every few days to check the progress of their macular disease using conventional eye methods such as Optical Coherence Tomography (

). The downfall of computers only affects macula. Therefore, your outlook on life will not change. That is, you will not be completely blind, but if your macular degeneration develops worse, you will fall under the category of ‘unlawful’. People with dementia from age-related macular degeneration look good. Their eyes look exactly like they always have and their vision (on the side) is retained, so they can move with little or no difficulty and they can also see a small black button that falls on the line of light. This ability to see everything around a room but not to see what one is looking at confuses others. This is partly because we tend to think in terms of vision as a dichotomy of full vision against blindness. About 20% of people with

visual impairment, for whatever reason, see life-like images at times unknowingly. This condition came to be known as the Charles Bonnet syndrome (CBS) after the Swiss naturalist and philosopher who first described it in 1760. Phantom images of Charles Bonnet syndrome are common, fun, everyday things like flowers or animals or people and the experience is like looking at a picture or watching a quiet color movie. Images are in full color and can move, but no sound, smell or contact. It is important to know that Charles Bonnet syndrome is related to loss of vision, not loss of mental capacity.

A cheap, home surveillance machine can be used effectively to monitor the progression of the disease. Such a device needs to accurately and quickly perform ARMD tests with the user interface. The graphical display allows the patient to communicate with a computer using a pattern detection indicator and the patient's feedback collection device. This ARMD home screening tool can alert a patient to urgently visit a doctor's office or hospital and if necessary Anti-VEGF injections. It is noteworthy that Anti-VEGF is the only treatment for a patient with chronic macular disease or so-called AMD fluid. The software platform can accurately and quickly perform various ARMD tests and should have the following features.

● Allows display of a series of graphical patterns in patients' computers

(e. g. tablets, laptops, or smartphones)

● Provide simple ways to collect test responses from patients. ● Allows quick

and flying responses to ensure that patients follow

and compliance with the due diligence process.

● The great advantage of such a system is that it can be used at home more

often for convenience ARMD acquisition and recruitment. If admitted to various

hospitals, they can also

to provide mechanisms for comparing various ARMD tests with variability performance

ARMD protective drugs. . 0 Also major data analysis on collected test results
can answer a variety of people’s questions and life consequences for ARMD.

1. 1. 1 Problem Statement

To optimize the treatment schedule in patients with Age-Related Macular Degeneration (ARMD) by developing an app to monitor patients at home.

1. 1. 2 Solution

Our proposed system will not only provide flexibility to patients but also provides a database, which can allow for user results to be continually monitored and analyzed. They will be implemented with the developed platform and their efficacy to complete ARMD tests at a fast and efficient rate will be assessed.

1. 2 Origin and Objective of the Research Proposal

A cheap, home surveillance machine can be used effectively to monitor the progression of the disease. Such a device needs to accurately and quickly perform ARMD tests with the user interface. The graphical display allows the patient to communicate with a computer using a pattern detection indicator and the patient's feedback collection device. This ARMD home screening tool can alert a patient to urgently visit a doctor's office or hospital and if necessary Anti-VEGF injections. It is noteworthy that Anti-VEGF is the only treatment for a patient with chronic macular disease or so-called AMD fluid. The software platform can accurately and quickly perform various ARMD tests and should have the following features.

- Allows to display a series of graphical patterns on patients' computers (eg tablets, laptops, or smartphones)
- Provide simple ways to collect test responses from patients.
- Allows quick and flying responses to ensure that patients follow and adhere to appropriate screening procedures.
- The great advantage of such a system is that it can be used at home more often to facilitate the diagnosis and employment of ARMD. Once approved by various hospitals, it can also provide ways to compare different ARMD trials and the effectiveness of different ARMD testing drugs. . 0 Also large data analysis on collected test results can answer a variety of population questions and lifestyle outcomes in ARMD.

