NUST COLLEGE OF

ELECTRICAL AND MECHANICAL ENGINEERING

Automated Viva Scoring App for Chiropractic Students

A PROJECT REPORT

DE-40 (DC&SE)

Submitted by

NS MUHAMMAD ANEES

ASC MUHAMMAD SHOAIB

ASC WALEED KHALID

BACHELORS

IN

COMPUTER ENGINEERING

YEAR

2022

PROJECT SUPERVISOR

DR. USMAN AKRAM

COLLEGE OF

ELECTRICAL AND MECHANICAL ENGINEERING

PESHAWAR ROAD, RAWALPIN

Automated Viva Scoring App for Chiropractic Students

A PROJECT REPORT

DEGREE 40

Submitted by

NS MUHAMMAD ANEES

ASC MUHAMMAD SHOAIB

ASC WALEED KHALID

BACHELORS

IN

COMPUTER ENGINEERING

Year

2022

PROJECT SUPERVISOR

DR. USMAN AKRAM

COLLEGE OF

ELECTRICAL AND MECHANICAL ENGINEERING

PESHAWAR ROAD, RAWALPINDI

DECLARATION

We hereby declare that no portion of the work referred to in this Project Thesis has been submitted in support of an application for any other degree or qualification of this for any other university. If any act of plagiarism found, we are fully responsible for every disciplinary action taken against us depending upon the seriousness of the proven offence.

COPYRIGHT STATEMENT

ACKNOWLEDGEMENTS

First of all, Alhamdulillah, that our FYP is finally made and all Thanks to Allah for giving us the strength and moral to keep pushing forward and helping us on each and every step of the way.

Secondly, we would like to offer heartily thanks our supervisors, Dr. Usman Akram who helped us a lot, tremendously, on each and every single issue, who's help ad guidance became a source of strong determination for us. Thank You, sir`s you played a great role in our lives, one that we can never forget.

And lastly, we would like to thank our parents and friends, without whose unimaginable support and constant motivation, we might not have been able to complete our Final year project. They played an unparalleled role throughout our journey and we are eternally thankful to them. Their constant support, motivated us to do more than we ever realized and they inspired new hope in us, when we found none in ourselves.

ABSTRACT

The Motivation of taking this research based project is actually to make something different to challenge our self in difficult situations and learn some different things to grow in our fields and the other things which motivates to do this project is the pandemic in which our all educational institutes are online and distance learning is making things difficult for our professors to conduct viva's apart from pandemic there are many virtual universities which are in need of this kind of work for their examination. We then started our work with passion to complete this research.

We are working on this project for 6 months, we faced number of challenges while making this web application which is actually designed to automate the system of scoring the viva's and smoothing the process of examination in which ever educational institute for examination purpose. Actually, it is a great idea and we get this project from Sir Imran Niazi from New Zealand who actually give us the idea of chiropractic web app which will score the viva automatically using NLP models using speech to text generation.

Our major challenge is the data set which should be accurate and error free so the accuracy should be maximum. we personally made datasets from transcripts and after 5 iterations of making data set, we are able to achieve 67% accuracy in dataset and our second big issue is that we are actually using the google API of speech to text generation but to buy the google API but we are facing issue and not able to buy the google from Pakistani bank account we used the international bank account of Sir Niazi to buy the API.

Table of Contents

Table of Figures

Table of Tables

Chapter 1: Introduction

1.1 Introduction

Chiropractic is a certified health-care profession that focuses on the body's natural potential to heal. Manual therapy, including spinal manipulation, is commonly used in treatment. Other treatments, including as exercise and nutrition advice, may also be employed. A chiropractic adjustment can aid in pain relief, bodily alignment, and physical function. Chiropractic adjustments are a sort of treatment that you can use in addition to your usual medical treatment.

A chiropractor can help with a variety of nervous system and musculoskeletal issues. Consider a chiropractor to be a doctor who treats muscle, bone, and joint pain and dysfunction. The following are the most prevalent causes for a chiropractic adjustment: Lower back pain, Neck pain, Muscle pain, Headaches. Chiropractors may also treat musculoskeletal pain everywhere on your body, including your head and jaws, shoulders, elbows and wrists, hips and pelvis, knees and ankles, and hips and pelvis. A chiropractor may help with aches, pains, creaks, and sprains. If you have an issue with your musculoskeletal system, a chiropractor can provide you with non-drug therapy options. A chiropractor may provide the following services:

- **Adjustments**: To reduce discomfort and enhance range of motion by gently realigning joints.
- **Soft-tissue treatment** is used to relax tense muscles, reduce spasms, and relieve tension in the connective tissue around each muscle (fascia).
- **Stretches and exercises** are used to restore and maintain joint stability and mobility.
- **Joint bracing/taping** (Kinesio taping): To aid in the healing of injured joints or muscles.
- **Experts in integrated medicine are referred to**: For diet and nutrition advice on how to minimize inflammation and/or encourage healthy eating in order to lose weight.

Chiropractors in the United States treat more than 35 million patients each year, with one million chiropractic adjustments conducted every day. These chiropractic data demonstrate how much this sort of treatment has spread. They also reveal that chiropractic is a good therapy option for back and neck discomfort because it is a drug-free technique. Over half of all chiropractic patients consider their therapy as very beneficial. Most people who have experienced chiropractic therapy have been pleasantly pleased. While many patients originally seek treatment from a chiropractor for back pain, once they see how beneficial chiropractic is, they frequently return to address other health conditions. Patients between the ages of 45 and 64 are the most likely to seek treatment from a chiropractor. According to data, the most common age group for chiropractic therapy is 45-64 years old. Even though low back discomfort and sedentary lifestyle-related illnesses are global concerns and among young employees, elderly people seek chiropractic therapy more frequently. That's because chiropractic therapy is well-suited to other age-related ailments like joint pain, muscular discomfort, and a variety of others.

There is a scarcity of descriptive and qualitative data on the features of modern chiropractic practice as practiced by UK-trained chiropractors in the UK. In one survey Sixty-eight percent agreed that chiropractors are "primary contact practitioners," and 49 percent said that "a chiropractor primarily treats neuro-musculoskeletal and, to some extent, visceral or organic disorders by delivering adjustments and employing complementary therapy methods." This information reveals that there may be inconsistencies in the substance of regulatory standards and real day-to-day chiropractic clinical practice in the United Kingdom. Through participant observation, observations, and recorded conversations with patients, this field research attempts to depict the everyday clinical practice of a modern British UK-trained chiropractic. Its precise objectives are as follows:

- To give a quick description of the Chiropractic Clinic and the operations at the front desk.
- To summarize the author's experiences as a patient at the initial consultation and during chiropractic therapy.
- To describe the therapy visits' features and organization.
- To investigate why patients came to see the chiropractor, their comprehension of the treatment methods, and some of their problems.
- The purpose of this study is to look at the reasons and beliefs that underpin the chiropractor's approach to chiropractic therapy and clinical practice.

So, chiropractic medical institutes train their students by considering these objectives, In Chiropractic sessions the chiropractor must mention the above things to patient to make him clear about what is his case and what is going to happen with him. These session between chiropractors and patients are very long depending upon the case of the patient. It can be of two to three long hours. The medical institutes chiropractor to conduct good sessions. These institutes take exams of these students, and it gets very tiresome for teachers to listen to these sessions of the students individually. It takes a lot of time of teachers to evaluate these students.

This project proposes a solution to this evaluation problem and automate the procedures for teachers. Automated scoring is a computer-based assessment method that scores or grades student replies by considering relevant characteristics. There are a few phrases that are used interchangeably and have similar meanings to automated scoring. Artificial intelligence, the branch of study that supplies some of the techniques and tools utilized in automated scoring systems, is usually used as a synonym for AI scoring.

We are making a web App as a solution using natural language processing that Automatically evaluates the student's viva. We take the data from the live video sessions in form of text and apply machine learning algorithms on it and by using different predict models, calculate the accuracy of the viva and generate the report of the students. The Machine Learning modules are train on the data set which we taken from the chiropractic institute in Auckland. The data set have sample of different cases provided by teachers and students. This App will work like a frame work between teacher and students of chiropractic institute where we will provide different features for both of them. The teachers will have the

schedule of all the students and would be able to set a scheduled meeting for the students. Students will receive a notification for viva and will have the schedule of all the meetings. The teacher will be able publish the result of the students. We can later on add many features for students that how much he is active or what are his facial expression in real time using different AI modules.

The project's primary goal is to make an evaluation for teachers so they can successfully evaluate the chiropractic students and we can make a more accurate, un biased and precise model for evaluation.

1.2 Motivation

The lack of dependability in some automated scoring systems is due to the fact that they rely on relatively basic parameters such as word count, paragraph count, and sentence length. As a result, scoring algorithms place a greater emphasis on the text's quantity and organization rather than its content and quality. The expanding quantity of data accessible to work with in the field of automated scoring is a positive development, making machine learning an appealing choice for solving this problem. The work which has been done is limited to essay scoring only. No advance work specifically related to some domain has been done yet. As automated scoring depend entirely on the given data set, it was really challenging for us train our algorithms on the data sets and getting the good accuracy of our model. The Purposed system will provide many facilities available including the data analytics and AI that will help the chiropractors see the patterns in chiropractic conversation using NLP.

Also, after COVID-19 a lot of institutes shifted to online studies and we have seen many cheating cases in online evaluation methods. With the advancement in technology, we are seeing different digital methods of evaluation but no such method has been developed yet to evaluate the oral sessions. We started with an example of chiropractic institute and with the advancement in data and ML models we can make generic models for any kind of datasets which will be a really great advancement in domain of automated scoring.

Third is domain of chiropractic which really helps people in getting better shape. Also, there has been a lot of growth in this medical treatment. Recent Surveys have shown that chiropractors treat more than 35 million Americans annually. Chiropractic is more successful than pharmaceuticals, massage, yoga, pilates, and over-the-counter meds for treating back pain. In the case of back discomfort, replacing medical appointments with chiropractic treatments might save Medicare $83.5 million per year.

Visiting chiropractor regularly reduces
your pharmaceutical costs by 85%

85%
Reduced Costs
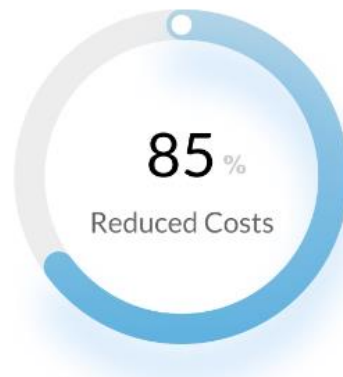
Figure 1: Visiting Chiropractor advantage

If you go to a chiropractor instead of a surgeon, you're 28 times less likely to have spinal surgery. You're 28 times less likely to undergo spinal surgery if you go to a chiropractor instead of a surgeon. The chiropractic market in the United States is estimated to be worth $15 billion or more.

Chiropractic Market Worth

$15,000,000,000
Market Estimation

2019   2020   **2021**   2022   2023

Figure 2: Worth of Chiropractic Market

1.3 Scope

The project`s aim is to develop a working app capable of conducting chiropractic-based viva sessions between teachers and students discussing some patient's case and evaluating them. The device will be handy in way that it can be used by a professor/teacher easily from

anywhere and that it can be used within one's home and there is no need to go to a hospital for specifically conducting viva. The device will be accompanied with a data driven mobile application for assisting the user in the operation of the device, the application will serve as the medium by which the teacher will be able to conduct viva sessions. Teacher would be able to schedule viva sessions with the students. The mobile application will also allow the students to see scheduled session with teachers, see the student`s past record history. After viva session it will generate report of the students in a PDF format. The portal will also serve as a service through which an administrator can add students and teachers.

