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|  | **Sri Lanka Institute of Information Technology**  Temporary ID : TMP-22-206 |

Project Topic Assessment – 2022 (Regular)

Topic

“AITor”- Smart Assistive and personalized student education platform based on AI.

Abstract (200 Words Max):

Education refers to the discipline that is concerned with methods of teaching, learning, and assessing subject matters. [1] For years, there is no significant change of the way we learn and how we assess what we learnt. At present, written examinations are in high demand for assessing the subject matters. But with the advancement of the technology there are new means of assessment methodologies available in the world. Considering the learning strategies, rather than teaching a student with pre-defined set of subjects, there should be a way to identify beforehand potential expert subject area of the student. Framing a student/s for a classroom/s with a tutor/s could affect in a negative way for a student who is highly engageable and active. Furthermore, there are students who finds it difficult to provide written solutions to a problem but finds it easy and engaging to verbally express the answer with real-world scenarios.

Due to the long education path of a student, it is difficult to track and provide analyzed/accurate solutions to above problems with current utilizing means.

Main objective of the research is to develop AI based Smart Assistive Platform to Provide Detailed Analysis on Student Education on their Learning Patterns.

Research Group/Area: Select the area by referring to the document uploaded to the Course Web

**Knowledge Inspired Computing (KIC)**

**Computational Linguistics (CL**

**Supervisor should fill this part**

Continuation of Previous Year Project?

Supervisor and Co-Supervisor endorse the proposed project, and hence, guide the students to acquire required knowledge skills pertaining to above sub domains of their specializations.

Supervisor: **Prof. Samantha Thelijjagoda**

If yes, state the Project ID

and year

Co-Supervisor: **Ms. Aarchana Kugathasan**

Signature

External Supervisor

Name

Team Members:

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| Student Name | Student ID | Specialization |
| Leader: Liyanage M.L.A.P. | IT19120812 | SE |
| Member 2: Thammita D.H.M.M.P | IT19120362 | SE |
| Member 3: Hirimuthugoda UJ | IT19138114 | SE |
| Member 4: Liyanage N.L.T.N. | IT19188546 | SE |

Research Problem:

Students show their skills in a unique way, sometimes the tutors/teachers may not be able to identify them. Considering a classroom with more than 30~40 students, it is a bit hard to identify all the students individually. Due to limited awareness of their strengths weaknesses students tend to make incorrect decisions throughout their lifetime. Having proper awareness of the best learning patterns, expert subject areas will allow students to make their decisions more accurately. Issues caused by less awareness of the learning strengths and weaknesses can be introduced as follows.

* Selecting the most suitable subject stream in higher studies and in universities can be one of the most crucial decisions in a student’s life that will affect the entire future of that student. But unfortunately, a considerable number of students are making wrong decisions due to reasons such as unawareness of their strengths and weaknesses, social influences, etc. In 2019, former Commissioner of Examinations Sanath Pujitha claims that around 80,000 students who sit for the GCE Advanced Level examination annually fail the examination due to the wrong selection of subject stream. [2]
* Even within the teacher-centric traditional educational system it is very hard to identify the mentality, strengths, weakness, and skills of each and every student, even though working very closely with the student. Even the great scientist Elbert Scientist also was treated as a “mentally handicapped” student by his teachers in his little and some of his teachers thought he might be retarded. [3]
* In a class or a lecture that are even consisting of many students with the same age are also different in their mentality and thus they are varied with respective the learning pattern. [4] With the size of students sample, it is very challenging for a teacher to teach in a way which suitable for each type of student. This nature will affect to reduce the effectiveness of the teaching effort and at the same time it will caused to reduce the productivity of both learning and teaching process. It is possible to mitigate this issue by introducing a personalized teaching and learning mechanism.

References

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| [1] | R. Browning, "education," 1 November 2021. [Online]. Available: https://www.britannica.com/topic/education. [Accessed 14 December 2021]. |
| [2] | S. P. Nanayakkara, "80,000 fail AL exam due to wrong selection of subject stream," 11 May 2019. [Online]. Available: https://www.dailymirror.lk/front\_page/80-000-fail-AL-exam-due-to-wrong-selection-of-subject-stream/238-163708. |
| [3] | A. Einstein, "Albert Einstein Biography," [Online]. Available: https://www.notablebiographies.com/Du-Fi/Einstein-Albert.html#ixzz7F32NN1Vl. |
| [4] | R. M. FELDER and R. BRENT, "Understanding Student Differences," 2005. [Online]. Available: https://www.engr.ncsu.edu/wp-content/uploads/drive/1pQQ7SL02ShCauYV13aI15hTQffqgsILv/2005-Understanding%20Student%20Differences%20(JEE).pdf. [Accessed 15 December 2021]. |

Solution proposed:

Proposed System, “AITor” is an AI based web application that is designed and implemented with several AI, ML, DL NLP, computer vision technologies, that will monitor the students’ behaviors throughout their learning path and help to boost the productivity of learning and predict the efficiency of the learning experience.