1. 3 Proposed Model

Block diagram for the proposed model is shown in figure1. 1

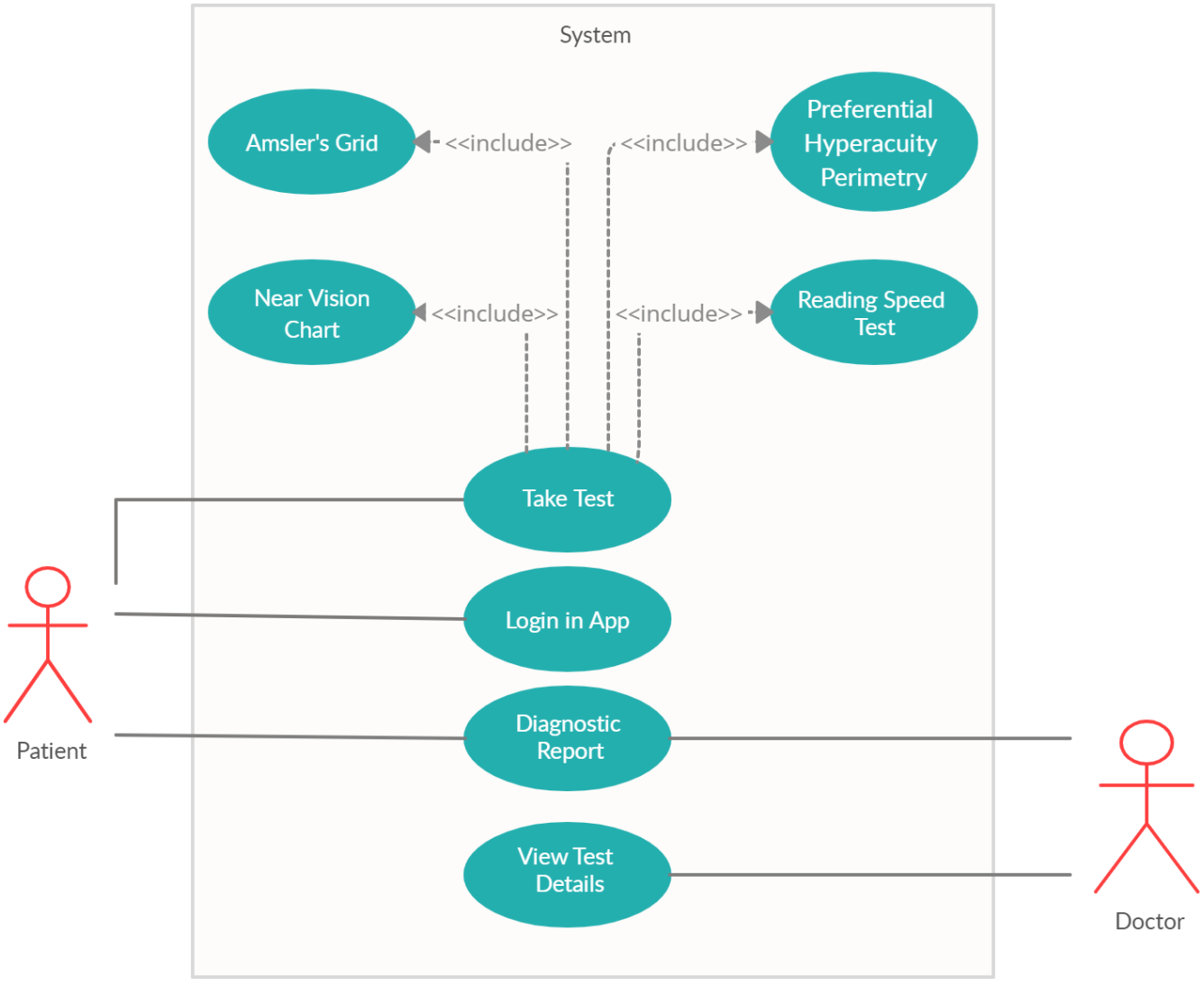


Figure 1. 1: Block Diagram

1. 3. Software Requirement

1. 3. 1. Android Studio:

Android Studio is the official integrated development platform (IDE) of Google's Google app, built on JetBrains' IntelliJ IDEA software and specially designed for Android development. Available for download on Windows, MacOS and Linux operating systems or as a subscription-based service by 2020. It replaces Eclipse Android Development Tools (E-ADT) as the main IDE for Android application development.

