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Development of Beta career predictor platform and it is user interface design in higher education system

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Declaration

I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged.

Nurzhan Sagyndyk

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Dedication

This thesis is dedicated to: This thesis is dedicated to those who are blind or visually challenged because their tenacity, tenacity, and unshakeable spirit have inspired me. I've been inspired by your perseverance in the face of difficulty to work on this project and work for a more inclusive digital environment.

I would like to express my gratitude to my visually impaired kids for teaching me the true meaning of perseverance. Your enthusiasm for studying and perseverance in the face of challenges have made me once again realize the transformational power of education. You are the subject of this thesis, which serves as a testimonial to your abilities and dedication to removing obstacles from the field of web accessibility.

Additionally, I want to dedicate my work to my friends who struggle to see in the outside world. My grasp of the difficulties you confront every day has been formed by your experiences, stories, and insights. Your commitment to experiencing life to the fullest and your steadfast faith in technology have served as an inspiration for me throughout my study process.

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Last but not least, I want to dedicate this thesis to my family and friends who have always given me support and inspiration. Your everlasting love and faith in me have given me the courage to face problems and pursue my academic goals.

This dedication is an expression of my thanks for everyone of you and an homage to your continuous support.

This thesis is dedicated to the blind people who have impacted my life and motivated me to do something positive. May our combined efforts help build a more welcoming and inclusive online environment where obstacles are removed and possibilities are made available to everyone.

Abstract

This thesis analyzes the possibilities of UI/UX design solutions to improve the digital experiences of visually impaired people while also examining the effects of the Beta Career program on the daily lives of university students. The Beta Career program gives fourth-year students the chance to learn practical skills while avoiding typical university studies by giving them the opportunity to intern with industrial companies.

The investigation into the Beta Career program's transformative influence on students' professional and academic growth comes first. It explains how the course fosters students' development and equips them with the necessary skills for successful professions after graduation. The thesis also examines the advantages for universities, such as the chance to generate graduates with a year of work experience, improving their employability and bridging the gap between education and the working world.

The thesis also discusses the difficulties that people with visual impairments encounter while interacting online and the value of using accessible design guidelines to enhance their web experiences. It draws attention to the potential of UI/UX design approaches to improve web accessibility and produce inclusive digital spaces. The study looks into how usability and readability of web content for those who are blind are affected by design factors including contrast, font size, and color selections.

This thesis intends to improve visually impaired people's digital experiences and advance inclusivity by incorporating UI/UX design solutions that address their unique needs and preferences. The results highlight the significance of user-

centered design and the necessity of working with users who are visually impaired to develop solutions that take into account their particular problems.

This thesis concludes by highlighting the beneficial effects of the Beta Career program on students' professional growth and by investigating the possibilities of UI/UX design solutions to enhance the digital experiences of those who are visually impaired. The study sheds light on the program's transformative effects and emphasizes the need of using accessible design guidelines when developing inclusive digital environments. This research supports an inclusive and equitable digital environment for people with visual impairments by prioritizing accessibility and embracing inclusive design techniques, supporting equal opportunities and boosting their engagement in the digital sphere.

Аңдатпа

Бұл диссертацияда көру қабілеті нашар адамдардың цифрлық тәжірибесін жақсарту үшін UI/UX дизайн шешімдерінің мүмкіндіктері талданады, сонымен қатар Бета мансап бағдарламасының университет студенттерінің күнделікті өміріне әсері қарастырылады. Бета мансап бағдарламасы төртінші курс студенттеріне өндірістік компанияларда тағылымдамадан өту мүмкіндігін бере отырып, әдеттегі университеттік оқудан аулақ бола отырып, практикалық дағдыларды меңгеруге мүмкіндік береді.

Beta Career бағдарламасының студенттердің кәсіби және академиялық өсуіне трансформациялық әсерін зерттеу бірінші орында. Бұл курс студенттердің дамуына қалай ықпал ететінін және оларды оқуды аяқтағаннан кейін табысты мамандықтар үшін қажетті дағдылармен қамтамасыз ететінін түсіндіреді. Диссертация сонымен қатар университеттер үшін бір жылдық жұмыс тәжірибесі бар түлектерді шығару мүмкіндігі, олардың жұмысқа қабілеттілігін арттыру және білім мен жұмыс әлемі арасындағы алшақтықты жою сияқты артықшылықтарын қарастырады.

Диссертацияда сондай-ақ көру қабілеті бұзылған адамдар желіде өзара әрекеттесу кезінде кездесетін қиындықтар және олардың веб-тәжірибелерін жақсарту үшін қол жетімді дизайн нұсқауларын пайдалану құндылығы талқыланады. Ол веб-қол жетімділікті жақсарту және инклюзивті цифрлық кеңістіктерді шығару үшін UI/UX дизайн тәсілдерінің әлеуетіне назар аударады. Зерттеу соқырлар үшін веб-мазмұнның ыңғайлылығы мен оқылуына контраст, қаріп өлшемі және түс таңдауы сияқты дизайн факторларының қалай әсер ететінін қарастырады.

Бұл диссертация көру қабілеті нашар адамдардың сандық тәжірибесін жақсартуға және олардың бірегей қажеттіліктері мен қалауларына жауап беретін UI/UX дизайн шешімдерін қосу арқылы инклюзивтілікті арттыруға бағытталған. Нәтижелер пайдаланушыға бағытталған дизайнның маңыздылығын және көру қабілеті нашар пайдаланушылармен олардың нақты мәселелерін ескеретін шешімдерді әзірлеу үшін жұмыс істеу қажеттілігін көрсетеді.

Бұл дипломдық жұмыс Бета мансап бағдарламасының студенттердің кәсіби өсуіне пайдалы әсерлерін көрсету және көру қабілеті нашар адамдардың цифрлық тәжірибесін жақсарту үшін UI/UX дизайн шешімдерінің мүмкіндіктерін зерттеу арқылы аяқталады. Зерттеу бағдарламаның трансформациялық әсерлеріне жарық түсіреді және инклюзивті цифрлық орталарды әзірлеу кезінде қол жетімді дизайн нұсқауларын пайдалану қажеттілігіне баса назар аударады. Бұл зерттеу қол жетімділікке басымдық беру және инклюзивті дизайн әдістерін қолдану, тең мүмкіндіктерді қолдау және олардың цифрлық салаға қатысуын арттыру арқылы көру қабілеті бұзылған адамдар үшін инклюзивті және әділ цифрлық ортаны қолдайды.

Аннотация

В этой диссертации анализируются возможности дизайнерских решений UI/UX для улучшения цифрового опыта людей с нарушениями зрения, а также изучается влияние программы Beta Career на повседневную жизнь студентов университетов. Программа Beta Career дает студентам четвертого курса возможность освоить практические навыки, избегая при этом типичного обучения в университете, давая им возможность пройти стажировку в промышленных компаниях.

На первом месте стоит исследование преобразующего влияния программы Beta Career на профессиональный и академический рост студентов. В нем объясняется, как курс способствует развитию студентов и вооружает их необходимыми навыками для успешной профессии после окончания учебы. В диссертации также рассматриваются преимущества для университетов, такие как возможность выпуска выпускников с годовым опытом работы, повышение их возможностей трудоустройства и преодоление разрыва между образованием и миром работы.

В диссертации также обсуждаются трудности, с которыми сталкиваются люди с нарушениями зрения при взаимодействии в Интернете, и ценность использования руководств по доступному дизайну для улучшения их веб-опыта. Он привлекает внимание к потенциалу подходов к дизайну UI/UX для улучшения доступности веб-сайтов и создания инклюзивных цифровых пространств. В исследовании рассматривается, как на удобство использования и удобочитаемость веб-контента для слепых влияют такие факторы дизайна, как контрастность, размер шрифта и выбор цвета.

Эта диссертация направлена на улучшение цифрового опыта людей с нарушениями зрения и продвижение инклюзивности за счет включения дизайнерских решений UI / UX, которые учитывают их уникальные потребности и предпочтения. Результаты подчеркивают важность дизайна, ориентированного на пользователя, и необходимость работы с пользователями с нарушениями зрения для разработки решений, учитывающих их конкретные проблемы.

Эта диссертация завершается подчеркиванием положительного влияния программы Beta Career на профессиональный рост студентов и исследованием возможностей дизайнерских решений UI / UX для улучшения цифрового опыта людей с нарушениями зрения. Исследование проливает свет на трансформационные эффекты программы и подчеркивает необходимость использования принципов доступного дизайна при разработке инклюзивной цифровой среды. Это исследование поддерживает инклюзивную и справедливую цифровую среду для людей с нарушениями зрения, отдавая приоритет доступности и используя инклюзивные методы проектирования, поддерживая равные возможности и повышая их участие в цифровой сфере.

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Abbreviations

UX - User experience

UI - User interface

QoV - quality of vision

GWAS - genome-wide association study

W3C - World Wide Web Consortium

PLV - people with low vision

WSAG - Web Content Accessibility Guidelines

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Chapter 1

Introduction

1.1 Backround and motivation

The internet has revolutionized the way we obtain information, communicate, and interact with numerous online services in the current digital era. It has become an essential part of our daily life. Web accessibility, however, is still a serious problem because people with vision impairments encounter many obstacles when accessing and engaging with websites. My personal encounters and interactions with people who are blind have inspired me to address this pressing issue as a master's candidate and professor in the field of UI/UX design.

I have had the honor of working with students from all backgrounds, including some who have vision impairments, while teaching at the university level. I have observed the difficulties and restrictions these students encounter when trying to access web content that is not tailored to their needs via my contacts with them. These interactions have deeply motivated me to investigate how UI/UX design solutions may significantly improve web accessibility for people with visual impairments.