The scope of the project can be defined in terms of the following objectives:

- Development of an automated viva scoring app.
- Development of Machine Learning models to predict different features.
- Development of Student Report.

1.4 Structure

Following is the structure of the report ahead:

- Chapter 2, it mainly deals with the explanation of chiropractic therapies and literature review undertaken to establish grounds for a chiropractic-based features for scoring.
- Chapter 3, it deals with the innovative side of the project, exploring related work and establishing how the project is different from others.
- Chapter 4, it deals with the design and development of the automated viva scoring app.
- Chapter 5, it deals with medical trials undertaken with chiropractors to establish the effectiveness of the device.
- Chapter 6, it consists of concluding the report and exploring future possibilities and directions in which the project can be taken.

Chapter 2: Chiropractic

There are a lot of chiropractic cases, only in America the chiropractic patients are more than 35 million annually and the cases of these chiropractic patients can be different from each other. After research with chiropractic team from Auckland who helped us built the certain checks to categorize patients. Following are one of the main reasons for which people see chiropractors.

- Relief of symptoms
- Correction of my underlying problem
- Better perform work or recreational activities

Some other necessary questions to identify the patient pain
- Is your appointment today as a result of a recent accident or injury?
- Please specify your main area of concern
- Please specify any other health problems
- Please state whether there are certain activities you would like assistance improving

2.1 Medical History

Only the patient history consists of a lot of parts which tells about the condition of the patient and all these points' works as rules to score the student during viva sessions. The answer to these questions is either taken as yes or no.

1. **Family History**
   - High blood pressure
   - Heart disease, type
   - Stroke
   - Cancer, type:
   - Musculoskeletal disease
   - Other family illness history

2. **Patient's current General History**
   - Recent weight change
   - On-going fever / chills
   - Periodic unexplained sweats
   - Re-occurring allergies
   - Anemia
   - Bleeding / bruising
   - Malaise / fatigue / weakness
   - Immuno-deficient condition
   - Cancer

3. **Endocrine History**
   - Heat / cold intolerance

- Thyroid conditions
- Diabetes

4. **Eye/Ear/Nose/Throat**
   - Corrective lenses
   - Eye redness, swelling, tearing, pain or itching
   - Other visual conditions
   - Difficulty hearing / deafness / ringing in
   - Ear growths / discharge / pain
   - Change in ability to smell or taste
   - Nose growths / discharge / bleeding / pain
   - Sinus conditions
   - Hoarseness
   - Difficulty chewing or swallowing
   - Enlarged / painful glands
   - Growths / lesions in mouth or throat

5. **Gastrointestinal System**
   - Change in appetite
   - Food intolerance
   - Nausea / vomiting
   - Indigestion / heartburn / excessive belching / gas
   - Abdominal pain or swelling
   - Change in bowel habits or stool (colour, consistency etc.)
   - Hernia
   - Hemorrhoids
   - Gallbladder / liver / pancreas disease
   - Liver disease

6. **Respiratory System**
   - Difficulty breathing / wheezing / asthma
   - Coughing / sneezing
   - Tuberculosis / TB exposure
   - Respiratory infections / pneumonia
   - Exposure to dangerous fumes, toxic chemicals or excessive pollution

7. **Cardiovascular System**
   - Chest discomfort / pain
   - Palpitations
   - Swelling / oedema
   - Cold hand / feet
   - Fainting
   - High blood pressure

- Heart disease (past / current)
- Rheumatic fever

8. Urinary System
- Frequent urination
- Increased thirst
- Urinary urgency / pain / hesitancy / discharge / dribbling
- Urinary tract infections
- Kidney disease / stones
- Flank (side) / pelvic pain

9. Skin/Hair/Nails
- Change in skin texture / coloration
- Mole changes
- Change in hair / finger or toe nails

10. Breasts (Male and Female)
- Breast lumps / mass / growths / pain / tenderness / dimples
- Nipple discharge / bleeding

11. Reproductive System
- Erectile dysfunction
- Heavy / painful / irregular periods
- Menopause
- Diagnosed reproductive conditions
- Are you currently pregnant?
- Fertility issues

12. Neurological System
- Headaches
- Seizures / epilepsy / involuntary twitches
- Dizziness / fainting
- Numbness / tingling
- Limb weakness
- Head trauma / concussion
- Stroke
- Disc injury
- Other neurological conditions

13. Musculoskeletal System
- Joint stiffness / pain / swelling
- Muscle cramps
- Neck pain
- Upper back pain / mid back pain

- Low back pain
- Buttock / groin pain
- Upper limb condition
- Lower limb condition
- Fractures / dislocation / sprains
- Other injuries – include auto accidents (even minor ones), sports injuries and
- work-related accidents
- Other musculoskeletal conditions

14. Hospital / Surgery / Medications
- Implants / supports (including heel lifts)
- Cardiac (pacemaker, etc.)
- Have you had any other hospitalization or surgery?
- Current prescribed medications
- Medication
- Non-prescribed medications or drugs (including over-the-counter or recreational)
- Medication

15. Psychological History
- Anxiety
- Depression
- Hospitalization for psychological care
- Other psychological conditions:
- Over the last 2 weeks how often have you been bothered by the following problems:
- Feeling nervous, anxious or on edge
- Not being able to stop or control worrying
- Little interest or pleasure in doing things
- Feeling down, depressed, or hopeless

16. Lifestyle
- Do you eat a healthy diet?
- Have an unusual appetite?
- Consume caffeine? Frequency _____/day or week
- Consume alcohol? Frequency _____/day or week
- Consume water? Frequency _____/day
- Eat junk food frequently?
- Exercise / sports activity Frequency _____ /day or week
- Smoker? past / present
- Hobbies

17. Is there anything else you think we need to know about you?

18. Some specific areas of pain/tingling
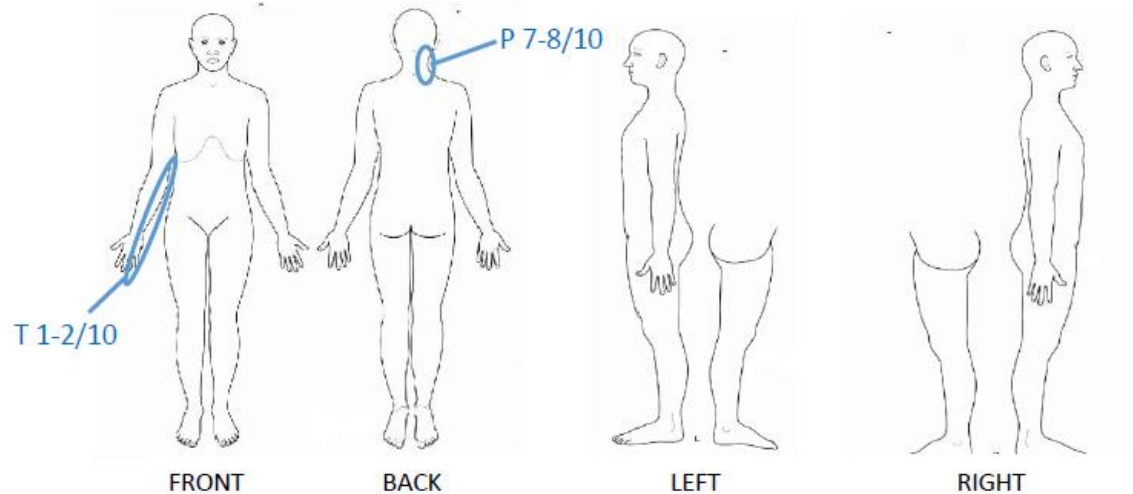
Figure 3: Patient Pain Points

2.2 Medical Case

Here is the example of Medical Case of a patient which doctor take during those medical sessions. We are trying to get this information digitally from verbal communication. One of the features of this app is to extract medical case from conversation which is being discussed.

Occupation: studies marine biology at Auckland University
Goals of care: relief of symptoms, correction of underlying problem and better perform work or recreational activities – swimming, diving & studying
Previous care: I have been seeing another chiropractor fortnightly since the start of this year to improve my posture (Dr Noel Payne in the CBD). I'm here today because he's now retired. No x-rays have been taken, responded well to manual technique.

Chief Complaint: neck pain
- Location: point to the entire right side of the neck
- Onset: this morning when I woke up
- Previous care/history: I have never experienced this before. No recent history of trauma or triggers
- Provocative: any neck movement
- Palliative: not moving the neck and having the head tilted slightly to the right
- Quality: very sharp pain
- Radiation/Referral: none
- Severity: 7-8/10
- Timing: triggered by any neck movement, lasts for less than a minute

Secondary Complaint: right arm tingling
- Location: point to the right medial arm, medial forearm, ring and little fingers

- Onset: first noticed at the beginning of this year
- Previous care/history: No history of trauma
- Provocative: prolonged studying sessions/computer usage (2hr+) and after swimming (free style)
- Palliative: not studying/using computers/swimming
- Quality: tingling. No temperature change or muscular weakness.
- Radiation/Referral: tingling in the location described
- Severity: 1-2/10
- Timing: on average occurs once/week, often at the end of the day/activity and would last for a couple of hours

Tertiary Complaint: right ear pain
- Went diving on Sunday and some sea water got into the right ear
- Started getting right ear pain on Monday (yesterday) and slight hearing loss
- The pain is provoked by moving the auricle; the mastoid process is warm and tender to touch
- Not seen anyone about this issue

Family History:
- No significant family history & lives with parents and younger brother

Psychological History:
- PHQ-4 anxiety score: currently preparing for end of year exams. She thinks the anxious feelings will disappear after exams are finished.