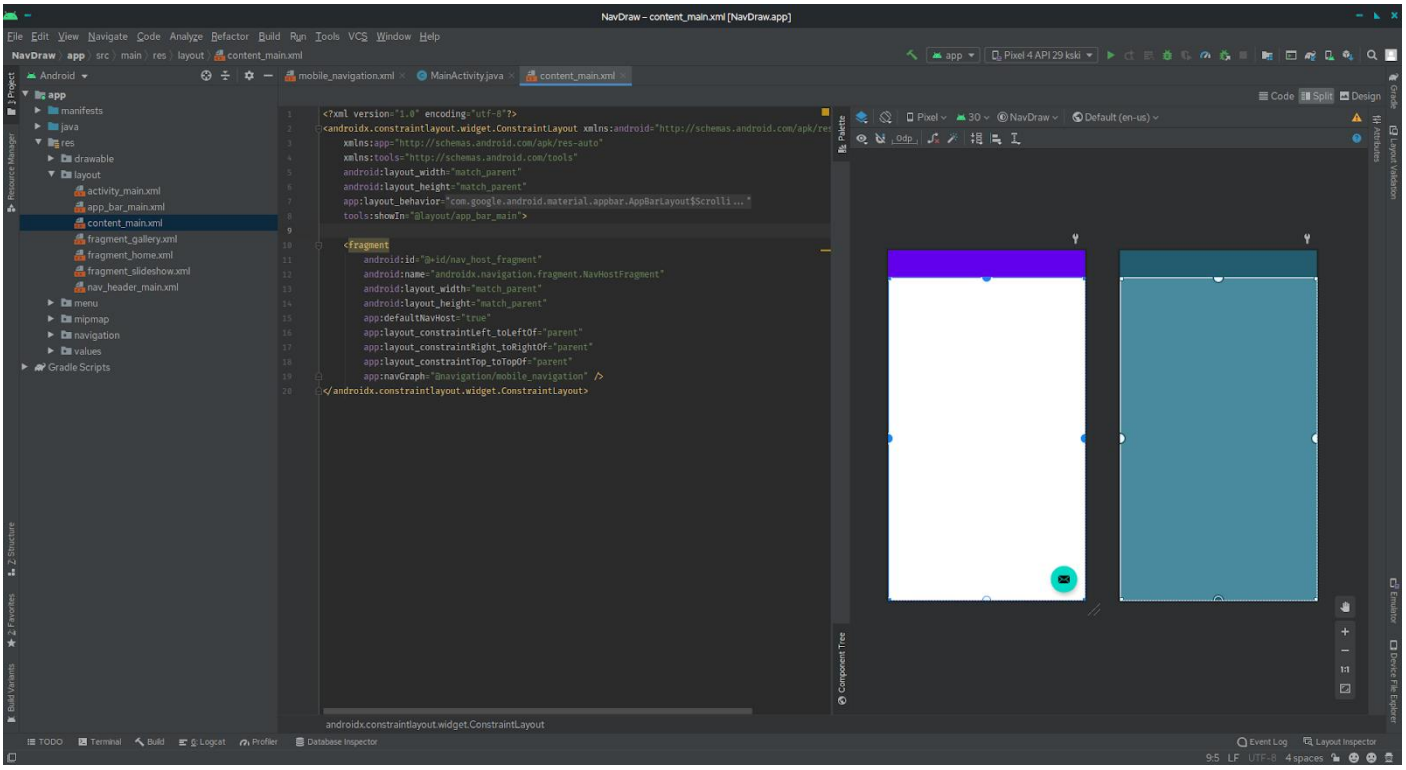


Fig. 1. 2. Android Studio

1. 4 Need of Project:

Macular mutations are the leading cause of vision loss, affecting more than 10 million Americans - more than acne and glaucoma combined. ARMD currently affects six million people in the UK alone and is estimated to have cost the world economy £ 155 million in 2011. By 2040, the number of people affected worldwide by the disease is expected to be 288 million. Currently, Macular Degeneration is considered a chronic eye disease. A cheap, home surveillance machine can be used effectively to monitor the progression of the disease. Such a device needs to accurately and quickly perform ARMD tests with the user interface.