The solution is widely spared among,

1. Identification of the best learning strategy of the student.
2. Predict the expert subject area of the student.
3. Student based preformed analysis and prediction by the assessment methodology.
4. Building up an “identification and recommendation” algorithm to cater the best-suited subject theories to the student in a systemic way.

The proposed solution will be made around achieving main objective of “To develop AI based Smart Assistive Platform to Provide Detailed Analysis on Student Education on their Learning Patterns” and the following three sub objectives will be achieved in fulfilling the main objective.

1. Add a middleware to the current student learning experience that will introduce personalized learning experience to the student
2. Track the student performance in a more accurate and efficient way
3. Identify potential skills of the student and up-scale them.

According to the identified factors that are aligned with identifying the personal education pattern, the solution is divided into four distinct components.

* Through the first component the system will predict the best learning strategy of the student.in achieving this objective a supervised ML model will used which get data by iteratively performing pre-defined tasks. This module will continuously evaluate the student by allowing students to take part in different tasks assigned by the system. It is intended to use different resources in order to cover the subject area. These resources can be classified as text with theory concepts, visual explanations of the theory concepts (images/videos), verbal/audio books which contains theory concepts, Live lectures, and real-time engagement activities (solve a math problem with a bot). As the final output it will be able to suggest a single methodology or hybrid/ combination of several learning strategies to teach the student.
* A separate component that uses Machine Learning, Deep Learning, and Natural Language Processing will be implemented in predicting the expert subject area of the student. This component will continuously assess the student with different subject areas to accurately identify the expertise on a subject of a student. Here it is aiming a pre-defined set of subjects like mathematics, science, and asses the student with the subjects. Here the model will suggest personalized subject content to the student so that he/she can have a proper guidance in the subject.
* With having the purpose of performance analysis and personalized assessment methodology prediction, another component will be implemented. Based on the results, producing from the above two components, this will predict the best-suited assessment methodology for the student. Along with that main objective, also it will perform a full analysis of the student while allowing users to get insights into the student by a given analysis report. In order to cater to this requirement, this component will track how much time, the student is exposed to that course content and assess the student with relevant course content continuously.
* Another separate module will be used in identifying and recommending best-suited learning materials to the students using a systematic way. This is the component that makes computer-guided learning a reality by adding out-of-the-box features into it. This component contains two main components and an optional component. One sub-component will interact will all of the above-mentioned components and the background data of the students. This sub-module evaluates and analyzes the results provided by the above components and will propose a matric that aligns with the best-suited learning plan for the student. Another sub-component of this component will dive into the publicly available learning resources and, it will classify these online resources according to their quality, type, ratings, etc. This way it will identify the best learning materials available over the internet for different subject scopes. Finally, an intermediate sub-component will combine these components (Material analysis component and learning pattern prediction component), and then it will choose and recommend the most suitable learning materials for the student by analyzing learning material classes and personalized learning plans. The optional module will be used on occasions when there is an interference of a tutor. In that case, the tutor can explicitly decide the subject scope and this module will predict the subject scope based on the syllabus and references provided by the tutor.

System Overview Diagram for the solution proposed. Recommended to draw using [draw.io.](https://app.diagrams.net/) Note: This is not an activity/flow (UML) diagram

1. **Man components including the data sources, stakeholders, interaction among the stakeholders, etc.**
2. **Interconnection among the components**
3. **Major SW and HW components**

**High Res Image :** [**https://mysliit-my.sharepoint.com/:i:/g/personal/it19188546\_my\_sliit\_lk/EUL7MtZPIhdKlFlwqY\_0sugB81Rlt9ziUZ7frMqTM7LNCQ?e=UJ32Io**](https://mysliit-my.sharepoint.com/:i:/g/personal/it19188546_my_sliit_lk/EUL7MtZPIhdKlFlwqY_0sugB81Rlt9ziUZ7frMqTM7LNCQ?e=UJ32Io)

Diagram

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Objectives (1 main objective and 4 sub objectives):

**Main Objective:**

To develop AI based Smart Assistive Platform to Provide Detailed Analysis on Student Education on their Learning Patterns

**Sub Objective 1:** Identification of the best learning strategy of the student

**Sub Objective 2:** Building up “identification and recommendation” algorithm to cater the best suited subject theories to the student in a systemic way.