Social History & Lifestyle:
- Diet: balanced diet of chicken/beef/egg and 5 servings of fruit & vegetables/day
- Water consumption: 1.5L/day
- Junk food: none
- Exercise: Swims twice a week for an hour (freestyle) 3-4 times/week
- Hobbies: diving with friends on weekends and playing the violin twice a week,

2.3 Overall Marking Guide
Here is the Marking guide on which we will evaluate the students.

1. **History**
    - Review New Person Health History Form
    - Examinee performs history-taking

2. **Differential Diagnoses**
    - List all differential diagnoses based on history
    - Discuss reasoning: supportive & refuting factors

3. Physical Examination
- Outline the physical examination components you would perform and explain why

4. Practical Assessment
- Examinee performs components of the physical examination as instructed

5. Physical Examination Feedback
- Only provide results for tests performed
- Examinee reviews physical examination results
- Discuss further tests & medical referrals required

6. Final Chiropractic Impressions
- List all final working diagnoses
- List all contraindications
- Technique choice & modifications

7. Case Management
- Outline management plan in a ROF format:
- Explanation of chiropractic
- Explanation of findings
- Frequency of care
- Lifestyle advice & non-medical referrals
- Informed consent

Table 1: Examination Timing

Section	Suggested Timing
History	20min
Differential Diagnosis	5min
Physical Examination	5min
Practical Assessment	5min
Physical Examination Feedback	10min
Final Chiropractic Impressions	5min
Case Management	10min

2.4 Differential Diagnosis

DDX	Supportive Factors	Refuting Factors
VS	• Pt has a spine and nervous system • List 3T's relevant to the history	None
Mark top 3 DDX's:		
Torticollis	• No trauma/trigger • Unilateral neck tightness & pain • Pain upon waking • Neck movement is provocative • No neck movement is palliative • No radiation/referral • Timing: short duration • Quality: muscle tightness & sharp pain • Guarded of cervical movement	None
Thoracic outlet syndrome	• Tingling medial arm, forearm & hand • Repetitive overhead movement – swimming • Non-ergonomic posture – studying & violin	• No temperature changes • No muscular weakness • No referred pain in post thigh
Otitis media	• Recent diving with sea water in ear • Pain with auricle movement • Mastoid warm & tender	None
Cervical sprain/strain		
Carpal tunnel syndrome		
Other DDX's		

Table 2: Differential Diagnosis

2.5 Physical Exam

Physical Exam		Reasoning	
Vitals	• Pulse • Temperature	• TOS could dampen pulse • DDX ear infection	

Blood pressure & respiratory rate		Snapshot of patient's health/screening
Inspection	• Postural analysis	• Identify alterations, areas of stress • Correlation of stooped posture with TOS • Functional baseline
ROM	• Cervical ROM	• Acute neck pain & right arm tingling • Reported limited ROM
Chiropractic Exam	Insight scans	Neuro function
Spinal exam		Acute neck pain Chiropractic assessment for VS
Orthopedic Exam	• Cx distraction, Cx foraminal compression, Jackson's, Cx max. compression, mod. Spurling's • O'Donoghue's	• Acute neck pain • Limited Cx ROM
• Allen's • Adson's, mod Adson's, intermittent claudication, EAST • Costoclavicular, Eden's • Wright's		• Suspicion of TOS • Differentiating different types of TOS
Neuro Exam – Cranial Nerves	CN 8	Hearing loss
Neuro Exam – NR	• Cervical dermatomes • Cervical myotomes • Cervical DTR's	• Functional baseline • Acute neck pain • Right arm tingling
Head & Neck exam	• Inspect & palpate auricle, external ear & mastoid • Otoscopic exam • Lymph node palpation	• Ear pain/suspicion of ear infection
X-rays	Cervical series/full spine	• Acute, severe neck pain • Right arm tingling • Aid in specificity of chiropractic care

Specificity of test selection	**Poor**	**Acceptable**	**Excellent**
	1	**2**	**3**

Table 3: Physical Exam

2.6 Practical Assessment

Dermatome	DTR
• Correct Area • Multiple Points • Soft touch • Pain • Reaches thumb/index fingertip	• Brachioradialis • Radial nerve (verbalize) • Correct location • Correct hammer use

Myotome			
Movement	Muscle	Peripheral nerve	Stabilization, motion & pressure
Shoulder fixation	Serratus anterior	Long thoracic	
Shoulder adduction	Latissimus dorsi	Thoracodorsal	
Elbow flexion	Biceps brachii	Musculocutaneous	
Wrist extension	Wrist extensors	Radial	
Forearm pronation	Pronator teres Pronator quadratus	Median	
Forearm supination	Supinator Biceps brachii	Radial Musculocutaneous	

Table 4: Practical Assessment

2.6.1 Performance on Right Ear
- Inspect the auricle and mastoid for swelling, discharge or skin discoloration
- Pull/move the auricle and tragus for tenderness
- Palpate the mastoid processes for tenderness or deformity
- Laterally flex the head to the left
- Use left thumb and index finger to pull the right auricle sup & post
- Remaining left fingers stabilizing against the parietal bone
- Holds the otoscope with right hand, handle up, speculum down
- Forewarns the patient prior to insertion
- Right pinky stabilizes against the right temple
- Carefully insert otoscope into canal
- Approximate eye to examine the ear structures

2.6.2 Performance on Right Ear
- Instructs PM to raise their right arm so their hand is up by their head
- Instructs PM to open and close their hand several times then clench their fist
- Compresses both radial and ulnar arteries at the wrist and lowers hand below heart level
- Instructs PM to open their fist

- Releases the radial artery and observes the palm
- Instructs PM to raise their right arm so their hand is up by their head
- Instructs PM to open and close their hand several times then clench their fist
- Compresses both radial and ulnar arteries at the wrist and lowers hand below heart level
- Instructs PM to open their fist
- Releases the ulnar artery and observes the palm

2.7 Physical Examination Feedback

Examiner provides results for tests requested for the examinee to review. Review the physical examination results and discuss further tests or medical referrals required. GP referral for potential otitis media – otitis media is confirmed and will be managed by the GP. Provide results only if above tests are requested

2.8 Final Chiropractic Impression

- Vertebral subluxations
- Torticollis
- Thoracic outlet syndrome
- Scalenus antics
- Otitis media (mark given under referral)

2.9 Case Management

- Explanation of chiropractic
- Explanation of findings
- VS findings
- Relate findings to presentation, chiropractic and/or goals
- Insight scans
- Relate findings to presentation, chiropractic and/or goals
- X-rays
- Relate findings to presentation, chiropractic and/or goals
- Frequency of care:
- Provide justifications based on:
  - PM presentation (should be high frequency due to acute presentation)
  - Exam findings
  - Goals of care
- Lifestyle advice/non-med referrals:
  - GP referral for ear infection
  - Posture
- Informed consent
- Overall professionalism

2.10 Literature Review

We currently working on an automation process using NLP as we all know future technologies are moving towards automation like massive research work on making robots and making them intelligent and super-efficient workers for the welfare of mankind. We are actually designing them to get our work done in more accurate, precise and to make it time saving so our tech industries are growing rapidly and we require more efficient work in every aspect of technology so pursuing these ideas of automation we put our sight on some ideas which need automation to make our work easier and time saving we see there is automated suggestion of search engine in our social media using AI support applying all tools to make it easy for user to search things in better way so here is some of the research on automation process which is quiet useful in our future technologies

We have made a significant interest in research on the mechanized scoring of open-finished errands for over 10 years. We want to work on the legitimacy of the score results, while making strategies and PC applications that decrease the expense and exertion associated with utilizing human graders. We accept that scores ought to help the purposes of appraisal no matter what the job PCs play in making them. We momentarily portray here the computerized scoring applications that we have created. These applications — the e-rater motor, the c-rater framework, the m-rater motor, and the Speech Rater motor — assist with assessing reactions to undertakings that require test takers to compose articles, fill in the clear, compose numerical statements or give oral reactions. We likewise portray the Language Muse, which educators can use to make tests and other homeroom materials more justifiable to English-language students in circumstances where information on English is certainly not an educational objective. We ceaselessly refine every one of these applications in light of the most ideal that anyone could hope to find meanings of ability and capability, as well as cutting edge psychometric, NLP and discourse science. We are additionally ready to give speedy outcomes using online administrations.

The c-rater framework is ETS's innovation for the programmed scientific based content scoring of short free-text reactions, going long from a couple to roughly 100 words. Logical based content is the sort of satisfied that is predefined by a test designer with regards to primary thoughts or ideas. These ideas structure the proof that an understudy needs to show as her/his insight in his/her reaction. The accompanying shows an illustration of a test thing with the normal scientific based content in the reaction and one approach to doling out score focuses. Matching calculation utilizes the phonetic elements finished from both SR and NLP to naturally decide if an understudy's reaction says exactly the same thing or suggests the normal ideas. The c-rater framework applies the scoring rules to deliver a score and individualized informative input that legitimizes the score to the understudy.

2.11 Using the Speech Rater engine in low-stakes settings (automated scoring process)

The latest variant of the Speech Rater motor (2.0, 2009) shows a relationship of 0.73 with human scores from the functional TOEFL test. In view of the motor's ongoing build inclusion

and concurrence with human scores, it is appropriate for use on appraisals used to settle on low-stakes choices. The elements the Speech Rater motor purposes to lay out its profile for a reaction are not restricted to the sort of things found on the TOEFL test. Since they focus on the basic talking capability develop, they could likewise be applied to other thing types that address a comparative build utilizing talking errands.

2.12   How the Speech Rater motor functions

The Speech Rater motor cycles every reaction with a robotized discourse acknowledgment framework extraordinarily adjusted for use with nonnative English. In light of the result of this framework, regular language handling is utilized to work out a bunch of highlights that characterize a "profile" of the discourse on various etymological aspects, including fluency, elocution, jargon utilization and prosody. A model of talking capability is then applied to these highlights to relegate a last score to the reaction. While the construction of this model is educated by satisfied specialists, it is likewise prepared on a data set of recently noticed reactions scored by human raters to guarantee that the motor's scoring imitates human scoring as intently as could really be expected. Moreover, in the event that the reaction is viewed as un-scoreable because of sound quality or different issues, the Speech Rater motor can save it for extraordinary handling. Right now, the Speech Rater motor purposes a subset of the data utilized via prepared human raters to score spoken reactions. In light of the difficult idea of computerized examination of discourse from nonnative English speakers, at different capability levels, a large number of the motor's elements center around discourse conveyance, as opposed to the more significant level parts of language use or point improvement. Notwithstanding, progressing research is step by step decreasing the distinctions between the model human raters use and those applied by the Speech Rater motor.

2.13   The c-rater System

The c-rater framework is ETS's innovation for the programmed logical based content scoring of short free-text reactions, going long from a couple to roughly 100 words. Scientific based content is the sort of satisfied that is predefined by a test engineer regarding primary thoughts or ideas. These ideas structure the proof that an understudy needs to show as her/his insight in his/her reaction. The accompanying shows an illustration of a test thing with the normal scientific based content in the reaction and one approach to relegating score focuses. There are four fundamental cycles in the c-rater framework:
1. The first is Sample Responses (SR), in which a bunch of model reactions are produced either physically or naturally.
2. Second, the c-rater framework naturally processes model reactions and understudies' reactions utilizing a bunch of NLP devices and concentrates the etymological elements.
3. Third, a matching calculation utilizes the phonetic elements finished from both SR and NLP to consequently decide if an understudy's reaction says exactly the same thing or infers the normal ideas.
4. What's more, fourth, the c-rater framework applies the scoring rules to deliver a score and individualized informative input that legitimizes the score to the understudy
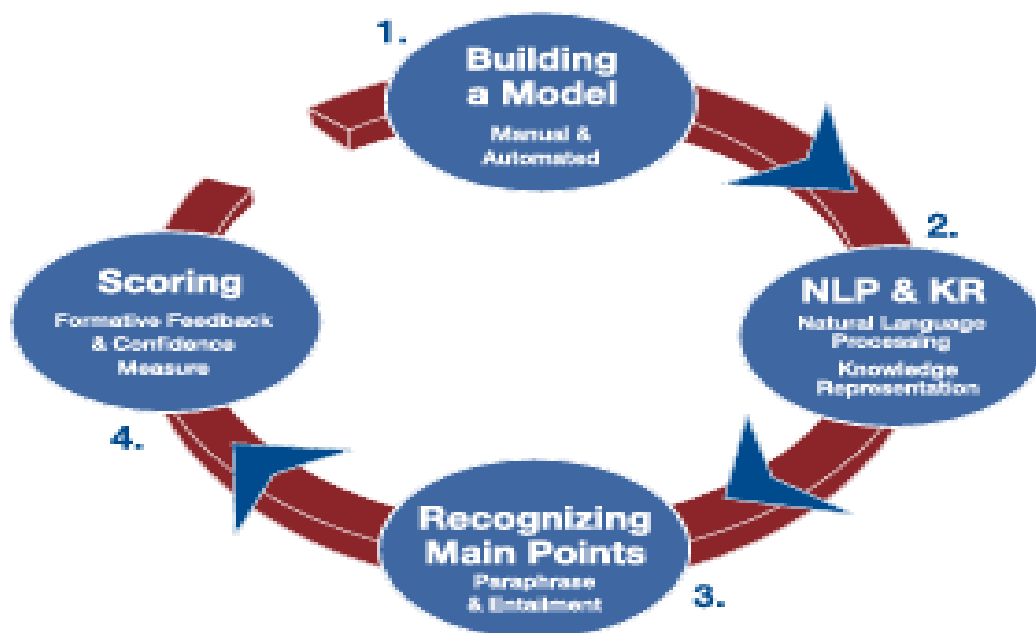
2.13.1 Main Process of Automated Scoring

Figure 4 Main Process of Automated Scoring

2.14 The m-rater Engine

The m-rater computerized scoring motor scores computer delivered developed reaction science things for which a reaction is either a numerical articulation or condition, or a diagram. At the point when the reaction is an articulation or condition, the m-rater motor is utilized related to ETS's Equation Editor, which permits an understudy to enter a condition or imbalance or other articulation in a standard configuration, with examples, revolutionary signs, and so forth. At the point when the reaction is a diagram, the m-rater motor is utilized related to ETS's Graph Editor, which permits the understudy to enter a chart comprising of at least one places, lines broken lines or bends. The m-rater motor can score reactions to things in a bunch of things restrictive on the understudy's reactions to past things in the set.