Chapter 2

LITERATURE SURVEY

[1] Raghu Raj P, Gurudatha Pai K, and Prof. S. S. Shylaja explained the prediction of the early disease using images in the paper “Algorithmic Approach for Prediction and Early Detection of Diseases Using Retinal Images”. Fundus images of the retina of the human eye can provide important details about people's lives and open a window of unseen possibilities. In this way, one can systematically scan digital retinal images, predicting chronic diseases. This eliminates the need for manual eye imaging in diagnostic services. It is also possible to detect certain types of cancer and membranes in its early stages in addition to diseases such as high blood pressure, stroke, and organ dysfunction in patients with diabetes. A database of visual images and accompanying details of any patient, which is routinely tested, for diagnostic tests can be easily installed.

[2] N. Mohaghegh, E. Ghafar Zadeh, S. Magierowski in the paper “Wearable Diagnostic System for Age-Related Macular Degeneration” explained This paper introduces the diagnostic system suggested in the title of the novel for further detection and monitoring of Age-Related Macular Modification (ARMD). This is an wearable open source platform enables accurate ARMD monitoring with the benefit of multiple standard clicks interface techniques such as Amsler Grid, Threshold Amsler Grid, Macular Computerized Psychophysical and Preferential Hyperacuity Perimeter (PHP). Here, we define the file for proposed multi-Grid or so-called NGRID software and explain in detail the type of hardware. This prototype includes an available Oculus HMD integrated with a single board computer. As a first step towards a fully integrated wearable system, this paper successfully proves the functionality of a head-to-head interface device that is ready to be shown live. Participants can access this device and take a 10-minute ARMD eye test. In addition, NGRID approved and approved clinical trials at the hospital.

[3] Ganesh Prabhu. S,Adarsh R,Arun Vikash SP, and Amarthiyan D explained analysis of retinal images in the paper “Analysis of Retinal Images to Diagnose Stargardt Disease ”. Stargardt disease is also called Stargardt macular dystrophy, a degenerative macular degeneration. The disease causes the macula to slowly or decrease, which is a small area in the center of the retina that is directly facing forward. There is no cure or cure for this disease. Doctors, however, recommend that people wear sunglasses in the sun and in places where the light is bright. Diagnosis of the disease will take several days but we can detect the disease in minutes by comparing the unaffected eye to the affected eye using automated algorithms and advanced histogram technique. We plan to use the LABVIEW tools to install this method.

[4] R. Geetha Ramani,Lakshmi Balasubramanian and Shomona Gracia Jacob explained in the paper

“Automatic Prediction of Diabetic Retinopathy and Glaucoma through Retinal Image Analysis and Data Mining Techniques”. The use of accounting techniques in the medical field has been the subject of intense research in recent years. Diabetic Retinopathy and Glaucoma are two retinal infections that are a major cause of blindness. Regular early diagnosis of the disease has been a daunting task - a task that requires resources. So automatic diagnosis of these diseases by computational techniques can be a good solution. In this paper, a spontaneous computational diagnostic method is proposed using retinal image analysis and data mining methods to accurately classify retinal images as affected by Normal, Diabetic Retinopathy, and Glaucoma. Three-factor analysis and sixteen-phase algorithms were analyzed and used to identify contributing features that provided better predictive results. Our results show that C4. 5 and random tree planning techniques produce 100% segmented training accuracy in classifying 45 images from the Gold Standard Database. In addition, Fisher's Ratio algorithm produces a very small and appropriate set of
predictive features in retinal image training data.

