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|  | **Sri Lanka Institute of Information Technology** |



PROJECT REGISTRATION FORM

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(This form should be completed and uploaded to the Cloud space on or before 23rd August 2021)

The purpose of this form is to allow final year students of the B.Sc. (Hon) degree program to enlist in the final year project group. Enlisting in a project entail specifying the project title and the details of four members in the group, the internal supervisor (compulsory), external supervisor (may be from the industry) and indicating a brief description of the project. The description of the project entered on this form will not be considered as the formal project proposal. It should however indicate the scope of the project and provide the main potential outcome.

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| PROJECT TITLE  (As per the accepted topic assessment form) | “AITor” education platform - A personalized student performance analyzer and recommendation system |

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| RESEARCH GROUP  **(as per the Topic assessment Form)** | Computational Linguistics |

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| PROJECT NUMBER | TMP-22-206 | (will be assigned by the lecture in charge) |

PROJECT GROUP MEMBER DETAILS: (Please start with group leader’s details)

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| --- | --- | --- | --- | --- |
|  | **STUDENT NAME** | **STUDENT NO.** | **CONTACT NO.** | **EMAIL ADDRESS** |
| Format | Perera C.D.D | ITxxxxxxxx | 0712345678 | itxxxxxxxx@my.sliit.lk |
| 1 | Liyanage M.L.A.P. | IT19120812 | 0773300941 | it19120812@my.sliit.lk |
| 2 | Thammita D.H.M.M.P. | IT19120362 | 0716292892 | it19120362@my.sliit.lk |
| 3 | Hirimathugoda U.J. | IT19138114 | 0768099042 | it19138114@my.sliit.lk |
| 4 | Liyanage N.L.T.N. | IT19184546 | 0771531426 | it19188546@my.sliit.lk |

**SUPERVISOR, CO\_ SUPERVISOR Details**

|  |  |
| --- | --- |
| **SUPERVISOR Name** | **CO-SUPERVISOR Name** |
| **Prof. Samantha Thelijjagoda** | **Ms.Archana  Kugathasan** |
| **Signature** | **Signature** |
| **Attach the email as Appendix 1** | **Attach the email as Appendix 2** |
|  |  |
| **Date** | **Date** |

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| EXTERNAL SUPERVISOR Details (if any, may be from the industry) | | | | | |
|  |  |  |  | **Attach the email as Appendix 3** |
| Name  **Mr. Koliya Harshanath** | Affiliation  **University of Wollongong** | Contact Address  **2A Fairy St. Gwynneville NSW 2500 (Dinindu@uow.edu.au)** | Contact Numbers  **+61444521571** | Signature/Date |

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| ACCEPTANCE BY CDAP MEMBER (This part will be filled by the RP team) | | |
|  |  |  |
| Name | Signature | Date |

PROJECT DETAILS

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| Brief Description of your Research Problem: (extract from the topic assessment form) |
| 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 learning pattern of the student.  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   |  |  | | --- | --- | | [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]. | |
| Description of the Solution: (extract from the topic assessment form)  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,   * Identify, Predict, and recommend best learning strategy of the individual student. * Building up an “identification and recommendation” algorithm to cater the best-suited subject theories to the student in a systemic way. * Evaluation based learning progress monitoring and intelligent feedback mechanism. * Performance based student skill prediction, carrier recommendation and overall learner classification.   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.   * Add a middleware to the current student learning experience that will introduce personalized learning experience to the student * Track the student performance in a more accurate and efficient way * Identify potential skills of the student and up-scale them. * Identify skills, Strengths, and weaknesses of students and carrier/learning path recommendation.   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. * 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 with 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. Along with mentioned subcomponents there will be another component running in the backend without notifying to the users. This component will integrate with the evaluation-based learning progress monitoring feature and with the data and insights getting by that component, this recommendation component will finetune its recommendation algorithm by recommending most suitable learning materials by considering on student’s progress upon recommended learning materials. Also, this component will have the ability to provide recommendations to the tutors/teachers by allowing them to organize their courses and teaching patterns in a productive way that helps to the individual progress of students. * With having the intention of improving the learning progress of students using the recommended materials by continuously monitoring the students, another component will be implemented. Through this component, a continuous set of evaluations/assessments will be held, and these assessments can be automated, or human created. By using both of these methods, this component will measure the progress of the student according to the learning materials recommended in the previous stage. This component collects and processes an overall statistical report of the student with respect to his/her progress or regress on learning. Further, this component will have the ability to monitor the interaction of the student with the given assessments and identify and their weaknesses and strengths of different areas, and then provide constructive feedback to the student by allowing them to mitigate their weaknesses while feedbacking to the recommendation component in order to finetune its recommendations according to learner’s progress. * Another component will act as a high-level analyzing and reporting component of the entire system. This component will classify and categorize the students into different groups by relying on the results provided by the above components. Then this component will rate the student based on different skills using scientific measures purposed. Also, this method will connect with external resources and categorize career opportunities based on different types of skills, and then it will recommend the best-suited carrier opportunities according to their skills. Also, this component will have the ability to identify the current trends of different subject areas and while feedbacking the recommendation component to suggest materials that mostly align with current trends in the subject area. This skill-based career recommendation approach will allow educational institutes to focus on gaps between the job market and skill levels of their students and to align their syllabuses to match with opportunities in the current job market. |