2.5 The E-rater Engine

ETS originally conveyed the e-rater computerized paper assessment and scoring motor in 1999 to give one of two scores to papers on the composing segment of an alumni confirmations program. The e-rater motor predicts paper scores in view of highlights connected with composing quality, including punctuation, utilization, mechanics, style, association and improvement. The computational philosophy basic the framework is NLP, which distinguishes and removes phonetic highlights from put away, electronic message or discourse. The motor's score forecasts have been demonstrated to be tantamount to human

peruser scores, and its extra capacities can consequently signal or recognize off-point reactions.

As some researchers are currently using the automation process for their required final product to make things easier and making our technology growing rapidly. The somehow relevant project is currently being made which actually automate the essay scoring using NLP Utilizing NLP techniques, the e-rater motor distinguishes and removes the accompanying highlights for model structure and article scoring:

- Grammatical, word use or mechanical blunders
- Presence and improvement of paper-based talk components
- Style shortcomings
- Statistical examination that looks at use in client articles when contrasted with preparing papers at various score focuses
- Two proportions of exposition content

These are actually some of the theories being used to automate the process in some of our technologies but currently we are working on the automation process of viva scoring using NLP which is actually a research-based project and we started from scratch and main hurdles we face is how to actually apply a reasonable strategy for the process of automation in viva scoring. First of all we need to convert all the transcripts to the datasets according to requirement of our logics and tools we used in machine learning codes we have to make an optimal datasets which comprises with our logics of automation we divided all the dataset of conversation or the viva that is conducted in to different classes for distinction of questions with their respective required answers we come up testing various classifiers of machine learning concepts to actually come up with an initiation process and make a scenario of studying further and apply our logics to display accurate scoring and report generation.

Chapter 3: Related Products and Therapies

3.1 Related Products

Actually, the product made in automation related to our project is an application which automatically score the essay written in text form but in our case of project we are using speech to text generation and we are building an app which automatically scores the viva conducted physically between teacher and student by speech recognition and further applying the machine learning algorithm for automating the process by checking the accuracy of all answers of the respective questions. We will see how actually the automated easay scoring app works.

Initially, they plan to utilize the proposed mechanized exposition scoring for the nursing understudies of Faculty of Nursing in Benghazi University. Sadly, we couldn't assemble article corpus yet because of its ongoing circumstance. For this review, we utilized genuine article tests from the principal year Computer Science understudies at Far Eastern University Institute of Technology. Our corpus is made out of various expositions about Human Computer Interaction. Understudies were approached to answer an exposition test about "Human Factor" theme in Human Computer Interaction course. The exposition set has a typical paper length of 1238 characters, 118 words and 8 sentences.

3.2 Methodology

Partition the phases of the review into two stages, the primary stage incorporates the utilization of OntoGen to create ontologies and decide the likeness from a corpus of important papers in every space. The subsequent stage is removing highlights utilizing NLTK devices that can be utilized for scoring the exposition.this shows the execution of our review, it begins with the extraction of space metaphysics from a text corpus. OntoGen will assist the instructors with recognizing the idea areas and the likeness of the expositions. Then we utilized the learning model to decide the boundaries in light of the highlights separated. Scores were anticipated for a particular arrangement of test expositions. We picked highlights that might act as a substitute for what a human grader could search for in evaluating understudies' paper.

3.3 Generating Domain Ontology

Cosmology can be created through various instruments like Protégé', Text2Onto and so on, yet for our review we utilized OntoGen. OntoGen is a self-loader and information driven philosophy proofreader zeroing in on altering of subject ontologies (a bunch of themes associated with various kinds of relations) [8]. It is a mix of text-mining methods and a decent UI to accelerate the improvement of cosmology. Through this, it can overcome any issues between the intricacy of utilizing metaphysics altering apparatuses and the space specialists who are fostering the cosmology yet need more information about philosophy designing.

3.4 Feature extraction

Include extraction can be thought of as one of the main pieces of any AI task. In this review, we involved OntoGen and NLTK libraries for text handling and element extraction. We want to assemble successful article scoring calculation by utilizing model ascribes like exposition length, word counts, accuracy, jargon and sorts of word utilized, space data and so on.

- Space metaphysics we involved this as a premise to produce ideas that are pertinent to the subject, this is a proportion of the presence of explicit substance and ideas in each paper set that the educator is searching for. The instructor will utilize OntoGen's regulate learning technique to create the area philosophy.

- Mathematical elements these are the highlights like the all-out word count and sentence district per article that incorporates the accompanying calculations: ☐ Tokenization is the most common way of parting or sectioning sentences into their constituent words. A sentence is an assortment of words, and with tokenization we basically split a sentence into a rundown of words that can be utilized to recreate the sentence. [9]. ☐ Stop words is a generally utilized word, (for example, "the", "a", "an", "in") that a web crawler has been modified to overlook, both while ordering sections for looking and while recovering them as the consequence of a pursuit question. As a matter of fact, eliminating stop words is better to have an improved outcome. We wouldn't need these words occupying room in our data set, or occupying important handling time.

- Grammatical features count Part of discourse count depends on ordering words and marking them in view of the various grammatical features, for example, things, modifiers, qualifiers and action words that is useful to recognize understudy's jargon abilities. We have separated the recurrence count of various grammatical forms in the article utilizing NLTK-grammatical forms tagger. Article were tokenized into sentences before the labeling process.

- Orthography checking for the right spelling likewise adds to a decent paper. For this, we separated number of spelling mistakes per article utilizing Pychant library which is spelling remedy API utilized in python.

- Closeness some datasets have a source exposition in light of which an inquiry has been posed [10]. In any case, article type test isn't restricted to have one right response to that end we have analyzed the comparability between the source exposition and the addressed paper. We utilized Latent Semantic Algorithm (LSA) to look at the similitude of the expositions.

3.5 Results and Analysis

After we wrapped up extricating the highlights and made the space philosophy, we utilize direct relapse to foresee the scores of each paper.

3.6 Conclusion and Future Scope

We proposed a programmed paper evaluating with AI application involving OntoGen for producing the area cosmology which we found valuable particularly to the educators who doesn't have the foggiest idea how to utilize various apparatuses in making their own

metaphysics. The outcomes acquired appear to be very uplifting particularly the programmed calculation of the closeness among archives. We likewise demonstrated our speculation that the quantity of words or jargon the understudies can show add to the score of the exposition. For additional examinations, we will add recommender to assist understudies with upgrading their composing abilities, improved the rubric in figuring the idea extricated from the cosmology and add opinion investigation.

Be that as it may, this procedure was immediately supplanted with the Latent Semantic examination method [16] and at times with a blend of different strategies, for example, Natural language Processing [24, 17], Rhetorical Structure Theory [12], profound learning [23] and cosine comparability [34]. Normal Language Processing [25,20,19,18] was exclusively used in many occurrences and in certain examples with mix of different procedures, for example, Information Extraction [15], AI [15,28,29,38,30,31] and profound learning [23]. AI [29] was generally utilized also in exposition scoring.

The DUOLITH SD1 is an extracorporeal shock wave treatment device used in orthopedics for the treatments of near-surface and deep sited areas of the body such as heel pain. It uses an electromagnetically generated shock wave produced within a handheld applicator (F-SW Hand piece).

Chapter 4: Automated Viva Scoring App

Making web app where online viva session will get conducted the speech data will get converted to text. After pre-processing the data, we apply machine learning algorithms and generate a report of the students.

4.1 Architectural design guidelines

This section of the design document covers the system's logical, implementation, and deployment guidelines. The software architecture document can be used to see more details about the architecture. Our project's architecture focuses on three primary areas: web, Android, and map-related activities.
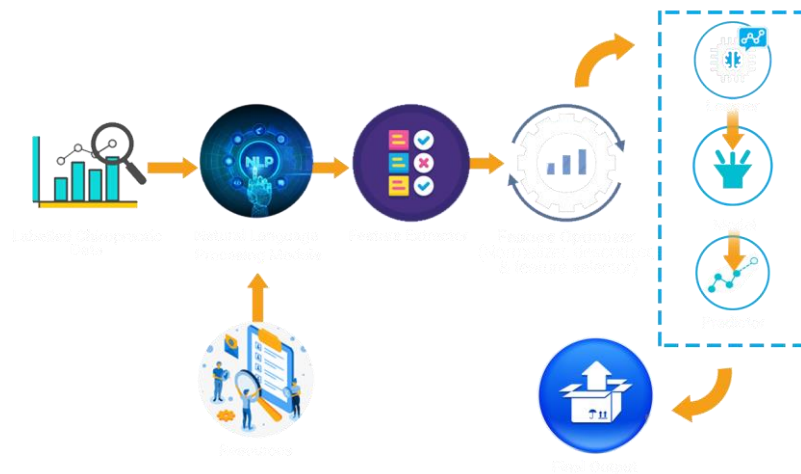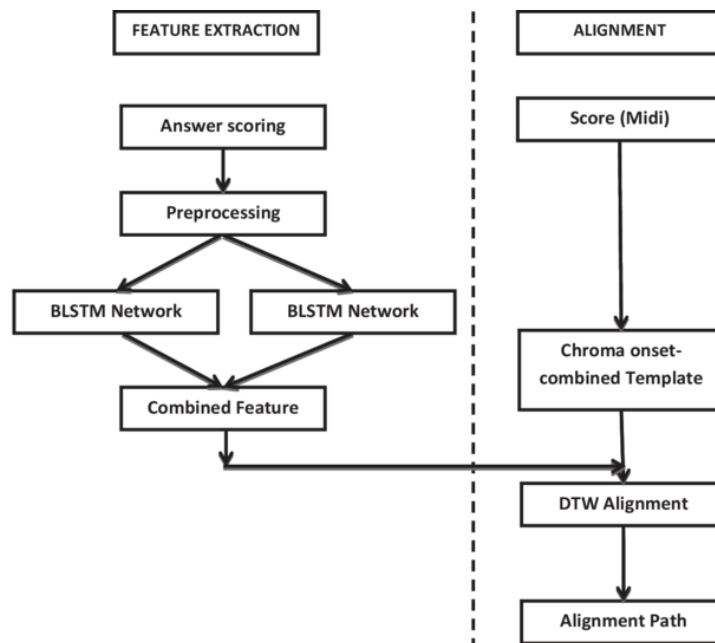