My thesis is to examine the efficacy of UI/UX design solutions in enhancing the responsiveness of online pages for people with visual impairments, driven by the goal to have a positive impact and to promote inclusivity. We may create design strategies that prioritize accessibility and provide all users with equitable access to information and services by comprehending their particular difficulties and demands.

1.2 Aims and objectives

This study's main goal is to investigate and suggest UI/UX design ideas that can dramatically improve the usability and accessibility of online pages for people with visual impairments. This project attempts to close the gap between design practices and inclusive web experiences, enabling visually impaired people to independently and with ease explore the digital world by taking into account their unique requirements and obstacles.

The following goals have been selected in order to fulfill this intention:

Research and Review: Conduct a thorough analysis of the best practices, guidelines, and existing literature in the areas of web accessibility and UI/UX design for people with visual impairments. This study will give a thorough grasp of the existing situation and show where there are knowledge gaps and potential research areas.

Investigate and assess a variety of UI/UX design ideas and techniques that have the potential to improve web accessibility for people who are blind or visually impaired. This investigation will look at assistive technology integration, alternate input modalities, inclusive design patterns, and navigation structures.

User-Centric Evaluation: To gain knowledge and feedback on the usability and efficacy of the suggested UI/UX design solutions, conduct user testing and assessments with people who are blind. The research findings will be based in the actual requirements and experiences of the target user group thanks to this user-centric methodology.

Create Guidelines: Create useful guidelines and suggestions for UI/UX designers and developers to make web experiences that are more accessible and user-friendly based on the research and analysis. These recommendations will be an invaluable tool for industry experts, encouraging the implementation of inclusive design principles.

These goals and objectives are addressed in this study in an effort to promote web accessibility and enable people with visual impairments to fully engage in the digital world. We may encourage a more inclusive and equal online experience for all users by emphasizing the significance of UI/UX design in the context of web accessibility.

The goal of this thesis is to investigate how UI/UX design solutions might improve web accessibility for people with visual impairments. This study tries to close the gap between design practices and inclusive web experiences. It is inspired by personal experiences and interactions with visually impaired pupils. We can enable designers and developers to produce more accessible and inclusive websites, enabling equitable access to information and services for people with visual impairments, through in-depth research, user-centric evaluations, and the establishment of useful standards. Let's work together to create a digital environment that values inclusivity, diversity, and equitable chances for all users.

1.3 Beta career

The Beta Career program is a ground-breaking project that gives fourth-year students the chance to get real-world industrial experience before they graduate from college. With the help of this program, students will gain useful real-world experience and be able to put their academic learning to use in the workplace. In exchange, participating industrial firms gain from the new viewpoint and zeal of these young talent, aiding in the gap-closing between university and industry.

The Beta Career program is a joint venture between academic institutions and business enterprises. It is planned to provide students with an immersive industry exposure while smoothly integrating into their academic curriculum. Since the program normally lasts for one academic year, students can devote a sizable amount of their fourth year to developing real-world knowledge and abilities.

The Beta Career program has a strict and tough application process. Students must fulfill particular academic requirements and go through a thorough evaluation to determine their appropriateness for the program. Academic achievement, extracurricular involvement, and personal interviews to assess their commitment, motivation, and suitability with the program's goals may all be criteria.

Students who are accepted into the Beta Career program are linked with respected businesses in their subjects of study. These internships are carefully chosen to match the academic background, career goals, and industry standards of the students. To achieve the greatest possible fit and optimize the learning opportunities for participants, the program directors collaborate closely with both students and businesses.

The Beta Career program seeks to help students with a number of important learning goals, including:

Knowledge Practical Application: The course enables students to apply the theoretical ideas they have learnt in the classroom to actual business situations. Through this hands-on learning, they gain a deeper comprehension of the material and strengthen their analytical and problem-solving abilities.

sector Exposure and Networking: Students acquire significant exposure to the corporate environment and its practices through working with professionals in the sector. They have the chance to build up their networks of business contacts and learn from seasoned mentors who can direct their career growth.

The curriculum places a strong emphasis on the development of industry-specific skills, which are crucial for successful career advancement. The opportunity exists for students to develop their technical expertise, communication skills, collaborative competencies, and project management competencies.

Personal and Professional Development: Early exposure to the working world helps students develop their independence, flexibility, and self-assurance. They get knowledge about how to deal with challenging situations, adhere to deadlines, and maintain a strong work ethic.

Continuous evaluation and assessment processes are used to guarantee the Beta Career program's effectiveness and quality. Regular feedback meetings with students, business managers, and program coordinators are part of these approaches. Project reviews, progress reports, and final presentations are just a few examples of assessments that can be used to gauge students' accomplishments and offer helpful criticism for further improvement.

Advantages and Impact: The Beta Career program has a number of advantages and effects for the participating students, the corporate partners, and the larger educational scene, including:

Improved Employability: Students' employability is greatly improved by working in the industry prior to graduation. They have an advantage over their competitors who simply possess theoretical knowledge since they join the job market with real-world experience, practical skills, and exposure.

Strong industry-academia collaboration is fostered by the program between academic institutions and commercial enterprises. A more relevant and modernized educational system is produced as a result of this collaboration, which also encourages research and development projects and guarantees that academic curricula match industry expectations.

Industry Talent Pipeline: Participating businesses gain from the infusion of brilliant and motivated students who bring new perspectives, original ideas, and a desire to learn. The initiative acts as a talent pipeline, giving businesses access to a pool of prospective employees who have already shown their aptitude and sector appropriateness.

Bridging the Gap between Theory and Practice: The Beta Career program helps students make the transition from the theoretical information they acquire in school to its real-world applications. It aids students in comprehending the applications of their studies in the real world, making learning more applicable and significant.

Mutual Learning and Knowledge Exchange: The program promotes a culture of mutual learning where professionals from the industry and students can share knowledge, experiences, and best practices. Both sides gain from this collaborative environment, which also encourages a culture of continual learning.

Positive Effect on the Education System: By encouraging experiential learning and industry integration, the Beta Career program advances the development of the educational system. In order to satisfy the shifting demands of the labor market and make sure that graduates are well-prepared for the professional world, it encourages colleges to modify their courses.

A ground-breaking program called Beta Career gives fourth-year students the chance to work in the field while still continuing their degree. This program improves students' employability, encourages industry-academia collaboration, and fills the gap between theory and practice by fusing academic learning with practical application.

Students gain useful skills, broaden their professional networks, and experience personal and professional growth thanks to the program's organized approach. By giving them access to a talented student pool and promoting a culture of innovation and knowledge sharing, the program also helps industrial enterprises.

The Beta Career program has an impact that goes beyond specific students and businesses. It advances experiential learning and fosters the development of a more dynamic and pertinent educational experience, which advances the growth of the educational system.

It is essential to assess the program's efficacy, collect input from stakeholders, and keep adjusting the program's structure and goals as it develops and grows. By doing this, the Beta Career program may continue to lead the way in bridging the divide between academia and business, educating students for prosperous professions, and fostering creativity in the workplace.

1.4 UI/UX design

User Interface (UI) and User Experience (UX) are crucial components of good web design that help people have positive digital experiences. While the UX focuses on the total experience and satisfaction that users gain from their interactions, the UI includes the visual and interactive components of a website or application. This thesis looks at the possibilities of UI and UX design solutions to improve the responsiveness of online pages, especially in order to meet the needs of people who are blind or visually impaired.

The collection of visual and interactive features that allow people to interact with a digital good or service is referred to as the user interface (UI). It includes screen-presented components including layouts, typography, colors, icons, and controls. The goal of UI design is to produce user interfaces that are easy to use and aesthetically pleasing.

Information architecture, graphic design, and interactivity are just a few of the elements that go into UI design. The main goal of information architecture is to logically organize and structure content so that consumers may quickly discover the information they need. The goal of visual design is to produce coherent and aesthetically pleasing user interfaces that are consistent with the brand identity. In order for users to properly interact with the interface, controls, navigational schemes, and user flows must be designed to be interactive [1].

User Experience (UX) refers to the overall happiness and experience that users have when interacting with a digital good or service. In order to design intuitive, engaging, and meaningful experiences, it focuses on understanding user behaviors, needs, and motivations.

Design, psychology, and human-computer interaction are all combined in the multidisciplinary subject of user experience design. It includes tasks like user research, persona development, mapping the user journey, wireframing, prototyping, and usability testing. These methods are used by UX designers to learn more about user preferences, enhance interactions, and produce experiences that meet user wants and objectives.

Web accessibility makes guarantee that people with disabilities, such as those who are visually impaired, can use websites and applications. Solutions for UI and UX design can considerably improve web accessibility for users who are blind or visually impaired, enabling them to perceive, comprehend, navigate, and engage with web information successfully.

UI for Web Accessibility: By taking the following factors into account, UI design can improve web accessibility: Clear and Consistent Layout: Giving visually impaired visitors a clear and consistent layout makes it easier for them to comprehend the organization and structure of web sites. The effective use of headings, subheadings, and lists facilitates content navigation [2].

Descriptive alternative text: By including descriptive alternative language for images, screen readers and other assistive technology can help visually impaired users comprehend the visual context of the content.

Color Contrast: Giving text and background elements enough color contrast improves legibility for persons with visual impairments. Users who have low vision should pay special attention to this factor.

Keyboard-Friendly Interactions: By implementing keyboard-friendly interactions, users can navigate web pages using keyboard inputs. This makes it possible for those who depend on keyboard access to interact with the interface in a useful way.

UX for Web Accessibility: By addressing the following issues, UX design can help make the web more accessible: material that is simple and Concise: UX designers should put an emphasis on writing material that is simple and concise, avoiding jargon and convoluted language. For users who are blind or visually impaired, well-structured content improves comprehension and makes knowledge retrieval easier.