[5] Gawon Kim, Student Member, IEEE, Dong Gun Kam, Member, IEEE, Seung Jae Lee,Member, IEEE,Jaemin Kim, Student Member, IEEE, Myunghyun Ha, Student Member,IEEE, Kyoung Chul Koo,Student Member, IEEE, Jun So Pak, Member, IEEE, and Joungho Kim, Member, IEEE in the paper “Modeling of Eye-Diagram Distortion and data-Dependent Jitter in Meander Delay Lines on High-Speed Printed Circuit Boards (PCBs) based on a Time-Domain Even-Mode and Odd-Mode Analysis”explained that the Crosstalk installed in the meander delay line produces a high amount of wave distortion and jitter that relies on data in the output port. This paper introduces a twisted rendering of the eye painting and how to generate jitter generation based on time-based analysis and in an unconventional way of an integrated transmission line. From the proposed analysis, this paper proposes jitter measurement in both short and long cases of unit delay. Eye distortion and jitter duration are predicted and estimated, respectively. To ensure jitter balance, a series of printed circuit board test vehicles with a meander delay line are constructed and tested. The rated jitter shows a good consistency with these proposed jitter rating figures.

[6] N. Mohaghegh, S. Munidasa, X. Ziho, Q. Owen, S. Magierowski and E. Ghafar-Zadeh in the paper “Age-Related Macular Degeneration Diagnostic Tools: Hardware and Software Development ” described This paper proposes the development and use of hardware and software for visual inspection of patients with macular degeneration. In this way, a group of graphical patterns is displayed and patient responses are collected. The data collected is used to show the progression of macular degeneration. Here we prioritize the proposed software and various other hardware methods to display and collect data on copyright. We demonstrated and discussed device design including the human-computer interface (HCI) smart glove. Also, the results of the division of time response response for each pattern and systemic error were achieved using twenty population studies. The proposed hardware / software platform is an excellent visual test solution dedicated to patients with macular disease such as ARMD.

[7] Emma Pead, MSa, Roly Megaw, MDb , James Cameron, PhD FRCOpthc , Alan Fleming,PhDd, Baljean Dhillon, FRCsEDb, Emanuele Trucco, PhDe and Thomas MacGillivray, PhD in the paper" Automated detection of age-related macular degeneration in color fundus photography: a systematic review"explained With the emergence of new therapies, it is necessary to develop methods that reliably evaluate patients' condition and the risk of further growth. The presence of drusen in the retina indicates an important first factor when size, number, and morphology are thought to be highly correlated with the risk of age-related macular degeneration. Handcrafting of corpses in color-coded images is powerful and is where automated computer detection can help patients care. We review and evaluate current approaches to the developmental and developmental mechanisms of the automatic detection of the drum in the context of age-related macular degeneration. Authors of 2019. Published by Elsevier Inc.

[8] Eva Chamorro, Juan Cedrún and Isabel Portero in the paper "Comparison between the preferential hyperacuity perimeter and the Amsler grid to detect age-related macular degeneration and Stargardt's disease" described Purpose: To evaluate the ability of selected perimeter hyperacuity (PHP) and Amsler grid to detect scotomas between Stargardt disease and degeneration of macular age. Methods: A prospective, comparative, randomized trial in which 16 patients affected by ARMD and Stargardt disease were evaluated. All patients have an optometric test including discharge, better adjustment, PHP Foresee test, and Amsler grid. The sensitivity of the macular test (Amsler grid and PHP) for each maculopathy was calculated. Results: For the diagnosis of scotomas in both macular diseases, PHP sensitivity is 60-70%, and Amsler grid sensitivity is 85-100%. As a means of testing maculopathies, PHP sensitivity is 83%, and Amsler grid sensitivity is 93%. Conclusions: The Amsler grid and PHP both help detect Stargardt and ARMD scotomas. As a diagnostic tool, the Amsler grid is useful in both cases; however, PHP is only useful for ARMD, not Stargardt's.