Figure 5: Work Flow

Figure 6: Architecture

4.2 Mechanism guidelines

This topic includes the means for putting the idea into action. Here is a diagram of the work flow that shows which mechanism will be used and how.
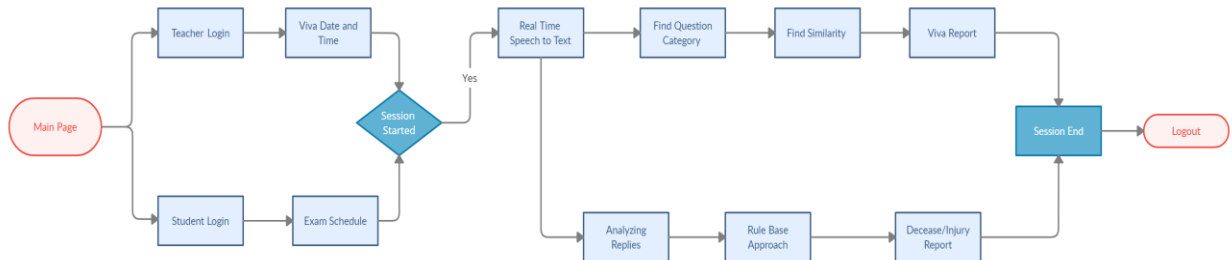

Figure 7: Web Application Flow

4.3 UML Stereotypes

The textual description of the Unified Modelling Language diagrams, including details of classes and connections, is found here.
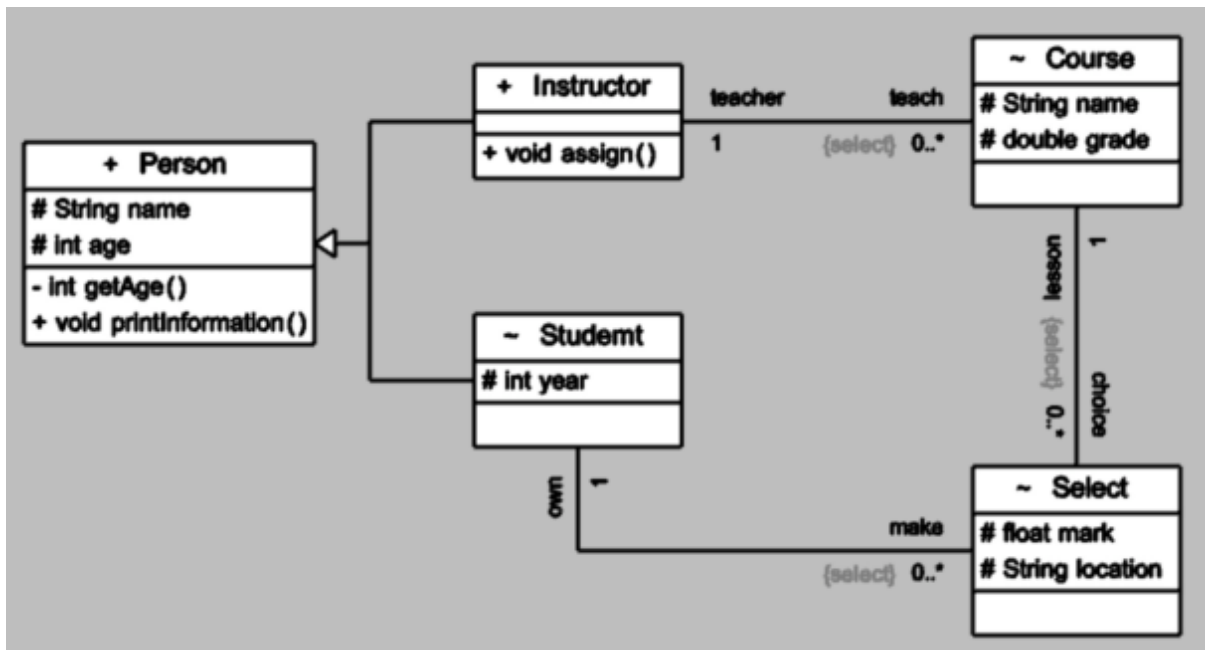

Figure 8: UML Diagram

4.4 Web-Based Application

We have designed the web-based application in Flask using HTML & CSS. It starts with asking login credentials from the user, Data from Registration Page is stored in a local data server which system automatically check whether it is a student or a teacher who is logging in.

4.4.1 Login & Registration Page

While logging in the page if the user does not have an account, Account can be opened simply by clicking Register Button. As our project is associated with two users at a time, so while Registration, account user can select if he is a student or a teacher and while logging. In system will check from database if the details entered are of Teacher or Student.
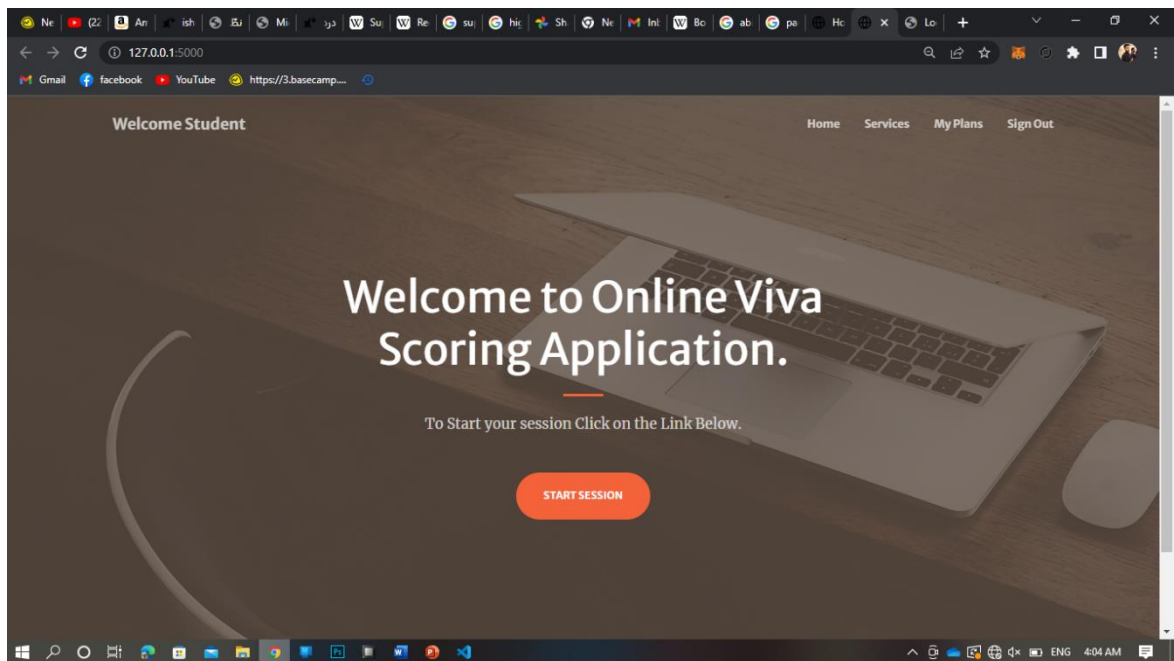

Figure 9: Login Page

4.4.2 Home Page:

After Login, home Page displays a Welcome salutation with the name of teacher or student. It contains multiple buttons through which different menus can be accessed. such as Home, Services, My Plans, Sign out. Main button on this screen is "Start Session" which takes you to the main page where proper session will start.
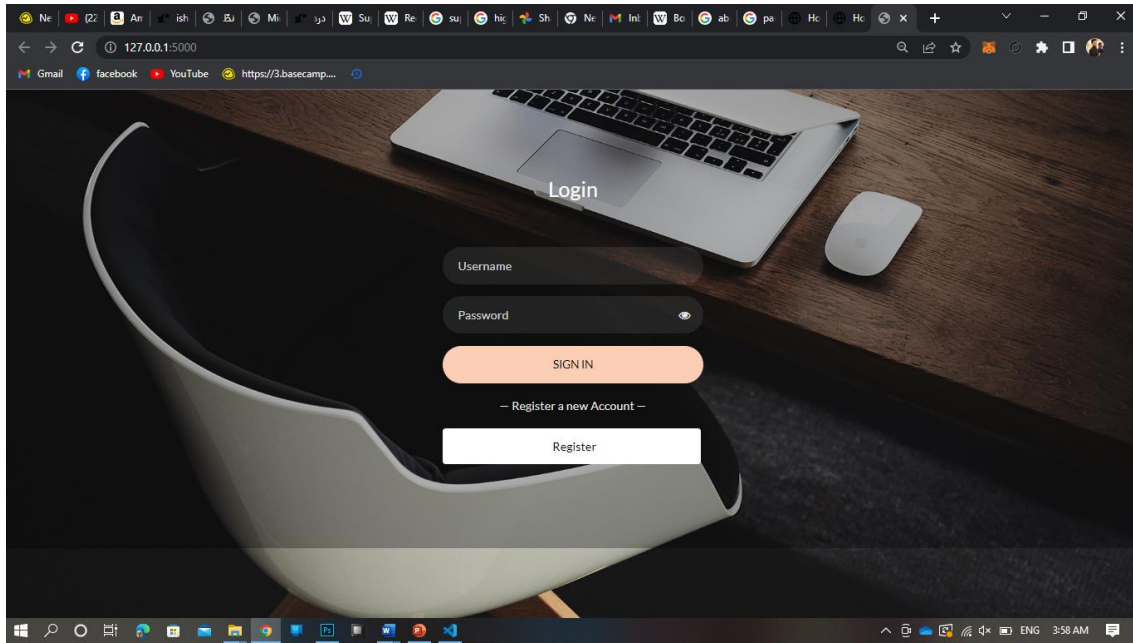
Figure 10: Home Page