Using intuitive navigation tools, such as menus that are easy to understand, breadcrumbs, and search capabilities, makes it easier for users who are visually impaired to navigate websites and locate the information they're looking for.

Consistent Interaction Patterns: By keeping the interface's interaction patterns same throughout, visually impaired users may better build mental maps and navigate. Interactions that are predictable enhance the user experience overall [3].

Error Prevention and Feedback: Giving visually impaired users clear error prevention and feedback messages makes it easier for them to spot and fix mistakes made during the submission of forms or other interactive procedures.

UI and UX Design Solutions to Increase Responsiveness:

Solutions for UI and UX design can help make web pages more responsive for all users, including those who are blind or visually challenged. In the following categories, UI and UX design can improve responsiveness:

Web pages must be adaptable and adjust to different screen sizes due to the increased use of mobile devices. Visually impaired users can access and explore web information with ease thanks to UI and UX design solutions that can guarantee that web material is shown accurately on mobile devices. This takes into account factors like flexible layouts, touch-friendly controls, scalable fonts, and streamlined navigation for smaller screens.

Design that is flexible and adaptable: UI and UX design solutions can use flexible and adaptable design concepts to meet a range of user preferences and needs. This may entail providing users who are blind with variable text sizes, contrast options, and other visual preferences. Web pages can accommodate the particular needs of many people with visual impairments by offering alternatives for customizing.

UI and UX design solutions should take into account compatibility with assistive technologies that are frequently used by people who are visually impaired. This includes making sure screen readers, magnifying glasses, and other assistive technology can understand and interact with web material properly. The use of assistive technologies is made easier by proper semantic markup, ARIA attributes, and adherence to accessibility standards.

Visual cues that are distinct and clear are essential for visually impaired individuals to navigate online pages. Clear and distinct visual signals, such as large buttons, highlighted interactive areas, and obvious focus indicators, can be used into UI and UX design solutions. These cues help visually impaired users navigate the content and comprehend the actions that are available to them.

Creating an effective and seamless interaction flow for users who are blind or visually impaired should be a top priority for UI and UX design solutions. In order to achieve this, jobs must be completed with the fewest possible steps, with clear directions, and with immediate feedback for user actions. The responsiveness of online pages is improved by seamless interactions and real-time feedback, which helps visually impaired users complete activities more quickly.

Testing and Iteration: To ensure that UI and UX design solutions are effective for users who are blind or visually impaired, they should be regularly tested and improved. Finding any usability problems or potential areas for development is made easier by conducting usability testing on people who are visually impaired and getting their input. Based on user insights and feedback, iterative design processes allow designers to improve the UI and UX solutions.

Solutions for UI and UX design have a big impact on how responsive web pages are for people with visual impairments. Web interfaces that are inclusive, intuitive, and responsive can be made by designers by taking accessibility, usability, and user-centered design concepts into account. The accessibility of web pages may be improved, interactions can be optimized, and visually impaired people can have a seamless and satisfying digital experience with the integration of UI and UX solutions.

The goal of this thesis is to investigate and evaluate alternative UI and UX design strategies that improve the responsiveness of online sites for people with visual impairments. This research advances UI/UX techniques in online design for accessibility by examining existing literature, assessing various approaches, and offering implementation suggestions. The importance of UI and UX design in meeting the needs of people with visual impairments must be understood by designers, developers, and stakeholders. It is also crucial to deploy responsive solutions that foster a more welcoming digital environment for all users.

1.5 Visual impairments

1.5.1 Myopia(near-sightedness)

The eye is constructed like a tiny camera that projects the environment's image onto its interior wall. The inside of the eye is covered with a light-sensitive tissue layer like wall paper rather than an electrical chip that records the image. It has an extensive collection of photoreceptor cells that produce an electrical signal in response to light. The projected image needs to be sharp in order to see it clearly. By matching the eye length with the optics' focal length with an astonishing level of accuracy of about 0.1 mm, this condition is created. Myopia occurs when the eye lengthens excessively to the point that the focussed image is just in front of the retina [4]. At a distance, one can no longer see clearly. One millimeter of eye lengthening, from 24 to 25 mm, results in around 2.7 diopters (D) of myopia.

What age does myopia start to develop? Most kids are still normal-sighted (emmetropic) or even slightly far-sighted (hyperopic) by the end of kindergarten. The most prevalent kind of myopia appears throughout the academic years. Therefore, it is referred to as "school myopia." 8 to 15 years old is the normal age range. The final results are often greater the earlier myopia occurs.

Can myopia go away as you age? The eye does not retreat once it has grown too long. Myopia is a lifelong condition. It actually has a tendency to move forward. In young people, myopia tends to worsen more quickly the more severe it is. Myopia often grows toward a final value as people age and progress usually slows down. Which varieties of myopia are there [4]? "School myopia" is the most prevalent form (approximately 90 % of cases). In adulthood, it usually achieves refractions of between -3 and -6 D, occasionally greater, and may then become sight-threatening. Additionally, there are forms of myopia that are only hereditary and start in childhood. In these situations, normal vision is never attained. This kind frequently achieves high refractive error values of at least 20 D. 2–5 hundred people in Europe and the USA and up to 20 hundred in South East Asia have high myopia, which is defined as being greater than 6 D.

Can myopia be harmful? The likelihood of degenerative processes in the tissue layers in the rear of the eye (the "fundus") increases as myopia increases. The choroid, a layer beneath the retina that provides nutrients and oxygen as well as being severely blood perfused, begins to shrink. The choroid becomes transparent and extremely thin with high myopia. Degeneration and retinal detachment are now more likely as a result. Additionally, the chance of a cataract and a rise in intraocular pressure (glaucoma) are both present. As a result, it is advised that patients who are highly myopic have their fundus examined by an ophthalmologist at least once a year. Myopia exceeding -6D, or an equivalent eye length of around 26 mm, increases the likelihood that changes may occur in the macula, the part of the retina responsible for clearest vision. Reading and working can be hampered by macular degeneration, which is the growth of new blood vessels in the macular area. On the other hand, a sizable portion of persons who are severely myopic do not have any visual impairments. There appears to be a lot of variation, which may be influenced by inherited factors.

1.5.2 Astigmatism

As the first refracting surface that light encounters, the tear film has a significant impact on ocular optics. Although it might seem intuitive, the impact of the tear film on optical clarity and visual function in dry eyes has not received much attention. This is probably because, with the exception of advanced or severe instances (such as Sjogren's syndrome and Steven-Johnson syndrome), the majority of dry eye patients have good best-corrected visual acuity. Measurements of visual acuity have come to represent visual function. Unfortunately, these traditional evaluations miss some signs of impaired visual function. By contrasting vision with static perimetry data in dry eye patients, Rieger1 established the significance of the tear film in vision in the early 1990s. Investigations have thus concentrated on the impact of the tear film on contrast sensitivity because this subjective metric more closely represents visual performance. Refractive surgery's invention signaled a significant advancement in ophthalmology. Understanding quantitative quality of vision (QoV) evaluations, rather than only the findings of traditional visual acuity testing, was essential for successful refractive outcomes [5]. As a result, significant progress has been achieved in objective QoV evaluations, leading to the creation of wavefront sensors and corneal topography systems. Notably, QoV evaluations can be used in ophthalmology specialties other than refractive surgery. In order to reliably and statistically evaluate optical quality, corneal topography systems and wavefront sensors are increasingly often employed in clinical practice. These data showed a rise in irregular astigmatism and allowed for additional investigation into the relationship between dry eye QoV and tear film behavior. Inconvenience, visual disruption, tear film instability, and possibly ocular surface injury are all symptoms of dry eye, a multifactorial condition of the tear film and ocular surface. Because of this, improvements in objectively evaluating optical quality are especially crucial for comprehending and treating dry eye disease [5].

1.5.3 Daltonism

When teaching genetics, the examples of eye color and color perception are particularly useful because they cover not only the fundamental Mendelian genetics of dominant, recessive, and X-linked disorders, but also many novel ideas like non-allelic diseases, polygenic disease, phenocopies, genome-wide association study (GWAS), founder effects, gene-environment interaction, evolutionary drivers for variations, copy number variation, insertions deletions, methylation, and gene regulation Beyond genetics, the perception of color involves ideas from optics, physics, physiology, and psychology and has the power to pique public interest, as the social media trend "the dress" demonstrated. Characters' eye color, as well as their Dire-wolves and Dragons, received a lot of attention in television programs like Game of Thrones. These cultural elements can be used to inform and interest people about genetics, which is now recognized as a major factor in all eye illnesses [6]. Ophthalmologists need to be genetically literate as the explosion of data from genomics, big data, and artificial intelligence affects medicine. Genetics is important for the primary causes of blindness, including age-related macular degeneration, glaucoma, myopia, diabetic retinopathy, and cataracts, in addition to inherited retinal diseases and congenital abnormalities. Every practicing ophthalmologist should have genetics in their toolbox. Every patient needs to have their family history discussed. Ophthalmologists will need to know how to screen, monitor, and treat patients who will soon visit eye clinics with genetic results indicating they are at high risk of specific eye disorders.

1.5.4 Dyslexia

Developmental dyslexia was formerly thought of be a congenital visual disorder that only selectively affected reading without impairing verbal or non-verbal cognitive abilities. After the phonological hypothesis of dyslexia was developed, this drastically changed; it not only ruled out any involvement of visual processing in its etiology but also raised questions about the diagnostic value of the disparity between reading and thinking abilities. In this essay, I contend that the explanatory power of this hypothesis is outweighed by the necessity to comprehend the pathophysiological visual and auditory mechanisms behind children's phonological difficulties. I go over how this is attempted by the "magnocellular theory" in terms of sluggish and error-prone temporal processing, which results in dyslexics' faulty visual and auditory sequencing when trying to read [7]. I make an effort to address the critiques of this theory and demonstrate how it results in a variety of effective strategies for assisting dyslexic kids in overcoming their reading challenges.