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| Main expected outcomes of the project: (extract from the topic assessment form) |
| **Main Objective:**  Main objective of this research is to, monitor, analyze and provide detailed analysis of a student throughout a period of his/her educational live by identifying the best suited learning strategy of the student, recommending ideal course materials and teach them via the identified learning strategies. It is planned to develop a web-based application which helps to provide the proposed solutions in real time.  **Sub Objective 1:** Identify, Predict, and recommend best learning strategy of the individual student.  **Sub Objective 2:** Building up an “identification and recommendation” algorithm to cater the best-suited subject theories to the student in a systemic way.  **Sub Objective 3**: Assessments based learning progress monitoring and intelligent feedback mechanism.  **Sub Objective 4:** Performance based student skill prediction, career recommendation and overall learner classification. |

WORKLOAD ALLOCATION (**extract from the topic assessment form after correcting the suggestions given by the topic assessment panel.**)

(Please provide a brief description about the workload allocation)

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| MEMBER 1 | ………………………………………………………………………………………………………………………………………………………… |
| **Liyanage M.L.A.P.**  **Identify, Predict, and recommend best learning strategy of the individual 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.     - Answers of pre-defined questionnaire   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 have a high accuracy, human emotions detection algorithm will be used.  As a workaround, this includes   * Gather raw video input of the student’s face and train model to analyze the emotions patterns * Evaluate assessment results * Train the model to identify and categorize potential learning strategy percentages according to every strategy. * Cross check the identified strategy with the output of facial expression model and finetune the final output’s accuracy. | |

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| MEMBER 2 | ………………………………………………………………………………………………………………………………………………………… |
| **Thammita D.H.M.M.P.**  **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.   + Other than that, this component receives the feedbacks provided by the continuous student monitoring system and these data will be used to fine-tune and re-recommend the learning materials according to the progress achieved by previously recommended materials. | |

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| MEMBER 3 | ………………………………………………………………………………………………………………………………………………………… |
| **Hirimathugoda U.J.**  **Assessments** **based learning progress monitoring and intelligent feedback mechanism**  In this phase, initially module content, assessments and the learning materials will be labeled/tagged under several aspects.  Module content can be categorized by,   * Knowledge structure (Basic, procedural, Conceptual) * Content type (Practical, Theory) * Effort level   Assessments can be categorized by,   * Question structure (Principle based, Procedural based, Facts, Concepts, Creativity.) * Required skills (Logical thinking, Problem solving, Creative thinking)   Learning materials can be categorized into,   * Delivery method (Text, Audio, Video)   Since assessment will be given by the lecturer/tutor, they can assign related labels to the assessment. Student performance will be analyzed according to them. These categorizations can be expand later as needed and get a detailed analysis.   * Assessments based learning progress monitoring   In this step, along with the content coverage, student will be evaluated by continuous assessment process. Some of assessment will be evaluate by the system and some of them will evaluate by the tutor/lecturer. System will collect the earned score in the evaluation process. Earned score and the learning speed of the student will be taken as the main parameters to analyze the learning progress. Also, system will identify the connection between student progress and the type of the learning materials provided. That information will be used in learning material recommendation part to suggest the learning materials in most efficiency way.   * Intelligent feedback mechanism   Student feedback will be given under two analytical phases.   * Module based performance analysis   In module-based performance analysis, the system will identify what are the learning areas student perform best and what are the learning areas need to be more focused. Student Learning speed will be analyzed with the performance showed in the assessments. Above mentioned classification will be used here to give a comparative report of the student qualities and skills.   * Analysis of how student perform during the assessment   In this phase, system will monitor how the student perform during the assessments. It will collect,   * Time management during the exam * Confident of answering * Exam revision   As the outcome of these two analysis processes, student will be recommended tips to face the exams more confidently and efficiently. Also, will suggest what are the learning areas need to be more focused on.  Additionally, analyzing assessment result along with the different tags/labeled, system will allow to get decision in different perspective to enhance the learning experience of the student. As an example, continuously analyzing student result with respective module content that covered by known learning material types, it is possible to identify what is the best learning style or material for the student to learn a particular module content to archive a higher grade. | |