4.4.3 Session Page

This main page is divided into 2 parts, one which displays 2 users, one a teacher and the other one student. And the second part is a blank text box which convert the speech into text the conversation between student and the teacher, with their names as we can experience in MS Teams. Left hand side we have multiple buttons to while calling such as End Call, Start Video, Mute.
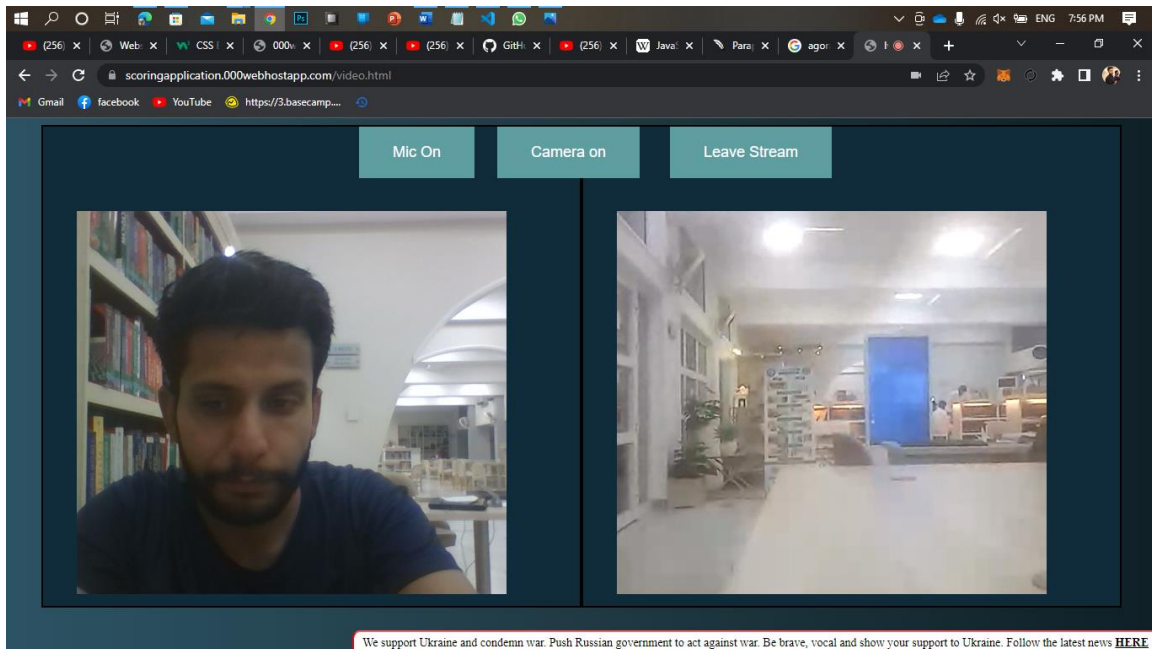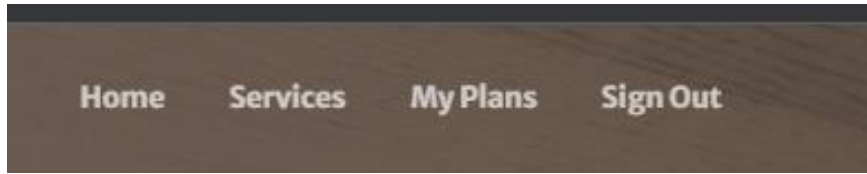

Figure 11: Meeting Page

4.5 Other Options

Figure 12: Other Options

4.5.1 Home:

Home button will take you to the main page from where you can start sessions on clicking the "Start Session" button.

4.5.2 My Plans

As this interface is for student and teacher and both have their plans and commitments so here is a schedule planner where you can save your deadlines, plans, commitments, and meeting details.

4.5.3 Logout

Logout Button will take you to a new webpage which will show a Thank you message from where you can exit the browser.

4.6 Final Results

The final results which we are obtaining are in the form of a PDF files which shows the patient report and accuracy of models. How good the students was during the session

Thu Jun 16 10:47:52 2022
Here are the results of the sessions0.5555555555555556

Accuracy through Naive-base : 0.5555555555555556

Accuracy through SVM : 0.7037037037037037

Thank you very much and we look forward to serving you.
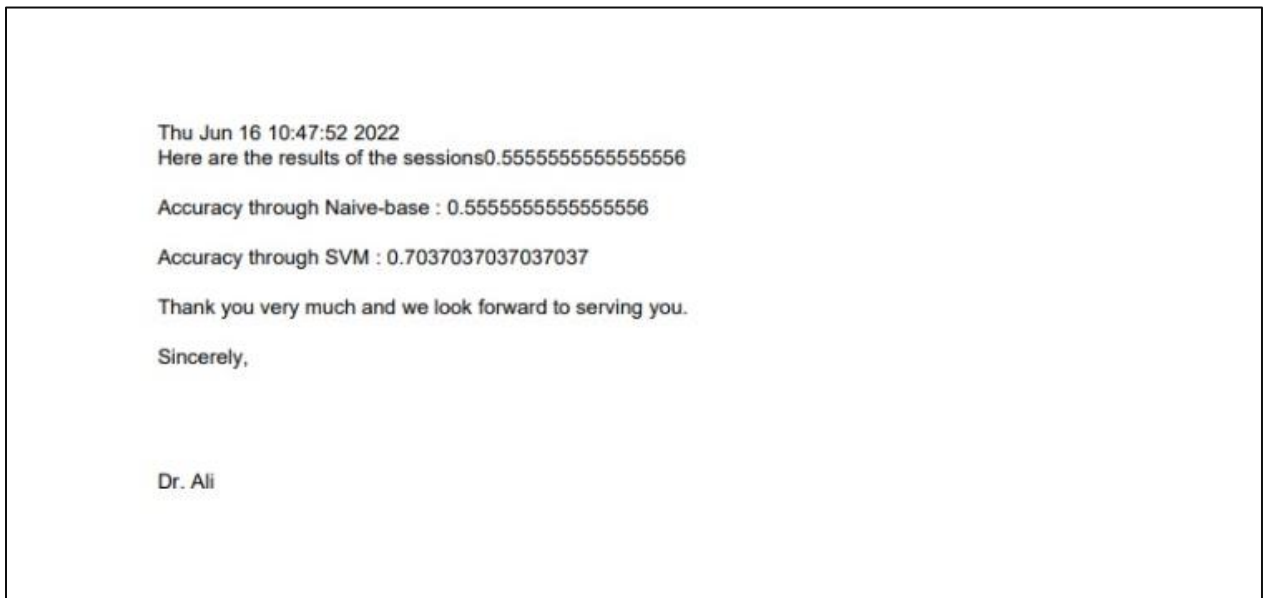
Sincerely,

Dr. Ali

Figure 13: Final Results

4.7 Machine Learning Algorithms:

We used different classification and neural network model for training our dataset. The details about the machine learning algorithms are given below

4.7.2 Support vector machine (SVM):

In Machine learning Support vector machines are learning models which are supervised with associated learning algorithms that analyze data for classification and regression analysis. SVMs are most sturdy prediction methods, which are based on statistical learning frameworks.

Working: In SVM a set of training sets are provided with marked as belonging to on of two categories, an SVM training algorithm will build a model that will assign the test cases provided to one category or the other. In addition to this linear classification, SVMs can effectively work ok non-linear classification using kernel trick, implicitly mapping their inputs into high-dimensional features spaces.

$$\lambda \|\mathbf{w}\|^2 + \left[\frac{1}{n} \sum_{i=1}^{n} \max\left(0, 1 - y_i(\mathbf{w}^T \mathbf{x}_i - b)\right) \right],$$

Equation 1: SVM

4.7.3 Naive Bayes:

It is a simple strategy to design a classifier. Naïve bayes classifier work on the principles of Bayes theorem.

This algorithm describes the probability of the event based on the previous information of condition that is related to the event. These classifiers are expandable, which requires multiple parameters linear in the number of variables in a learning problem

Working: A naive bayes classifier assumes each and every feature of the data set provided to contribute independently to the probability that to which category testing data set lies. Features could be color, roundness, shape.

$$\text{posterior} = \frac{\text{prior} \times \text{likelihood}}{\text{evidence}}$$

Equation 2: Naive Bayes Equation

4.7.4 Recurrent Neural Network

RNNs work on the idea of preserving a layer's output and feeding it back into the input in order to anticipate the layer's output. Image below explain the conversion of a Feed-Forward Neural Network into a Recurrent Neural Network:
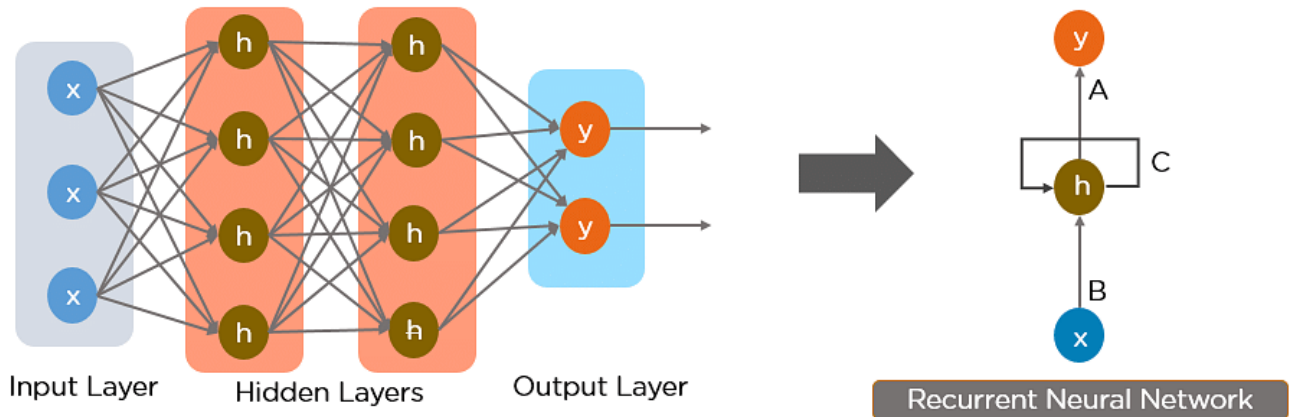

Figure 14: Simple Recurrent Neural Netwok

4.7.5 BERT

BERT is basically a machine learning technique which is used for natural language processing, BERT has 2 two models, the BERT(base) 12 encoders with 12 bidirectional self-attention heads, and the BERT(large) 24 encoders with 16 bidirectional self-attention heads.