**Sub Objective 3**: Student based performance analysis and prediction of the most suited assessment methodology

**Sub Objective 4:** Predict the expert subject area of the student.

Task divided among the members

Member 1: Liyanage M.L.A.P.

* Identification of best learning strategy of the student
  + This is the entry module of the application where; the student will be evaluated in many different forms with reference to the learning strategies available in the system. Furthermore, the student will be firmly monitor for his reactions on the face when he/she is facing each and every learning session and assessment session. Intention of the above is to identify the level of engagement of the student with the relevant learning strategy. As main inputs, the application will be fetched with
    - - Raw video footage of the student’s facial emotions
    - - Assessment answers with relevant learning strategy.
  + Describing about the flow of the scenario, the student will be asked few questions related to a subject area that he/she is interested in learning. Then he/she will be provided a sequence of learning materials related to the above subject area which will fall into different learning strategies and give time to learn through them. Then a series of assessments will assess the student and fetch the data with an assessment module. This module will output marks and related learning strategy that was used to teach the subject area. Then this data will be fetched along with the data coming from the emotion’s detection algorithm to another supervised model to get the final output of the “best learning strategy”. Since one student may have one or more best learning strategies, this would be an iterative process until we find a result with ideal accuracy.
  + To overcome a high accuracy of the final output, the above implementation will consist of 3 main modules.

* + - - Human emotions detection module
    - - Keyword detection module (This will be used to assess the verbal or written inputs of the assessments)
    - - Best methodology prediction module
* Identification of potential learning strategies
  + This step is to identify new learning strategies that can introduce to the student via the platform. Currently we have identified,
    - - Text with theory concepts (suggesting theory concepts in the reference books)
    - - Visual explanations of the theory concepts (suggestion of filtered YouTube videos, recorded lecture videos)
    - - Verbal/audio books (Text-to-speech, Audiobooks)
    - - Live lectures
    - - Real-time engagement activities (repl.it, codebyte, litecode web-applications)
  + In this module, the application will look and identify potential combination of best learning strategies.

Member 2: Thammita D.H.M.M.P – IT19120362

Building up “identification and recommendation” algorithm to cater the best suited subject theories to the student in a systemic way.

The entire component can be divided into four major subcomponents as follows,

* Identification of the best suited learning plan of for an individual student
  + This step will use the results provided by other modules (Best Learning strategy, Best Suited Evaluation Method, Expert Subject Area) of the systems as well as the background data of the students (Ex: age, Student subject preference, ambition of the student, etc.)
  + It is proposed to use decision tree algorithms using python in implementing this prediction module.
  + This will be implemented as a separate module that can be exposed as an API.
* Identification of the subject scope based on references and the syllabus.
  + This is an optional feature that allows tutors to feed their expected syllabus and the reference materials into the system which will used in identifying the scope of the subject that is intended to be taught.
  + The system has the ability of recommending the best suited learning materials to students with or without having a subject scope provided by the tutor.
  + This will be implemented using text classification technologies that comes with Python (NLTK)
* Learning material classification and analysis
  + Intention of having this module is to classify and analyze the learning materials that are available over the internet.
  + System will access to the freely available learning materials over the internet and then these materials will be classified and based on some factors (Material Type, Material Ratings, Publication Year, Publisher Ratings, comments, etc.)
  + Input factors of this module also will have their separate prediction and identification modules to process their individual outputs. (Ex: Publisher analyzing and rating module, Comment Classification module).
  + Logistic Regression algorithms, Python based NLP technologies and even publicly available services such as Google “AutoML” will be used in implementing main and subcomponents of this module.
* Best Suited Learning Material Identification and Recommendation
  + This could be explained as the combining module of the above three modules.
  + This module will take the predictions of the above three module and will recommend the best suited learning materials for a student based on his/her best suited learning plan, Intended Subject Scope and best learning materials.
  + According to the prediction of this module the Best Suited Learning materials will be identified and presented to the student.
  + Decision tree algorithms will be intended to use in making predictions through Best Suited Learning Material Identification module.

Member 3 : Hirimuthugoda U.J.