Chapter 2

Related works

2.1 Role of Beta Career in education

Experiential learning programs, like the Beta Career program, have gained popularity because they give students exposure to real-world business environments and the chance to put their academic knowledge to use in real-world situations. These programs provide opportunities for students to interact with experts, gain practical experience, and build vital skills that supplement their academic learning through internships, cooperative education, and industry-based projects.

Programs that emphasize experiential learning have a variety of positive effects on students. First off, by exposing students to the application of theoretical ideas in real-world contexts, these programs increase students' comprehension of contemporary business processes. Because individuals can make the connection between academic theories and their real-world applications, this experience encourages a stronger engagement with their studies.

Second, experiential learning programs encourage the growth of vital employability skills including adaptation, teamwork, communication, and problem-solving. Students who work in real-world settings are exposed to difficulties and opportunities that call for critical thinking, effective communication, teamwork, and adaptation to changing work conditions. Employers place a great value on these talents, and students' employment chances are significantly improved [8].

Programs that emphasize experiential learning also help individuals develop personally and build their confidence. Students get a sense of accomplishment, boost their self-belief, and increase their confidence in their skills by working with professionals and successfully completing real-world tasks. This self-assurance leads to higher academic achievement, motivation, and general happiness with their school experience.

Programs that emphasize experiential learning, like the Beta Career program, have an overall positive influence on education. By bridging the gap between academia and industry, these programs promote greater cooperation and partnership between academic institutions and the business world. Universities make sure that graduates are better equipped to fulfill the requirements and expectations of employers by giving them the chance to obtain industry experience.

Programs that emphasize experiential learning also increase the usefulness and relevance of education. They enrich all students' learning experiences in the classroom by bringing in real-world viewpoints and business knowledge. The inclusion of real-world experiences in the curriculum also encourages a greater level of engagement with the subject matter and a more comprehensive knowledge of academic topics.

Programs that give students real-world experience in the workplace, like the Beta Career program, have a big impact on education because they make students more employable and give them valuable industrial experience. These initiatives help students learn important employment skills, bridge the gap between academia and industry, and boost their confidence and personal development. The curriculum is made more relevant, interesting, and in line with the demands of the working world by including practical experiences. The Beta Career program is an innovative effort that serves as an example of the transformative power of experience learning in influencing the direction of education.

2.2 Web accessibility

The W3C standards are unquestionably significant, particularly in light of the sophistication of modern websites, which have become true visual communication tools inaccessible to the blind due to their development. Adherence to these standards primarily ensures the normative accessibility of websites. Screen readers used by the blind can transform visual information into auditory information by adhering to these rules. The information presented on the screen is read out by the screen reader using a normal reading of the source code of web pages (from left to right and from top to bottom). In reality, blind users communicate via the keyboard and hear all information, including metainformation (information about the sort of information, such as a link, title, or image). For instance, kids can choose links by pressing the "Enter" key and the arrow keys together to move between items. People who are blind may therefore have access to content via a screen reader when websites are created in compliance with online accessibility requirements. The adoption of these standards could be helpful for all parties. In fact, the investigation found that the average purchase time on an accessible website is decreased by a third when compared to a non-accessible website, not just for customers who are blind but also for sighted users. However, this panel also pointed out that web accessibility guidelines are regularly ignored by online designers [9]. Who likewise came to the conclusion that only a small number of e-commerce websites are user-friendly, provided evidence to support this claim. There would still be issues for users with special needs even if web designers followed all of these principles since there are too many variables to take into account when creating a website that would satisfy all of these users' needs. Everyone has different goals, some of which may conflict with one another, therefore they cannot all be met simultaneously. So, the extent of providing access to information may be to provide a text equivalent for each piece of visual information supplied on the interface, making websites less useable for those who are blind. Actually, surfing the Web presents blind persons with around three times as many difficulties as sighted users do. As a result, using the Internet presents numerous difficulties for blind people. For instance, when reading a table line by line, the screen reader loses the overall meaning, requiring the user to repeat the reading in order to understand the text. Furthermore, these difficulties are exacerbated by the use of rich interfaces, as those in virtual learning environments where dynamic web pages are included [10].

2.3 Web Accessibility and Usability for People with Visual Impairment

Accessibility is defined as "the degree to which products, systems, services, environments, and facilities are able to be used by a population with the widest range of characteristics and capabilities (e.g., physical, cognitive, financial, social, and cultural, etc.), to achieve a specified goal in a specified context." [11]. In studies on ICT-related accessibility, the web is the technology that is most frequently used. Web accessibility is the concept of creating and designing web content so that all people with disabilities can use it. The primary method for developing accessible websites is to apply accessibility guidelines, the best-known of which are those created by the W3C under the Web Accessibility Initiative [12]. However, numerous studies conducted from the beginning of accessibility studies to the present have indicated that simply adhering to accessibility criteria is insufficient [10]. When websites adhere to online accessibility guidelines [13], it is not a guarantee that users with visual impairments will be able to accomplish their objectives with a reasonable amount of time and effort. Aside from that, accessibility concerns can be divided into three categories: those that are not addressed by guidelines, those that are but are not implemented on websites. By abandoning a problem-focused technique and developing a much broader set of design principles based on user data and the use of the web by people with disabilities, web accessibility research should follow usability research's example. This viewpoint sees usability as the second half of the accessibility story. According to this perspective, accessibility is a prerequisite for basic use, whereas usability is concerned with optimized use. From a different perspective, accessibility and usability problems can be seen as two overlapping categories that include: pure usability problems that only affect users without such limitations, pure accessibility problems that only affect users with specific performance restrictions. Usability can be viewed as a part of accessibility in addition to the accessibility literature. Despite divergent opinions on the relationship between accessibility and usability, both must be taken into account when building web interfaces.

2.4 Adaptation to Promote Usability of Web Interfaces to People with Low Vision

Despite the rise of digital text in audio and braille formats, visual reading is still significant. By increasing the typefaces, PLV can read digital documents, which requires either enormous screens or screen magnifying technology [11]. Additionally, they move closer to the screen, combining physical modifications with technical ones. PLV still need improved tools for enhancing their vision despite advancements in assistive technology [10]. The PLV population does, however, have the special quality of being diverse, which is challenging in HCI. To deal with variability and assure the usability and accessibility of interactive systems, user interface adaptation seems reasonable. User-invoked adaptation (adaptability) and automatic adaptation (adaptivity) are the two basic categories of interactive system adaptation strategies. An adaptable system's users can alter the system's characteristics (via an adaptation mechanism). The system comes with a number of different alternate display and interaction elements that users can select from. As a result, adaptation is established within the design process. On the other hand, adaptivity refers to the interface's capacity to continuously gather information about the user, the usage context, etc. and use that knowledge to further modify itself to better suit the updated interaction requirements. An adaptive system dynamically alters its features at runtime based on assumptions about the user's current usage. The route of adaptation was followed by many academics, professionals, and regulators who were particularly interested in PLV. Tan et al. created a method for developing an adaptive and flexible system that provides accessible graphic online information for people with visual impairment in accordance with their profles and preferences. Bigham developed a piece of software that automatically enlarges web interfaces with the fewest possible side effects. Another area of research focuses on web adaption methods [14]. In their 2015 paper, Moreno et al. looked into and evaluated personalized interfaces for PLV. They found that in a setting that comprised both adapted and non-adapted web pages as well as two assistive technologies (browser zoom and screen magnifcation), the advantages of certain adaptation procedures depend on the type of assistive technology being used. In fact, adaptability is extremely common in well-liked web-based solutions. PLV-specific websites provide user interfaces that can be modified with features like font magnification and color customization.1. 1Visit https://www.afb.org to view this page. There is a reading mode in certain widely used web browsers (such Mozilla Firefox and Safari). Such systems take the content of a web page as input and alter its presentation (for example, linearize it in one column), structure (for example, filter out some content (for example, buttons, ads, background images), and styling options (for example, fonts, colors), as well as adding a read-aloud feature. Modern user agents, which offer some features to assist individuals with impairments and target wide and diverse audiences, are now communicating accessibility in the cloud. For instance, Microsoft developed the Immersive Reader to help kids who have trouble reading due to dyslexia or eye problems. To meet PLV criteria, it is very straightforward to change font properties such size, color, and contrast [13, 14]. Helperbird, SnapandRead, ReadandWrite, and Mercury Reader are a few products in this sector that promote universal access.

2.5 Adaptation of web pages for people with low vision

This study proposes a framework for creating user interface elements that are flexible for users with vision impairments. By creating a toolkit that facilitates the runtime customization of web components to suit the needs and preferences of people with vision impairments, the authors address the issue of universal access to digital technology. By capturing and examining user inputs and behavior, the framework is intended to automatically adapt the interface to user preferences depending on their expected purpose. Because of the user-customizable user interface (UI) components, the web is more accessible to a wider range of end users.

These modular components were used by the authors to create a prototype, which they then tested for effectiveness. Participants in the evaluation, which included simulating a vision impairment, regarded the functionality offered by the accessibility options menu to be helpful because it made it easier for them to observe specific website items. The findings demonstrate that an adaptive user interface offers important advantages in a number of crucial W3C accessibility domains, such as navigation, readability, and usability.

The study recognizes the drawback of not include actual vision-impaired users and proposes future work to include a variety of vision-impaired participants to incorporate their opinions for a more thorough understanding. The authors add that it would be insightful to compare task completion between actual and simulated user groups.