[9] Hannah J. Yu, Daniel F. Kiernan, David Eichenbaum, Veeral S. Sheth, Charles C. Wykoff in the paper "Home Monitoring of Age-Related Macular Degeneration: Real-World Utility of the ForeseeHome Device for Detection of Neovascularization" describe the article that has been developed after adoption, such as the cover page and metadata and formatting for readability, but it is not yet a clear version of the record. This version will be subject to further copying, reset, and review before its final form is published, but we provide this version for immediate reference of the article. Please note that, during the production process, errors may affect the content, and all exceptions applicable to this magazine are applicable.

[10]Syed Hasan Adil, Mansoor Ebrahim, Kamran Raza, and Syed Saad Azhar Ali in the paper"Prediction of Eye State Using KNN Algorithm " described In this study paper, the basic method of learning eye equipment for Eye State planning (eg Eyes Open or Closed) is using Electroencephalography (EEG) Data.

The idea is to compare and ensure that the basic Machine Learning (ML) method (K-Nearest Neighbors KNN) can provide better predictability for certain domains (in this case prediction) than more complex ML (Support Vector Machine (SVM)), Artificial Neural methods Network (ANN), or Deep Neural Network (DNN). EEG data was collected using the EMotiv EPOC headset and each record was handwritten, consisting of 14 channels (record columns) using an open or closed camera. Test results confirm that KNN's application provides better predictability in less time than other complex methods. of ML.

Chapter 3

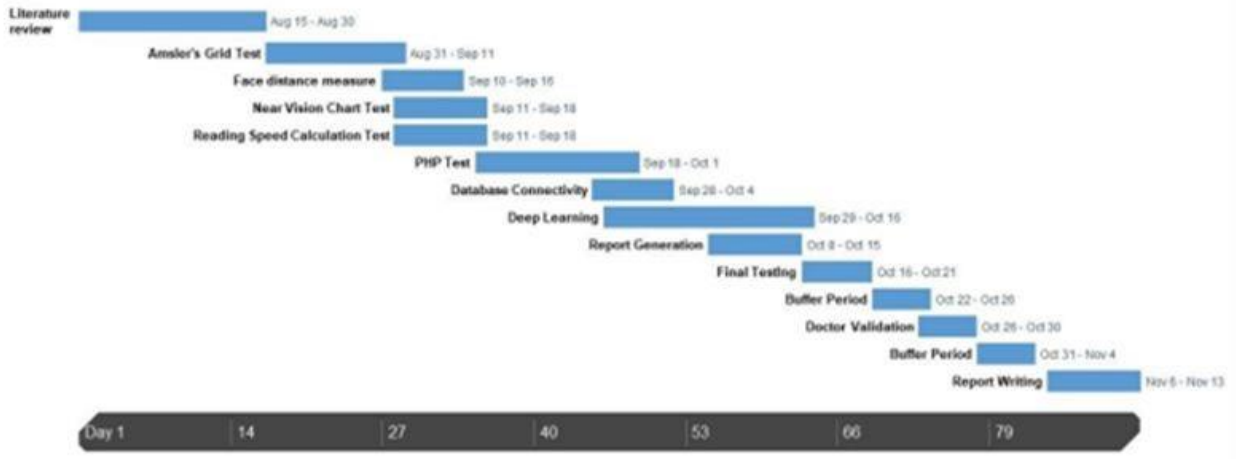
3. 1 Feature:

1. Patient-oriented application
2. User Friendly for doctors as well as patients
3. Time-saving and economically efficient
4. Economically efficient

3. 2 Advantages

- The application is convenient to use.
- It saves time for the patient.
- It can be used at home frequently to ease the detection and monitoring of ARMD.
- Once adopted by various hospitals, it can also provide a means of comparing various ARMD tests.