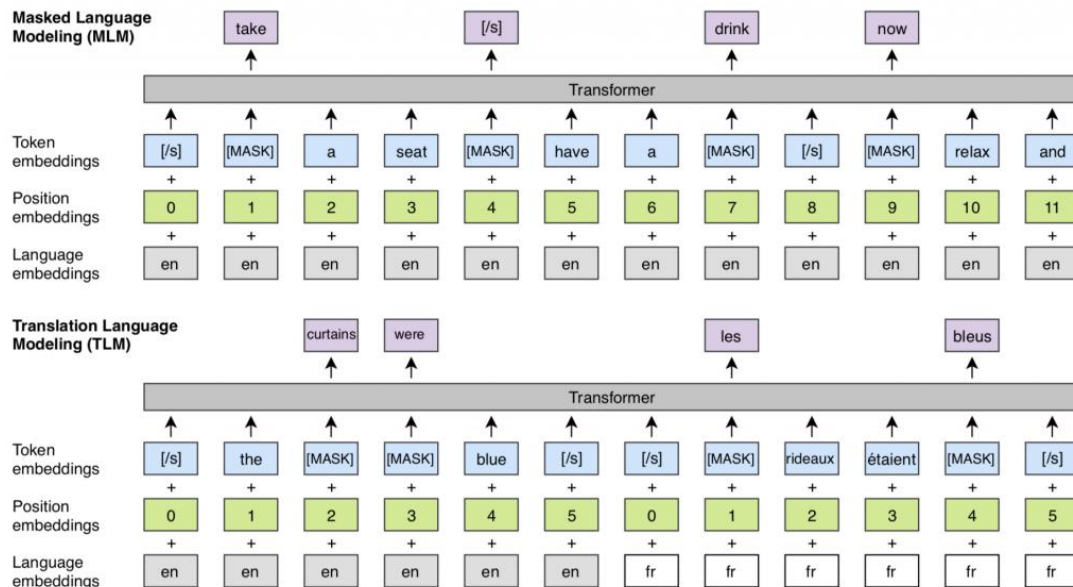*Figure 15: BERT Logo*

Figure 16: BERT Model of Question & Answer

4.5 NLP

NLP is the component of AI; it is capability of a program to understand the human language just like as it is spoken or written. It makes the computer to understand the language as human do. NLP use AI to detect the language and process it that a computer can understand.
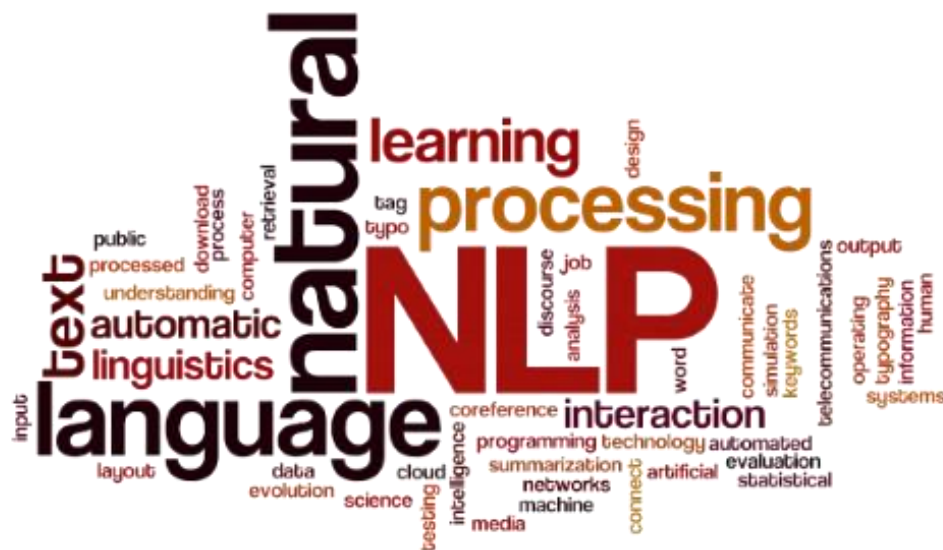

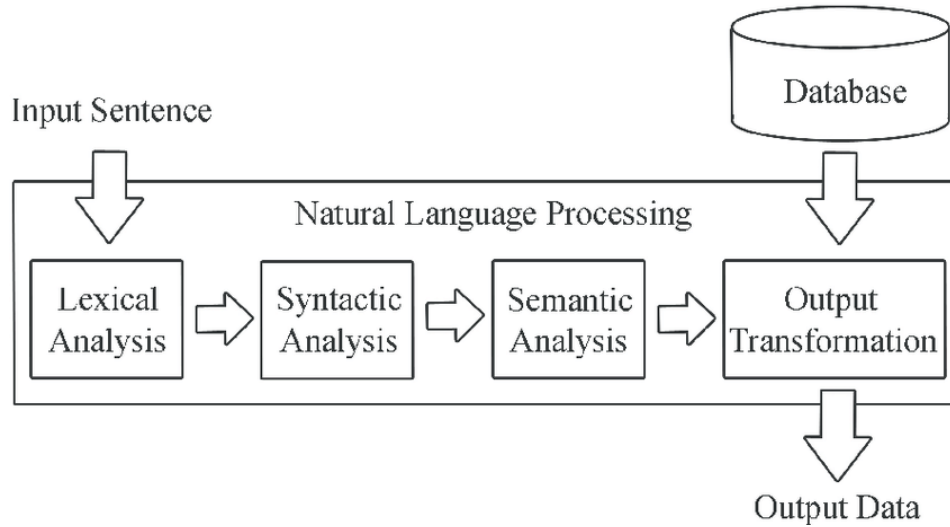*Figure 17: Natural Language Processing*

Figure 18: Working Of NLP

4.6 Tensor Flow

TensorFlow is a machine learning and artificial intelligence software library that is free and open-source. It can be used for a variety of applications, but it focuses on deep neural network training and inference. TensorFlow is compatible with a wide range of programming languages, including Python, JavaScript, C++, and Java. This adaptability lends itself to a wide range of applications in a variety of industries.

Figure 19: TensorFlow Logo

4.7 PyTorch

Formulated on torch library, PyTorch is open-source machine learning framework which is commonly used for computer vision and natural language processing. PyTorch has been used to design multiple software such as Tesla Autopilot, Ubers Pyro etc. Main two features which PyTorch provide includes:

- Tensor computing that provides strong acceleration via graphics processing units.
- Deep neural networks built on a tape-based automation differentiation system.

Figure 20: PyTorch Logo

4.8 KERAS

KERAS is also an open-source library provides interface of python which can be used for artificial neural network. KERAS serves as a user interface for TensorFlow. It includes many implementations of standard neural-network building blocks like layers, objectives, activation functions, optimizers, and a slew of other tools to make working with picture and text data easier while also reducing the amount of coding required to write deep neural network code.

Figure 21: KERAS Logo

4.9 000 Web Hosting

It is a free web hosting platform where you can upload your HTML, CSS, JS Files and run them on server. 000webhost is a free website hosting service with a lot of useful features like a website builder, WordPress support, and no adverts. Users can upgrade to a paid plan to gain access to more services and support, but based on our research, 000webhost is the finest free web hosting option for people who are truly on a budget.

Figure 22: 000WebHosting Logo

4.10 JavaScript

Js is the abbreviation of Java Script which is used with HTML, CSS for web designing. JavaScript is an ECMAScript-compliant high-level, frequently just-in-time compiled language. It has first-class functions, dynamic typing, and prototype-based object orientation. It's

multi-paradigm, allowing you to programme in event-driven, functional, or imperative styles. It contains APIs for working with text, dates, regular expressions, standard data structures, and the Document Object Model, among other things (DOM)

Figure 23: JavaScript Logo

4.11 Agora

It is a free web application for Audio as well as video connections. The Real-Time Engagement Platform allows you to make meaningful human interactions in real time. When people see, hear, and interact with each other, they are more engaged. Agora provides 10,000 free minutes to its users which we are using in our project.

Figure 24: Agora logo

4.12 Software Tools Used:

4.14.2 PyCharm

It is an integrated development Environment used in the field of Engineering, focusing on python development. Developed by JetBrains it includes code analysis, a graphical debugger, an integrated unit tester, Version Control System(VCS) Integration, it also supports Django and Anaconda for web development and data science, respectively.
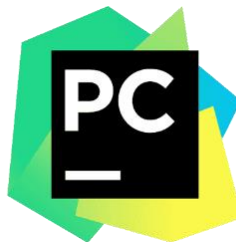

Figure 25: PyCharm Logo

4.11.2 Flask

Flask is a web framework which is written in python, which let you design web application. It is considered as micro framework as it doesnot use any particular tool or library. It doesn't have a database abstraction layer, form validation, or any other components that rely on third-party libraries to do typical tasks. Flask works on the principles of Werkzeg, WSGI toolkit and Jinja2 template engine.

Figure 26: Flask Logo

WSGI: Web Server Gateway Interface is used as a standard for python web application development.

Werkzeug: It is a WSGI toolkit that sends request, response objects, and utility functions. It is used as a base by Flask framework.

Jinja2: It is a template engine for python. It combines a template with specific data source to render a dynamic web page.

4.14.3 Bootstrap

Bootstrap is a free and open source CSS framework which contains hundreds of templates which user can use free. It contains HTML, CSS and JavaScript based design template for multiple interfaces on web. It provides basic designs for all type of web pages, where user can easily access CSS classes to access and edit its style, color, design.

Figure 27: Bootstrap Logo

4.14.4 Visual Studio Code

Visual Studio Code is an open-source text editor and development tool, designed by Microsoft. It has a lot of features and can be set up to create a development environment for many kinds of apps and coding. It features debugging capabilities, as well as built-in Git support, syntax highlighting, and Intelligence.

Figure 28: Visual Code Logo

4.11.4 MS Excel

It is Microsoft Owned software use to manage data in appropriate way, Data could be arranged in rows and columns with proper headings. It provides all the features of Spread sheet providing 480 different functions.

Figure 29: Microsoft Excel

Chapter 5: Market Analysis

Any idea that is to be commercialized requires a thorough market study, from which a business strategy is developed. The market study aids in determining not just the device's requirement but also its demand. The main goal is to prove that there is a market for this product and that demand will be sufficient to create sufficient revenues to maintain a firm that can grow and invest in additional research & development in the long run.

5.1 Market Size

The market size is considerable as there are a lot of people not only in Pakistan but also in the world who suffer from body pain issues. In foreign countries there are a lot of chiropractic Institute providing medical degree in chiropractic. We can target a really big market for our product. In 2022, the market for chiropractors in the United States is worth $19.5 billion dollars. According to Marketdata, chiropractic services in the United States are a $15 billion "business" with a predicted annual growth rate of 4.5 percent from 2021 to 2015. Marketdata researchers estimate that chiropractors' revenues reached $15.47 billion last year, based on the ratio of payroll to sales (32.3 percent in 2017). In 2019, receipts totaled $15.06 billion, implying that receipts increased by 2.7 percent in 2020.
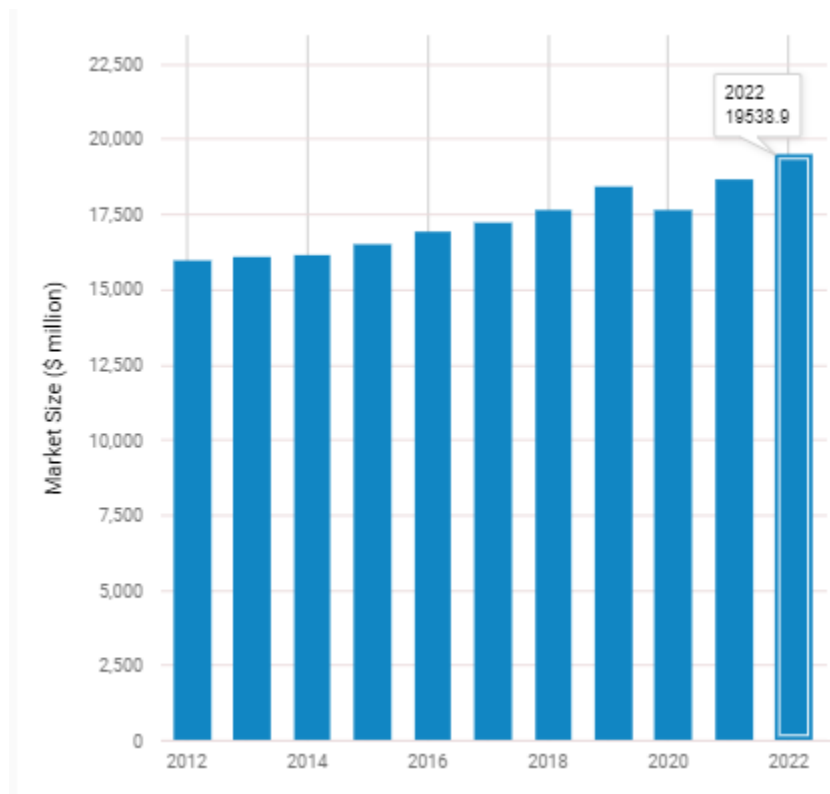
Figure 30: Market Size

5.2 Business Model

The backbone of each new firm is its business model. It is a strategy for the effective running of a firm that identifies income streams, target customers, goods, and financial data. It is the document that guides a company's first two years of operations and strategic choices.