In order to enable universal access for a variety of end users, the study emphasizes the significance of flexible user interfaces. According to the authors, varied users include those who have cognitive or visual impairments, older people, and people from a variety of socioeconomic and cultural backgrounds. The framework provided in this paper can be used to create flexible user interfaces for a variety of users, increasing accessibility and inclusivity of digital technology.

In summary, this research offers an important addition to the fields of adaptive user interfaces and human-computer interaction. For various end users, more accessible and inclusive digital technology can be created using the methodology established in this study. The study also emphasizes the necessity for additional studies with actual visually impaired people in order to better comprehend their perspectives on utilizing adaptive user interfaces.

2.6 Considering accessibility and usability together

The transposition of all visual information does not, therefore, appear to be a suitable strategy for ensuring usability for blind people. In spite of the fact that they adhere to accessibility standards, websites are not always useable by them. Implementing the WCAG only addresses 50 % of accessibility issues. In addition, some issues that visually impaired users encountered could not be resolved by the WCAG. In fact, only 19 % of the problems examined were averted by the WCAG, although this 19 % included the most common accessibility issues. However, these authors emphasize the need of eliminating the need for these coping mechanisms, which are behavioral indicators of problematic conditions. Normative accessibility encourages the inspection-based evaluation of interfaces. However, the accessibility issues discovered during an audit of the HTML code's compliance do not match the issues that users really face. In addition, the evaluation of interfaces is significantly influenced by the amount of competence and subjectivity of the assessors. The standards are in fact fairly broad in order to be relevant in a variety of situations, which helps designers, developers, and web editors interpret them, especially given how frequently delays put them under pressure. Highlighting the WCAG's limitations. First of all, these criteria are still arbitrary. Depending on the designer and the situation, they can be understood in a number of different ways. Second, it may be challenging to comprehend and apply these rules in a specific circumstance. Designers typically lack the knowledge necessary to determine the best course of action since they are unaware of the needs or potential issues that consumers may be experiencing. Thirdly, these standards continue to follow a logic of interface modification that was originally designed for sighted people. In the end, comprehension of these standards depends on a certain amount of familiarity with and understanding of accessibility difficulties [15]. Therefore, normative accessibility may result in an incorrect assessment of a website's accessibility, and it encourages designers to place more emphasis on meeting standards for providing access to visual information than on UI usability for those who are blind. Access to website material alone does not suffice, though. Web interfaces should meet the three usability requirements of effectiveness, efficiency, and satisfaction so that blind users may accomplish their objectives. In this regard, a list of fifteen web design standards to aid web designers in creating websites that are both accessible and usable. They demonstrated how these criteria shorten navigation times and boost user happiness. As an alternative to the graphical user interface, has created nine recommendations for designing an upgraded text user interface. With this improved text user interface, users who are blind perform their search tasks more quickly and with fewer mistakes, according to the results. Using this improved text user interface. Many tools have been created to benefit end users or web designers. Some authors created tools for automatically or semi-automatically evaluating the accessibility of websites; sadly, the most of them are no longer useful due to the inability to specify and update the criteria without re-implementing the tool and their ineffectiveness on dynamic pages. These problems are resolved by the accessibility evaluation tool MAUVE suggested. A more adaptable tool to guarantee users with particular needs or preferences have access to a customised web experience [16]. In order to meet web accessibility guidelines or the needs of blind users, other authors created automated transformation tools that dynamically change the content of web pages. For example, non-visual web browsing can be made more usable using a variety of techniques, such as segmentation, skimming and summarization, web automation, etc.. Some technologies use a set of predetermined rules to transcode web pages. Other programs convert web pages in accordance with the significance of page fragments for blind users. Similar to this, Yesilada et al.'s program "DANTE" was developed in 2007 and annotates web pages with semantic data to make their transversal qualities obvious. Although efforts to increase web accessibility are growing, there is still a dearth of knowledge about user demands, skills, and how they engage with interfaces. Emphasized the need of having a solid understanding of user requirements not just when designing tools and websites but also when raising the bar for web accessibility. In order to ensure interface usability, specifically underlined the significance of knowing user web navigation, the capabilities and limitations of assistive technologies, and their interactions with these technologies. Other writers claimed that when adjustments are offered through a user-centered design, interface usability for a specific demographic is conceivable. User-centered design, also known as user sensitive inclusive design, attempts to provide high quality interaction by encouraging personalization. Emphasize the value of personalisation as a key component of the design process. These authors approach accessibility from the ground up, rather than as an afterthought. According to this viewpoint, we promote thinking about web accessibility more broadly than just a simple sensory translation and taking into account the entire interaction experience of people with blindness with web pages in order to take into account their unique needs based on the use context, in the design of assistive solutions. Considering the context of use, which includes users' needs and characteristics (such as perceptual, cognitive, or physical abilities or disabilities), domain requirements (such as tasks users must complete, environmental factors, etc.), technological requirements (such as the availability of software and assistive agents), and performance requirements (such as success rate, navigation time, satisfaction, etc.). In light of this, we advocate integrating accessibility and usability into the design process to ensure that users who are blind can complete their jobs and achieve their goals with a reasonable amount of time and effort. Conducted a contextual inquiry with blind users to gather data regarding actual web interaction. She developed a web navigation model for blind users that takes into account their demands after analyzing comparisons between travel in the virtual and real worlds. This study showed that the most crucial necessity for blind users is to swiftly access the pertinent information, particularly by filtering out extraneous and unnecessary information to get to the key information. By providing the option to filter redundant and irrelevant information with the same temporal and cognitive costs as a quick glance, information filtering ensures that people with blindness and sighted people have the same usability. This is because the goal of information filtering is not to provide people with blindness with the same access to information as people with sight [11]. Through information filtering, which removes extraneous information from the page, it transcodes web pages. Our primary objective in writing this essay was to demonstrate the advantages of such a filtering of redundant and irrelevant information, particularly the advantages in terms of cognitive burden. Several writers have characterized redundant and irrelevant information and demonstrated how it raises cognitive load, as is shown in the next section.

Chapter 3

Methods

3.1 Methods

3.1.1 Braille display

Research trends have been leaning toward human-computer interaction for a while now, with communication between physically challenged individuals playing a significant role. Physically People who are challenged, such as those who are blind and deaf, often have a difficult time speaking to or interacting with others. Recent technological advancements have been working to produce several skilled approaches to improve the communication processes of the visually impaired persons [17]. People who are blind or visually handicapped always use the Braille representation of various alphabets, numerals, symbols, etc. for reading and writing. For more over 175 years, there has been no significant competition from any other form of written communication for this global standard system of reading for the blind. Automatic teller machines, elevators, hospitals, menus, and many other frequently overlooked locations all use braille technology. The blind read regular letters in relief before the invention of Braille. With this approach, it was burdensome and challenging to read anything rapidly. However, a fifteen-year-old boy by the name of Louis Braille created a complete sixty-three-character code in 1824 in Paris, France, using cells consisting of six easily producible dots. Charles Barbier, a French artillery commander, showed him a new code that directly influenced him. The captain had created a system for messages conveyed in the dark among the army that he named "night writing" [18]. He roughly attempted to make it instantly available to the blind under the term of "sonography," and while doing so, he met Louis Braille, who expanded the concept into what is currently the most popular reading technique for the blind.

This Body Braille system makes use of six different microvibrators, which are typically found in mobile phones. They have been altered so that visually impaired people can read the Braille script using any part of their body surface. This "Body-Braille" approach can be used by those who have sensitivities in their fingers, palms, ears, heads, abdomens, backs, arms, and legs. The arms and back have the best Braille reaction, according to the study.

3.1.2 Font settings

Reading is necessary for full involvement in contemporary society, and as the population ages, there will be a growing worry over the print accessibility of government papers. Reading print provides a significant problem while preparing for and carrying out daily duties for the large population of people with vision loss. According to Statistics Canada's 2001 Participation and Activity Limitation Survey (PALS), of the approximately 600,000 people in Canada who have "seeing disabilities," the majority have low vision, and about 500,000 people need accommodations to read newsprint, such as special lighting, large print, or magnification [19]. According to census data from 2000, 2.4 million Americans had impaired vision and an estimated 937,000 were blind (by U.S. standards) at the age of 40 or older. Age-related macular degeneration (AMD), cataract, and glaucoma were the main causes of blindness and impaired vision in persons in the United States 40 years of age and older. According to the International Council of Ophthalmology's report Visual Standards: Aspects and Ranges of Vision Loss, when people can be significantly helped by vision-enhancement aids and devices, they have low vision. When detailed reporting on the ranges of vision loss is not possible, the range for low vision should be less than 6/18 (0.3) (20/6), according to the report. Low vision has also been defined as the inability to recognize faces or read a newspaper at a standard reading distance (40 cm, or about 16 inches), even while using the greatest corrective lenses. Even with the proper magnification and illumination, many elderly persons have trouble reading conventional type, including medicine labels. For many people with impaired vision, high magnification can diminish the extent of the usable field, and manipulating the properties of fonts can cut down or even completely eliminate the need for extra magnification. Legibility and reading acuity can be affected by a variety of factors, according to previous studies on the subject. This is true for both sighted readers and readers with low vision. These characteristics include leading (the space between lines of text), point size, the height of letters (x-height, defined), the presence or absence of serifs, the width of strokes; kerning or inter The specific properties of a typeface or variations between entire or unaltered fonts have been investigated in order to determine the legibility and readability of fonts. The adjustment of some parameters while maintaining consistency with others is necessary for research on the specific font traits, such as the employment of serifs or the width of the stroke. Alternately, studying entire fonts may be simple to execute in practice, but it restricts the generalizability to particular traits. Because it can be difficult to determine if observed discrepancies in readability are due to the size of the type, various lighting circumstances, or fundamentally different designs, the results of font evaluations may be tainted. The test material should be carried out under "threshold seeing conditions," which is a psychophysical acuity measurement that establishes a threshold value at which the majority of subject replies are accurate, according to one concept of the legibility of print. Another idea is how different typeface designs perform when displayed at sizes that are far larger than the reader's comfort zone. One factor to take into account may be the reader's comfort or attraction to the font design, which is sometimes referred to as "readability". The seeming contradiction may be explained by the inconsistent use of terminology when one font design "A" is judged to be more legible than another font design "B," yet typeface "B" is found to be more readable than "A." Reading speed and crucial print size are two other factors that are taken into account when evaluating a typeface's legibility [19]. The smallest print size at which people can read at their fastest reading speed is known as the crucial print size. This is a significant measurement since it shows the smallest magnification needed for simple reading. The main goals of this review were to locate any research pertaining to the effective characteristics of typefaces for readers with low vision, to ascertain the existence of any standards or guidelines that are related to such legibility, and to address the characteristics of French-language typefaces for readers with low vision. This review was conducted with an overview of research and performance measures in mind. The latter was taken into account because French has a number of accent marks that are not present in English, the typeface employed can either make these accent marks more or less obvious, and Canada, where this research was conducted, is a recognized bilingual nation. Additionally, studies on the legibility of drug labels were taken into account.