3. 3 Workplan



Conclusion

We propose flexible, software alternatives to current ARMD diagnostic tests like Amsler'sGrid, Preferential Hyperacuity Perimeter (PHP), Reading speed calculation, Near Vision chart, platforms which can be used via portable devices like mobile or tablet which is readily available with users. To perform the various tests as listed above we will be building an android app using Android App Development, once the test has been performed we will be applying Deep Learning on the obtained data to predict the severity and Scotoma size. Based on previous data and predicted data we would be comparing and displaying the progression or regression of the patient's health status. Key problems with current diagnostic platforms are that they are not commercially available for at-home use and don't allow for the analysis of widespread user data. Our proposed system will not only provide flexibility to patients but also provides a database, which can allow for user results to be continually monitored and analyzed as well as a source of Big Data analysis for medical research. They will be implemented with the developed platform and their efficacy to complete ARMD tests at a fast and efficient rate will be assessed.

FUTURE SCOPE

Our project would mainly focus on the reliable assessment of the patient with ARMD disease through prior intimation of the disease through a series of question sets which the patient needs to fill. Along with this data set, we would also use deep learning through some predetermined dataset, which may help us to detect the disease early. This home diagnostic ARMD assessment tool can alert the patient about the urgency to visit the doctor's office or hospital and if Anti-VEGF injections are needed. It is noteworthy that Anti-VEGF is the only treatment therapeutic procedure for a patient with progressive macular disease or so-called wet AMD.

Bibliography

[1] Raghu Raj P, Gurudatha Pai K and Prof. S. S. Shylaja explained prediction of early disease using images in the paper “Algorithmic Approach for Prediction and Early Detection of Diseases Using Retinal Images”.

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[3] Ganesh Prabhu. S.Adarsh R, Arun Vikash SP and Amarthiyan D explained analysis of retinal images in the paper “Analysis of Retinal Images to Diagnose Stargardt Disease ”.

[4] R. Geetha Ramani,Lakshmi Balasubramanian and Shomona Gracia Jacob explained in the paper “Automatic Prediction of Diabetic Retinopathy and Glaucoma through Retinal Image Analysis and Data Mining Techniques”.

[5] Gawon Kim, Student Member, IEEE, Dong Gun Kam, Member, IEEE, Seung Jae Lee, Member, IEEE,Jaemin Kim, Student Member, IEEE, Myunghyun Ha, Student Member, IEEE,Kyoung choul Koo, Student Member, IEEE, Jun So Pak, Member, IEEE, and Joungho Kim, Member, IEEE in the paper “Modeling of Eye-Diagram Distortion and data-Dependent Jitter in Meander Delay Lines on High-Speed Printed Circuit Boards (PCBs) based on a Time-Domain Even-Mode and Odd-Mode Analysis”.

[6] N. Mohaghegh, S. Munidasa, X. Ziho, Q. Owen, S. Magierowski, and E. Ghafar-Zadeh in the paper” Age-Related Macular Degeneration Diagnostic Tools: Hardware and Software Development ”.

[7] Emma Pead, MSa, Roly Megaw, MDb , James Cameron, PhD FRCOpthc , Alan Fleming, PhDd , Baljean Dhillon, FRCsEDb , Emanuele Trucco, PhDe and Thomas MacGillivray, PhD in the paper” Automated detection of age-related macular degeneration in color fundus photography: a systematic review”.

[8] Eva Chamorro, Juan Cedrún, and Isabel Portero in the paper “Comparison between the preferential hyperacuity perimeter and the Amsler grid to detect age-related macular degeneration and Stargardt’s disease”.

[9] Hannah J. Yu, Daniel F. Kiernan, David Eichenbaum, Veeral S. Sheth, Charles C. Wykoff in the paper “Home Monitoring of Age-Related Macular Degeneration: Real-World Utility of the ForeseeHome Device for Detection of Neovascularization”.

[10] Syed Hasan Adil, Mansoor Ebrahim, Kamran Raza, and Syed Saad Azhar Ali in the paper “Prediction of Eye State Using KNN Algorithm ”.