According to Marketdata, chiropractic services in the United States are a $15 billion "business" with a predicted annual growth rate of 4.5 percent from 2021 to 2015. Marketdata researchers estimate that chiropractors' revenues reached $15.47 billion last year, based on the ratio of payroll to sales (32.3 percent in 2017). In 2019, receipts totaled $15.06 billion, implying that receipts increased by 2.7 percent in 2020.

In 2019, the "average" chiropractic practice in the United States was expected to generate $380,300 in revenue, with a profit margin of 28%. From 2012 to 2017, revenue per office increased at an annual rate of 2.8 percent on average. Chiropractors are thought to treat more than 35 million Americans (adults and children) each year. In 2018, 53% of individuals in the United States saw a chiropractor for neck or back discomfort. There are 39,613 chiropractor offices in the United States, according to the industry. There are no significant operators in this industry, which makes it extremely competitive. Only 3.5 percent of total sales are captured by the top 50 companies in the market. According to a 2019 poll, the average chiropractic patient is female (57%) and between the ages of 30 and 64. (46 percent).

5.3 SWOT Analysis

A SWOT analysis helps a business analyze its strengths, weaknesses, opportunities and threats. Having an oversight of such things enables a business to succeed in the market and be a better competitor. Our SWOT analysis shows that although we have existing threats and weaknesses but the opportunity at hand is too good to be thrown away. A market that in largely untapped, a people who suffer from pain and difficulty along with completed research and obtained funding give us the perfect platform to succeed. A rise in chiropractic patients demands more chiropractors which increases the demand of our application and its market value.

5.3.1 Strengths
- Complete research and currently in prototyping phase.
- Have Industry partners
- Experienced Team
- First in market with automated viva scoring app.
- In collaboration with chiropractic institute of Auckland.

5.3.2 Weaknesses
- Lack of Industry recognition
- Lack of marketing experience
- Output depends a lot on dataset
- Issue of different accents
- Lack of industry recognition

5.3.3 Opportunities

- No competitors
- Targeted market is neglected
- New in the industry, a lot chances to grow
- Market demand of this service
- Can pitch the product to other chiropractic institutes

5.3.4 Threats

- Customer's response may not be good.
- No awareness of such web app in the market
- Third parties may steal this idea

Figure 31: SWOT Analysis

5.4 Innovative Comparison

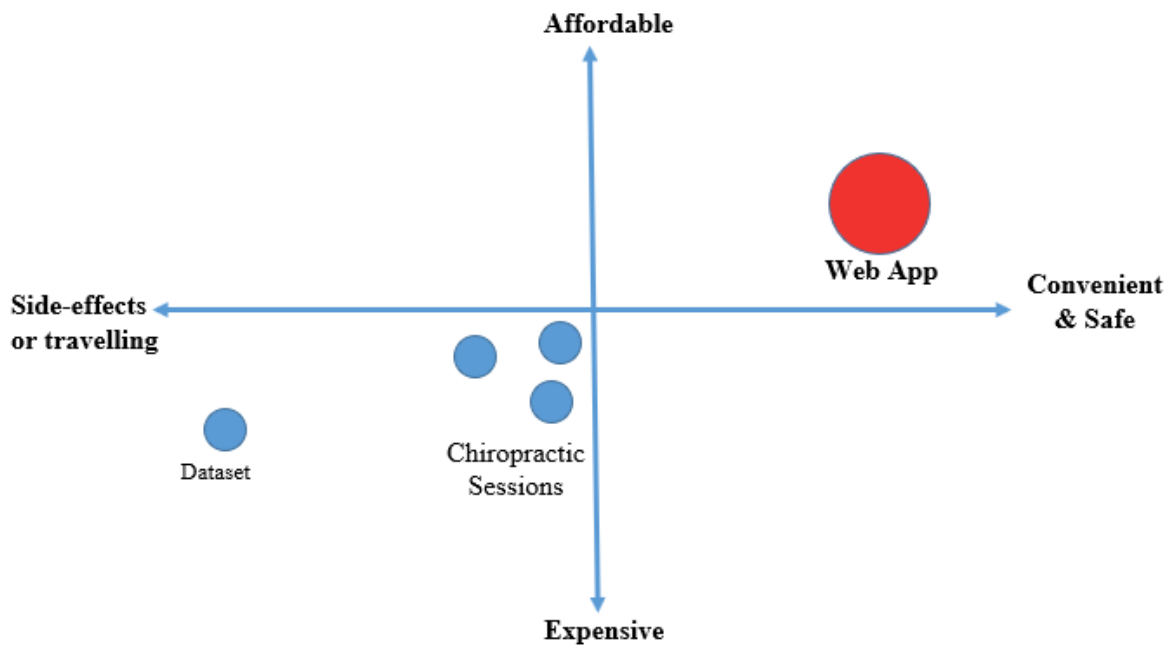The innovation comparison of automated viva scoring ap is undeniable.

Figure 32: Innovation Comparison

Chapter 6: Conclusion and Future Prospects

6.1 Conclusion

The project developed a Web App based on the chiropractic datasets. The web app is working as evaluation mechanism of students. A mobile app was also developed to assist teacher of chiropractic institute. The app development and designing were carried out all the way from inception to development to β-testing. The objectives of the project set at the start have thus been met and are stated below:

- A mobile / web app which will serve as an evaluation mechanism.

6.2 Future Prospects

The project has a bright future ahead of it. As a full product, there are several new methods to improve it and add new features. We can add a variety of features for professors and students, as well as connect this app to a university's learning management system. Due to scheduling restrictions, several of the proposed enhancements could not be executed. We hope that these suggestions will be seen positively and that they will be implemented with passion.

With just a little more effort we can make this app ready for the University. Beside automated scoring we can add features of real time expression and motion detection which can better tell the behavior of students while giving the viva. We can use this dataset to acquire different question related to patient. This app can further be used to detect patient brief history and can suggest solutions. Another option is to utilize AI and Machine Learning to track advances in speech, which may then be used to adjust the treatment as needed. Furthermore, AI may be used to make the knowledge base entirely AI reliant.

Furthermore, before this application no such solution has been ever designed which can automatically evaluate the students. There was no such dataset available on any online platform which we can use for automated scoring. With the advancement in datasets, we can take more accurate measurements. Large quantity of datasets helps to train machine learning models more accurately. There are also a lot of better online paid services which we can use for speech to text conversion. And with better real time data we can preprocess it easily and there would be no grammatical and linguistic errors.

References

[1] NLP Based Test Automation https://www.nextgenerationautomation.com/post/nlp-based-test-automation, Accessed on (14, June, 2022)

[2] ETS Automated Scoring and NLP Technologies https://www.ets.org/s/criterion/pdf/automated_scoring.pdf , Accessed on (6, May, 2022)

[3] Ramesh, D., Sanampudi, S.K. An automated essay scoring systems: a systematic literature review. *Artif Intell Rev* **55,** 2495–2527 (2022). https://doi.org/10.1007/s10462-021-10068-2

 [4] Differential Diagnosis https://my.clevelandclinic.org/health/diagnostics/22327-differential-diagnosis#:~:text=A%20differential%20diagnosis%20is%20a,is%20potentially%20causing%20your%20symptoms, Accessed on (10, May, 2022)

[5] Chiropractic Information: In depth https://www.nccih.nih.gov/health/chiropractic-in-depth#:~:text=Chiropractic%20is%20a%20licensed%20health,may%20be%20used%20as%20well, Accessed on (22, May, 2022)

[6] Platt "Probabilistic outputs for SVMs and comparisons to regularized likelihood methods", Accessed on (20, May, 2022)

[7] Wu, Lin and Weng, "Probability estimates for multi-class classification by pairwise coupling", JMLR 5:975-1005, 2004.

[11] Fan, Rong-En, et al., "LIBLINEAR: A library for large linear classification.", Journal of machine learning research 9.Aug (2008): 1871-1874.

[12] Chang and Lin, LIBSVM: A Library for Support Vector Machines, Accessed on (26, May, 2022)

[13] Bishop, Pattern recognition and machine learning, chapter 7 Sparse Kernel Machines

[14] "A Tutorial on Support Vector Regression" Alex J. Smola, Bernhard Schölkopf - Statistics and Computing archive Volume 14 Issue 3, August 2004, p. 199-222.

[15] Schölkopf et. al New Support Vector Algorithms

[16] Crammer and Singer On the Algorithmic Implementation ofMulticlass Kernel-based Vector Machines, JMLR 2001.

[17]. Naïve -bayes-classifiers https://www.geeksforgeeks.org/naive-bayes-classifiers/, Accessed on (24, May, 2022)

[18] A Guide to RNN: Understanding Recurrent Neural Networks and LSTM Networks

[19] BERT Explained: State of the art language model for NLP

[20] Automated essay Scoring System https://link.springer.com/article/10.1007/s10462-021-10068-2, Accessed on (4, June, 2022)

[21] Adamson, A., Lamb, A., & December, R. M. (2014). Automated Essay Grading.

[22] Ajay HB, Tillett PI, Page EB (1973) Analysis of essays by computer (AEC-II) (No. 8-0102). Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education, National Center for Educational Research and Development

[23] Ajetunmobi SA, Daramola O (2017) Ontology-based information extraction for subject-focused automatic essay evaluation. In: 2017 International Conference on Computing Networking and Informatics (ICCNI) p 1–6. IEEE

[24] Alva-Manchego F, et al. (2019) EASSE: Easier Automatic Sentence Simplification Evaluation." ArXiv abs/1908.04567 (2019): n. pag

[25] Bailey S, Meurers D (2008) Diagnosing meaning errors in short answers to reading comprehension questions. In: Proceedings of the Third Workshop on Innovative Use of NLP for Building Educational Applications (Columbus), p 107–115

[26] Basu S, Jacobs C, Vanderwende L (2013) Powergrading: a clustering approach to amplify human effort for short answer grading. Trans Assoc Comput Linguist (TACL) 1:391–402

[27] Bejar, I. I., Flor, M., Futagi, Y., & Ramineni, C. (2014). On the vulnerability of automated scoring to construct-irrelevant response strategies (CIRS): An illustration. Assessing Writing, 22, 48-59.

[28] Bejar I, et al. (2013) Length of Textual Response as a Construct-Irrelevant Response Strategy: The Case of Shell Language. Research Report. ETS RR-13-07." ETS Research Report Series (2013): n. pag

[29] Berzak Y, et al. (2018) "Assessing Language Proficiency from Eye Movements in Reading." ArXiv abs/1804.07329 (2018): n. pag

[30] Canadian Medical Protective Association. Clinical Decision-Making. (https://www.cmpa-acpm.ca/en/education-events/good-practices/physician-patient/clinical-decision-making) Accessed 1/28/2022.

[31] Centers for Disease Control and Prevention. Generate a Differential Diagnosis. *(https://www.cdc.gov/urdo/differential.html)* Accessed 9/16/2021.

[32] Cook CE, Décary S. Higher Order Thinking About Differential Diagnosis. *(https://doi.org/10.1016/j.bjpt.2019.01.010)* Brazilian Journal of Physical Therapy. 2020; 24(1), 1–7. Accessed 9/16/2021.

[33] Merck Manual. Multiple pages reviewed for this article. Accessed 9/16/2021.

[34] Scott DC, Stern, AS, Cifu DA. Symptom to Diagnosis: An Evidence-Based Guide *(https://accessmedicine-mhmedicalcom.ccmain.ohionet.org/content.aspx?bookid=2715&sectionid=228237277)* , 4e. New York, NY: McGraw Hill; 2020. Accessed 9/16/2021.