3.1.3 Color themes

The white cane continues to be the most common instrument employed for obstacle detection in the challenging setting of day-to-day life for visually impaired/blind people, provided that the encountered sites have been visited before and memorized. They fully rely on other people to get them where they need to go in an unfamiliar environment. Any system intended to enable autonomous navigation must be able to recognize impediments in video streams showing extremely dynamic urban environments[20]. In this study, we present and evaluate a reliable system for providing guidance and help to users in urban situations, including both indoor and outdoor locations, and alerting them to the existence of static or moving objects a few meters away. Our technology first recognizes both static and moving impediments in video streams. First, the multiscale Lucas-Kanade algorithm is used to pick and track only a sub-grid of interest points. The RANSAC method is then iteratively applied to the set of matching keypoints to identify camera/background motion. Using the related motion vectors, the outliers are combined into clusters. Finally, the risk posed by the obstacles is calculated by categorizing them as urgent or usual based on their motion and proximity to the camera. We concentrated on difficult sequences for validation that had complicated motions, sometimes with high amplitude, and abrupt changes in the background primarily brought on by the subject displacement. In the second stage, we spoke about how to classify obstacles. The picture patches corresponding to the detected obstacles are now separated into 128 8 x 8 pixel cells and shrunk while maintaining aspect ratio [20]. Using a modification of the HoG (Histogram of Oriented Gradients) descriptor, which captures the object structure from its surrounding regions, we extract an interest point from each cell. We then use the k-means clustering approach to create a visual codebook and map the picture patches to the closest visual word. The novelty of a real-time application running independently on a typical smartphone is found at the system level. In this situation, our framework offers a cheap, unobtrusive, and straightforward blind navigation method.

3.1.4 Screen readers

There has never been a greater or more dynamic opportunity for technology to link people and offer a method of access to education, commerce, employment, and entertainment. By removing obstacles and enhancing accessibility for people with disabilities, communication technologies and new media promise to "revolutionize our lives".Technology is frequently described as freeing since it eliminates physical, social, and educational constraints on full participation in society. Technology is frequently perceived in very idealistic ways. It promises to free us from the bonds of enslavement and give us a cutting-edge cure for disability. Disabilities would merely disappear or become a minor distinction as a result of technology developments. These presumptions have a strong undercurrent that assistive technologies in particular 'level' the playing field; yet, in our opinion, technology and access are paradoxically related. On the one hand, disabled individuals now have more access to educational opportunities than they did in the past. Technology is become easier to use and obtain as it gets smaller, faster, and cheaper. The technology divide is becoming more and more about the underlying, deeper connotations of "access" rather than how easy it is to use technology. In other words, access encompasses more than the division between the "haves" and the "have-nots." We propose a change in the discourse on access away from notions of equity that qualify and contextualize technology-centered disparities within local and societal histories, values, languages, and perceptions of success and disproportion in order to more fully capture the deeper meaningsof access. For instance, despite the fact that access and integration are often associated with technology, technology can also isolate people, resulting in particular types of social exclusion. These exclusions may be the outcome of formal, mechanical procedures, such as the prescriptive technology matching that occurs in primary and secondary school settings when assistive technology is used to address student "impairments." But exclusion might also take a more subtle form. For instance, technology favours certain ways of being that are rooted in social, cultural, and economic norms and are further solidified through the design, production, marketing, and application of technology. In other words, technology is created in a way that reflects presumptive notions of what is normal.

3.1.5 Smart guiding glasses

This research introduces a unique ETA (Electronic Travel Aids)-smart guiding device in the form of a pair of spectacles for providing these people with guidance effectively and safely in order to overcome the traveling problem for the visually impaired population. A new multi-sensor fusion-based obstacle-avoiding algorithm is developed that, in contrast to previous research, uses both the depth sensor and the ultrasonic sensor to address the challenges of recognizing small impediments and transparent obstacles, such as French doors. Three different types of aural clues were created for those who are completely blind to help them navigate. For those who have poor vision, however, visual improvement that incorporates the traversable direction and uses AR (Augment Reality) technology is used [21]. A prototype that consists of a set of display glasses and a number of inexpensive sensors has been created, and multiple users have tested its effectiveness and accuracy. According to the results of the investigation, smart guiding glasses can significantly enhance a user's indoor travel experience. Thus, it functions as a consumer item that enables those who are visually impaired to travel securely.

3.1.6 Voice helpers

Artificial intelligence-powered software agents are known as "Virtual Assistants," with Apple Inc.'s Siri being the first to gain widespread use. It was initially made available in 2011 and integrated into the iOS (iPhone operating system).

Other noteworthy Virtual Assistants that have received support from rival digital behemoths to date include Alexa from Amazon Inc., Assistant from Google Inc., and Cortana from Microsoft Corp. The information is presented on display screens on "traditional" devices like computers, cellphones, and tablets, and data is entered using keyboards or touchscreens. For elderly people with degenerative eye and joint problems, these tasks might be challenging because they call for adequate eyesight and manual dexterity. However, voice-driven "smart speakers" that are supported by Virtual Assistants are able to get around these limitations by depending on the users' speech and hearing abilities. The first always-on voice-controlled smart speaker powered by "Alexa" is the Amazon Echo. A senior with visual impairment may benefit from using such a device to help with daily activities. Users of the Internet can listen to audio books, music, radio stations, and the news [22]. They may also use voice commands to check the time, set timers and alarms, organize personal calendars, do fact-finding searches, and conduct online shopping. Installed'smart' household appliances allow for remote management of the thermostat and lighting. For the first time, someone with low vision and no prior computer knowledge can use such cutting-edge devices just by talking to them. The extremely elderly and those who are socially isolated face a higher risk of vision-related quality of life degradation, therefore these helpful techniques do confront considerable obstacles to adoption in this elderly cohort. Who also happen to be the older population group least likely to use the Internet and possibly least able to acquire such gadgets and home broadband connections. Furthermore, such gadgets might not be useful for senior people who also have hearing or speech impairment, such as those caused by cerebrovascular accidents. At the moment, several basic operations-like removing things from a shopping list on the Alexa-cannot be voice-controlled and still require a display screen. These always-on, Internet-connected items with microphone capabilities have raised concerns about potential privacy invasions. In the years to come, we as healthcare providers will undoubtedly confront an increasing number of technologically competent older patients. Will these voice-activated smart speakers improve the psychological wellbeing of elderly persons with visual impairment and help them go about their daily lives? Perhaps; additional real-world studies will undoubtedly be required to assess their effectiveness. In order to fully benefit from this technology, technology companies, healthcare services, and patient support groups must all optimize pricing and functionality to make them more affordable and user-friendly to this demographic.

Chapter 4

Experiment and results

4.1 Experiment

Participants for my evaluation were chosen by me from a computer science class. I assigned each participant, and I led an evaluation session.

This tool was designed with those with low vision and color blindness in mind. However, because there weren't any visually impaired kids there, I used color filter plugins to mimic color blindness for them. In total, fourteen people took part in the evaluation. The distribution of individuals and the simulated type of vision impairment is shown in Table 4.1. Personas were given to each participant in order to gauge how accessible our prototype adaptive application was. The personas differed in terms of their type of color blindness and their degree of normal and shortsightedness because this program serves a variety of color blind users. A Google Chrome color vision simulator called Colorblindly was added to the web browser to help with personas. This allowed the participant to view the websites just as their persona would. Based on the heuristic evaluation method, a questionnaire was created for the evaluation. This was chosen as the testing technique for this study because it aids in identifying usability and accessibility issues with UI designs. The chosen heuristics comply with the W3C accessibility recommendations.

Type of Colour Blindness	Type of Partial Sightedness	Participants
Normal	Normal	4
Deuteranopia	Normal	4
Protanopia	Normal	2
Tritanopia	Normal	2
Monochromacy	Normal	2
Normal	Short Sighted	4
Deuteranopia	Short Sighted	4

Table 4.1: Summary of Personas Participants Simulated

4.2 Results

The users of the rebuilt adaptive Google website thought it was substantially more accessible than the initial website for practically all of the metrics that we used in our heuristic evaluations. All vision impairment guidelines from the W3C. Low line spacing, line length, and letter spacing scores may be the result of unintended consequences of the Flutter settings. For instance, increasing the font size will result in wider lines, while enabling the dyslexia-friendly font will result in wider letters. To better understand the root of the problem, additional testing with more users is required for the scores for capitalization, hyphenation, justification, margin, and borders.