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| MEMBER 4 | ………………………………………………………………………………………………………………………………………………………… |
| **Liyanage N.L.T.N.**  **Performance based student skill prediction, career recommendation and overall learner classification.**  In this module, based on the student performance throughout the process as well as a few more areas will be evaluated to make the prediction and do the recommendation.  This component can be divided in to two main sub-components like following,   * Student Skill prediction and Career recommendation * Overall learner classification   **Student Skill prediction and Career recommendation**  In this phase, the performance of the student will be evaluated in many approaches to obtain more accuracy for the skill prediction of the student. Initially, the intention is to consider the student’s marks of the assessments that is going to conduct in the ‘**Assessments** **based learning progress monitoring and intelligent feedback mechanism**’ component. And the objective is to consider the ‘Skill factors of the students’ which is provided by the above-mentioned component.  Also, the initial proposition is to consider the following parameters for career recommendation. They are,   * Current trends in the world in the industry * Interests of the leaner * Current opened job opportunities   **Overall learner classification**  As the second and the most important phase of the component, here the main objective is to generate a full-detailed report as the output of the main system. The proposition is to divide the report in to two components. They are,   * A report for a single student for identify his/her abilities and weaknesses by referring the report. * A report for a whole batch of students for identify their capabilities.   In the generated report, all outputs of the previously mentioned components will be presented.  The report will be generated in a collaboration with an existing third-party software in the case of increasing the accuracy of the report. | |

## **Corrections for minor issues in topic evaluation**

### Concern about availability of data

* Identify, Predict, and recommend best learning strategy of the individual student.
  + To gather the initial data about the user, while the user is registering with the platform, basic set of tests will provide to get an idea of the student. The data collect using this approach will have less accuracy and these data will gathered only as a starting point to predict the learning strategy. With progressing this module will get the results of other three modules and according to the performance of the learner, their initial dataset will be fine-tuned and thus it will increase the accuracy of the prediction.
  + For facial behavioral analysis, [DAiSEE](https://iith.ac.in/~daisee-dataset/) data set will be used to train the model. This is a multi-label video classification dataset comprising of 9068 video snippets captured from 112 users for recognizing the user affective states of boredom, confusion, engagement, and frustration "in the wild". The dataset has four levels of labels namely - very low, low, high, and very high for each of the affective states, which are crowd annotated and correlated with a gold standard annotation created using a team of expert psychologists.
* Building up an “identification and recommendation” algorithm to cater the best-suited subject theories to the student in a systemic way.
  + At the initial implementation of the solution, this component will integrate will predefined set of freely available learning platforms that freely expose their developer API’s (YouTube, Coursera, etc.). Also, this component will rely on the data provided by other components. In training the machine learning models, freely available data sets will be used. Also, freely available datasets and already implemented services will be used in in training the models of content-classification, material classification and sentiment analysis. As per the research done so far there were few datasets found that goes with learning patterns of students. In that case these data sets will intended to be used in training the model of material recommendation based on student learning pattern and progress.
* Assessments based learning progress monitoring and intelligent feedback mechanism
* Student learning progress data will be gathered from the above learning content recommendation component. (Module completeness, Content covering speed…)
* Student assessment marks will be collected through the given assessment. Assessments will be conducted and evaluate through the platform and marks will be calculated.
* Student behavior of answering will be monitored by the system during the assessments. (Time, revisions, answer changes.)

These collected data will be used to analyze the student performance and give personalized feedback.

* Performance based student skill prediction, career recommendation and overall learner classification
  + For the subcomponent ‘Student Skill prediction and Career recommendation’, the data will be gathered through the previous components as the outputs of them. Marks and the identified skill factors of the leaner will consider as the initial data to the subcomponent to analyze. For the career recommendation, the data related to the current trends in the industry will be gathered through the analyzing the reports of the third parties (Such as Stack overflow, LinkedIn, GitHub).
  + And the gathered data regarding the students’ performance will be considered in the process of the overall learner classification. In here all the data which is gathered in the previous stages will be considered here to increase the accuracy of the learner classification report.

DECLARATION (Students should add the Digital Signature)

“We declare that the project would involve material prepared by the Group members and that it would not fully or partially incorporate any material prepared by other persons for a fee or free of charge or that it would include material previously submitted by a candidate for a Degree or Diploma in any other University or Institute of Higher Learning and that, to the best of our knowledge and belief, it would not incorporate any material previously published or written by another person in relation to another project except with prior written approval from the supervisor and/or the coordinator of such project and that such unauthorized reproductions will construe offences punishable under the SLIIT Regulations.

We are aware, that if we are found guilty for the above mentioned offences or any project related plagiarism, the SLIIT has right to suspend the project at any time and or to suspend us from the examination and or from the Institution for minimum period of one year”.

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|  | **STUDENT NAME** | **STUDENT NO.** | **Signature** |
| 1 | Liyanage M.L.A.P. | IT19120812 | Shape, arrow  Description automatically generated |
| 2 | Thammita D.H.M.M.P. | IT19120362 | A black and white image of a guitar  Description automatically generated with medium confidence |
| 3 | Hirimathugoda U.J. | IT19138114 | A picture containing computer, dark, domestic cat, night sky  Description automatically generated |
| 4 | Liyanage N.L.T.N. | IT19184546 | A close-up of a logo  Description automatically generated with low confidence |

**Appendix 1: Reply email from the supervisor**

Graphical user interface, text, application, email

Description automatically generated

**Appendix 2: Reply email from the co-supervisor**

Graphical user interface, text, application, email, Teams

Description automatically generated

**Appendix 3: Reply email from the external supervisor**

Graphical user interface, text, application

Description automatically generated