* Implementation to identify most suited assessment methodology for a student for a particular subject.
* Analysis how student perform for various assessment methods
* Several assessment methods will be used like verbal, written and
* Based on analytical data, determine the best suited method to evaluate the student for selected subject
* Most of the subject have predefined assessment methods. If tutor or student want to identify what is the most suitable evaluation method for him/her to evaluate specific subject, this feature can be used.
* Identify most suitable evaluation materials and conduct assessment.
* Based on student progress level and the identified assessment method, Evaluate student continuously
* Freely available question and answers, assessments on the internet will be used to evaluate the student
* Those assessments will be selected by the system, based on student current progress and performance.
* When student complete a specific learning area, assessments will be given according to that.
* Analysis the performance of the student and keep track of the progress along with the time
* Assessment data will be collected and analysis to measure the student learning progress.
* Those analytical data will be used in learning material suggestion phase.
* Analysis and predict the Interests and the future path of the student.
* Implement complete student profile with collected and predicted data which can be used by the student and the tutor.
* As the final output of the system there will be a detailed report for the student that will update continuously and explain the skills, performance, learning progress, interests and predicted information about the future path of the student.

Member 4 : Liyanage N.L.T.N.

Identification of the expert subject area of the student.

Every person is an expert for at least in one particular area. That area could be changed time to time. In this step we are identifying the expert subject area that the student by considering some factors of his/her studies and the background as well.

The component of expert area prediction is divided to three main subcomponents.

* Assessment answers analyzing module
* This will be the initial subcomponent of this component. The student will be given an assessment for gather some data to analyze to make a conclusion regarding the subject area. The inputs of this subcomponent will be the answers that will be provided by the student for the given assessment.
* And the output of the ‘Identifying the most suited assessment methodology’ main component will be used to the assessment providing to the relevant student. The data will be classified by using the Logistic regression analysis by python.
* Student academic background analyzing module
  + For this subcomponent the initial data will be gathered by providing a questionnaire for the student. The answers provided by the students will be the inputs for this subcomponent. The data will be classified by using the Logistic regression analysis by python. Same as the above subcomponent.
* Expert subject area prediction module
  + This will be the decision-making subcomponent. The outputs of the first two components will be the inputs of this component. And if there is any pre predicted expert subject area for the same student it will also be considered for this prediction. The final prediction will be done by the decision tree analysis by python.
  + This subcomponent will be looping in every 2weeks to one month time to get more accuracy for the predicted expert subject area of the student. And if there is any change in the prediction the new prediction will be saved in the database.

Technologies to be used:

* Programming Languages:
  + Python
  + JavaScript
* Frameworks and libraries
  + Vue JS
  + PyTorch
  + SpaCy
  + YAKE
  + RAKE-NTLK
  + OpenCV
  + NLTK
* Databases
  + Apache Cassandra/AWS Keyspace
  + Redis/AWS elasticache
* Cloud Solutions
  + AWS
* Other
  + Docker
  + AutoML

If supervisor States that this year is a continuation of previous work, state the further work the students should do compared to the previous years.

(NOTE: This part has to be filled by the supervisor)

**This part will be filled by the Topic Screening Panel members**

Acceptable: Mark/select as necessary

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| Acceptance/  Rejection | Correction State | |
| Minor Correction | Major Corrections |
| Accepted |  |  |
| Resubmit |  |  |
| Rejected |  | |

**Accept with Minor Corrections**

Corrections (if necessary)

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| --- |
| Reconsider the title. Match the sub-objectives according to the member components. Consider the availability of data required for each member’s component. |

Major changes proposed:

Reconsider the title. Match the sub-objectives according to the member components. Consider the availability of data required for each member’s component.

Any other Comments: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Approved by the review panel:

|  |  |
| --- | --- |
| **Member’s Name** | **Signature** |
| Dr. Dharshana Kasthurirathna |  |
| Dr. Kalpani Manathunga |  |
| Mr. Udara Samaratunge |  |

**Important**:

1. According to the comments given by the panel, do the necessary modifications and get the approval by the **same panel**.
2. If the project topic is rejected, find out a new topic and inform the CDAP Group for a new topic pre-assessment.
3. A form approved by the panel must be attached to the **Project Charter Form**.

# **Appendix 01: Best Suited Assessment Methodology Prediction Component – High-level overview diagram**

# **Diagram Description automatically generatedDiagram Description automatically generatedAppendix 02: Best Suited Subject theories identification and recommendation Prediction – High-level overview diagram**

# **Diagram Description automatically generatedAppendix 03: Best Suited learning strategy of a student Prediction Component - High-level overview diagram**

# **Appendix 04: Expert Subject Area of a student Prediction Component – High-level overview diagram**

**Diagram

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# **Appendix 05: Reply email from the supervisor**

Graphical user interface, text, application, email

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# **Appendix 06: Reply email from the co-supervisor**

Graphical user interface, text, application, email, Teams

Description automatically generated

# **Appendix 03: Reply email from the external co-supervisor**

Graphical user interface, text, application

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