4.2.1 Contrast

The ability for a user to change the colors of website parts makes it easier to tell apart elements by color. Users had the option of selecting their own color schemes or established colour blind friendly themes. The initial Google website performed poorly, as shown by the results of Figure 4.1, which have a mode value of 1. This was true for all respondents, as 70 % gave the comparison a 1 or a 2. In contrast, our adaptive version of Google did better than the original on the basis of contrast, receiving a rating of 5 from about 80 % of respondents. This showed that the adaptive interface was quite successful in enabling users to change the background and text colors to enhance contrast.

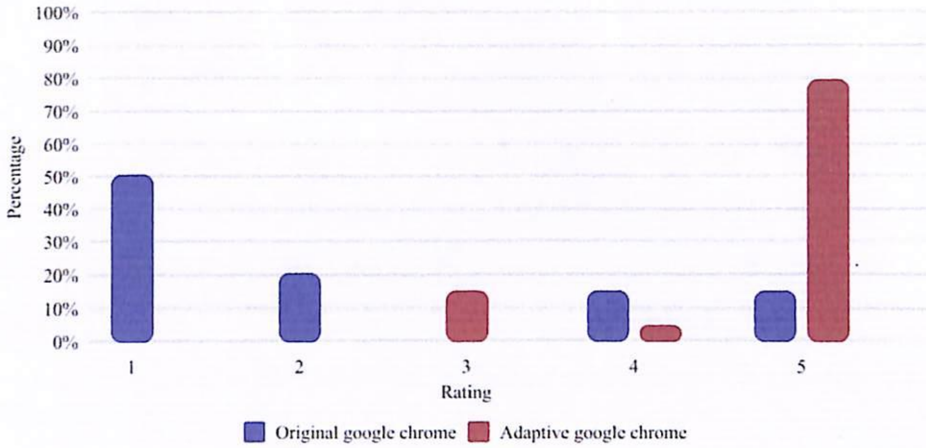

Figure 4.1: Participant responses evaluating Contrast

4.2.2 Differentiate without Color

A fundamental W3C Accessibility recommendation is the ability to communicate ideas, denote actions, or distinguish specific visual components without relying on color. The original Google website fared satisfactorily when asked if "colour is not the only visual means of conveying information, indicating an action, prompting a response, or distinguishing a visual element". According to Figure 3, 3 and 4 garnered the most responses, accounting for a combined 42.9 %. Its performance in this category was somewhat above average, demonstrating that it did not rely entirely on color to convey information. Results, however, show that adaptable Google fared better than the original, with 64.3 % giving it a 5, and 36.7 % giving it a 4.

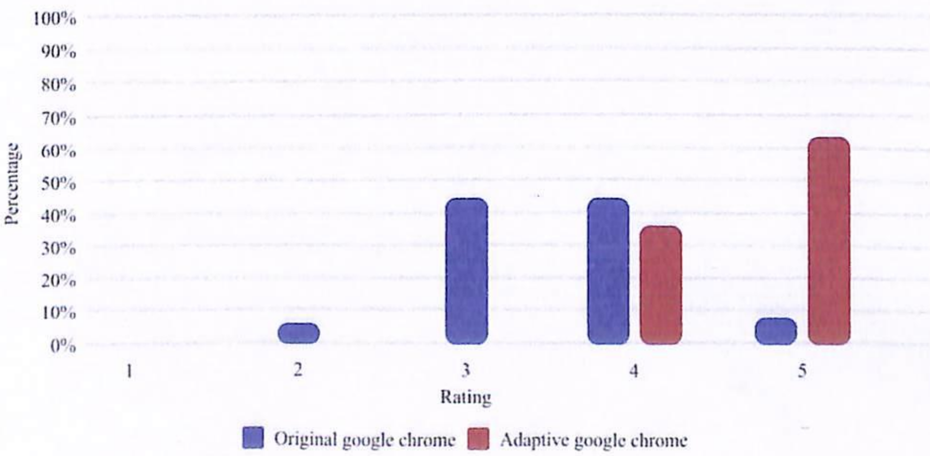

Figure 4.2: Participant responses evaluating Contrast

4.2.3 Text size

Users of my app will be able to adjust the font size of the on-screen text without zooming in or out using the menu. The ability to "change the text size of text, without zooming the entire interface" was assessed by participants. The results were significantly different, as seen in Figure 4.3. 78.6 % of the participants gave the performance of the original Google website a negative rating. The converse was true for our customizable version, which received a 5.9 rating from 78.6 % of users.

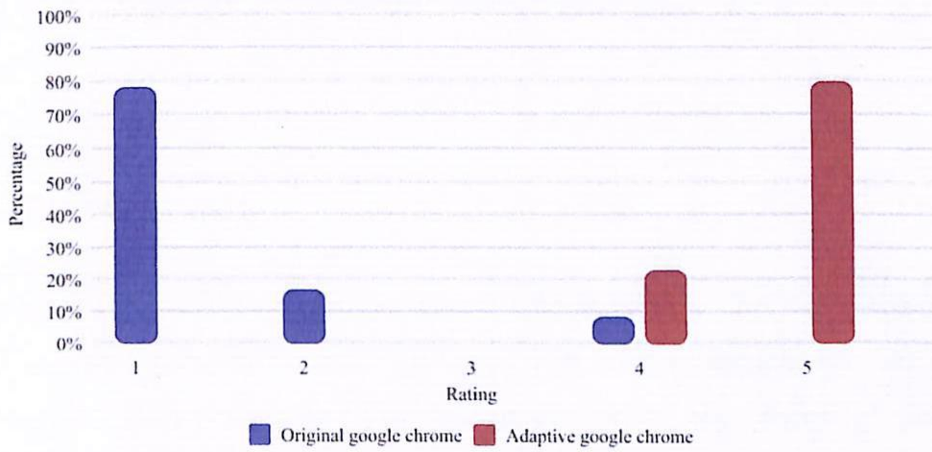

Figure 4.3: Participant responses evaluating Contrast

Chapter 5

Conclusion and Discussion

5.1 Conclusion

I set out on an interesting and instructive trip to study the difficulties that people with visual impairments encounter in their day-to-day digital encounters throughout the course of this research. The investigation of the different problems these people ran into has highlighted the significance of web accessibility and the part that UI/UX design solutions can play in improving their online experiences.

It has been a wonderful and enlightening experience to do this research. Through a thorough analysis of the literature, user-centered assessments, and experimental investigations, I was better able to grasp the unique challenges faced by people who are visually impaired as well as potential solutions that might greatly enhance their digital interactions.

The tremendous influence that little design changes can have on improving online accessibility is one of this study's main results. I found that adjusting the contrast, font size, and colors can significantly improve the accessibility and reading of web material for those with visual impairments through trials. We can design more inclusive digital experiences and lessen the difficulties this user group has on a regular basis by taking their particular requirements and preferences into account.

Additionally, this research has emphasized the significance of empathy and user-centered design in meeting the requirements of people who are visually impaired. We can develop solutions that genuinely meet their needs by actively integrating them in the design process, hearing their input, and taking their viewpoints into consideration. It is impossible to stress the importance of working together and co-creating with this user group because their viewpoints have been crucial in building powerful design strategies.

The findings of this study highlight the necessity of spreading awareness of and putting accessible design principles into practice across digital platforms. We can create a more accessible digital environment that puts the needs of people with visual impairments first by highlighting the value of contrast, font size, and color choices. These results can be used as the foundation for policies and suggestions that organizations, designers, and developers can use to make the web more accessible.

In conclusion, this research has been a fascinating and enjoyable investigation of the difficulties that people with visual impairments encounter while interacting with technology. The basis for building more inclusive digital experiences is laid by the identification of design changes that can dramatically improve web accessibility. The lives of visually impaired people can be improved by incorporating these discoveries into design methodologies, allowing them to move around the digital world more easily and independently. To create a digital environment that is accessible to all, let's continue to put accessibility first, encourage empathy, and use inclusive design principles.

5.2 Future works and discussion

The study that was done for this thesis has revealed important information on how UI/UX design solutions might increase web accessibility for people with visual impairments. The results have brought attention to how important contrast, text size, and color selections are for improving their digital experiences. There are various areas for additional research and potential breakthroughs in this field based on these findings.

The creation of a software program that enables users to alter and customise their web accessibility settings is one potential direction for future work. With the use of this program, people with visual impairments may readily alter the contrast settings, letter sizes, and color schemes to suit their own requirements and preferences. Users can enjoy a customized and optimized digital experience across numerous websites and applications by automating the adaption process.

Collaboration with people who are visually impaired is essential when creating this software. You can utilize user-centered design approaches, such as focus groups, interviews, and usability testing, to make sure the software satisfies the user group's wide range of needs. The program must be improved with the help of visually impaired users' feedback and suggestions in order to meet their specific demands.

The software's adaptive skills can also be improved by using machine learning (ML) and artificial intelligence (AI) methods. The software can effectively adapt and change the online accessibility settings in real-time by examining user preferences, browsing behavior, and contextual data. The user experience can be greatly enhanced by this dynamic adaptability, which can also lessen the need for manual adjustment.

Additionally, extending the research's purview to examine additional facets of web accessibility is a crucial direction for future investigation. While contrast, font size, and color selection were the main topics of my thesis, there are other elements that affect how usable a website is for those with visual impairments. Investigating the efficacy of alternate design components including auditory cues, voice interfaces, and haptic feedback can offer more information about how to make digital experiences that are more inclusive.

Collaboration between online designers, developers, and organizations is also essential for putting accessible design ideas into practice. The incorporation of inclusive design principles from the very beginning of online development can be encouraged by increasing knowledge of the value of web accessibility and by offering instructional resources. This partnership can encourage the development of user-friendly websites and software, enabling people with visual impairments to smoothly navigate and engage with digital information.

In conclusion, future work in this area will focus on creating software that can be customized so that users can change web accessibility settings to suit their own requirements and preferences. The software's ability to adapt can be improved by integrating AI and ML algorithms, giving users a more tailored and optimized experience. The objective of developing a fully inclusive digital environment can also be advanced by investigating other facets of web accessibility and encouraging collaboration with stakeholders. We can help create a more inclusive and accessible digital environment for people with visual impairments by continuing to put research, innovation, and cooperation first.

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AppendixA

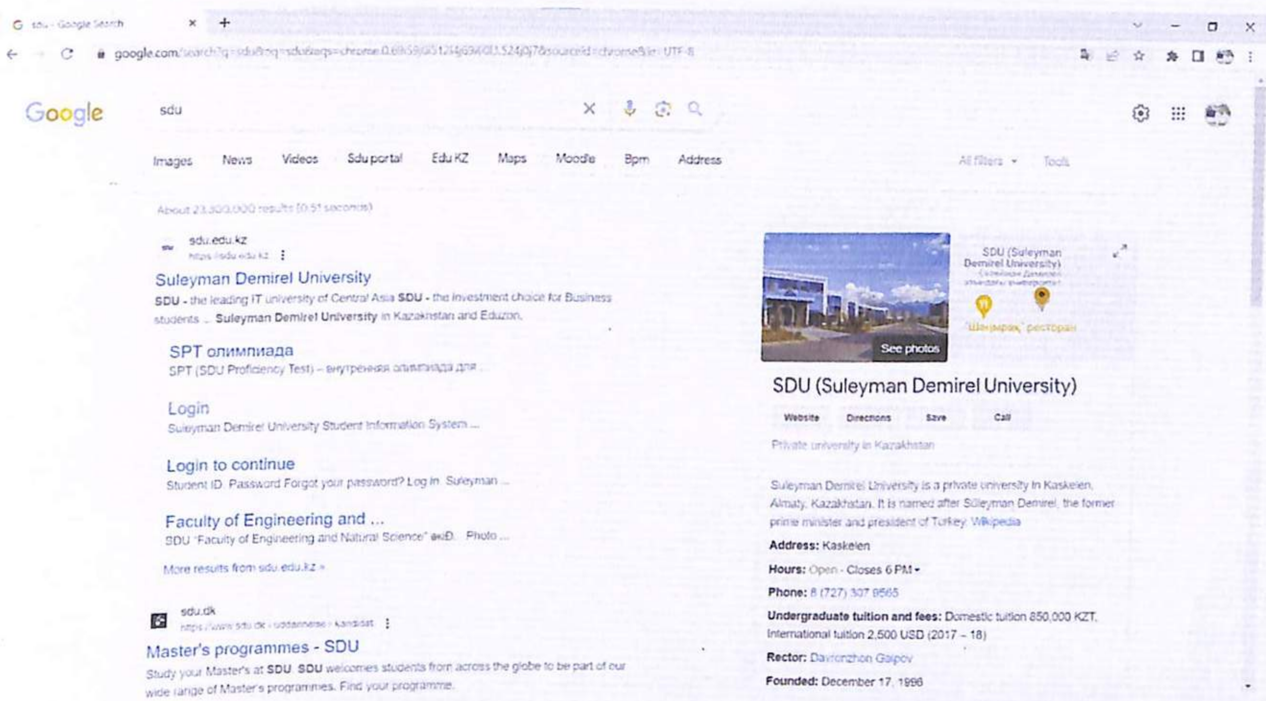

Figure 1: How people with Protanopia see

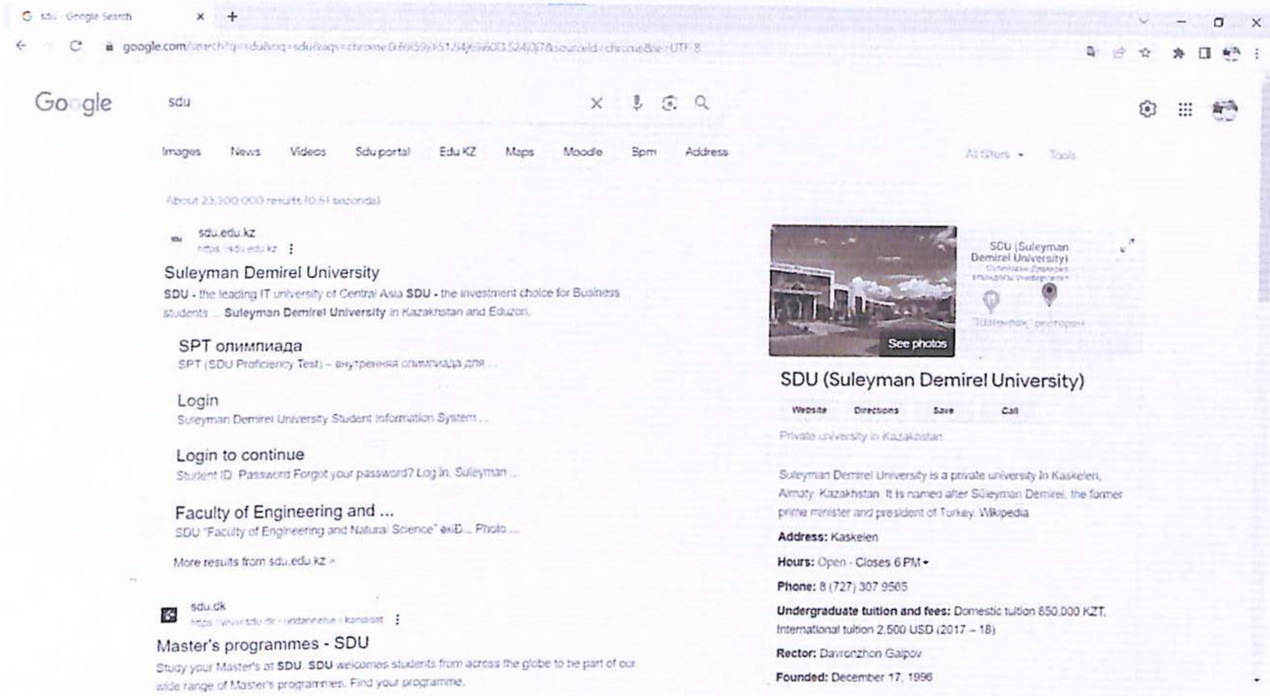

Figure 2: How people with Achromatopsia see

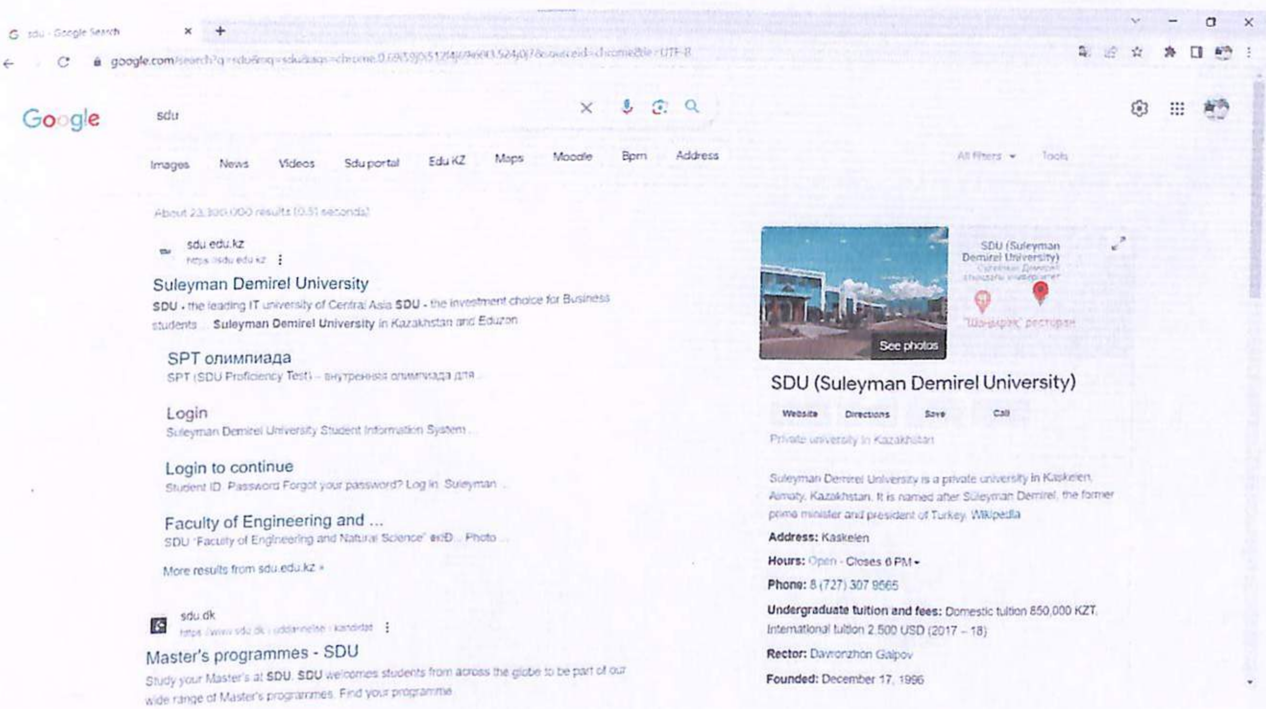

Figure 3: How people with Tritanopia see