# CHAPTER III

# RESEARCH METHODOLOGY

Each section discusses the approach to be used for the analysis and other technical specifications to help reinforce the proposal. It also includes diagrams, designs features techniques, and materials for implementing "iLearnCentral: a cloud-based learning center platform with mobile technology" to fulfill the study's goals requirement.

## Software Engineering Methodology

iLearnCentral's development study will use the agile approach as the project framework for software engineering. Agile software development defines an approach to software development under which requirements and ideas progress through the collaborative effort of cross-functional self-organizing teams.

One of the benefits of the agile approach that suits this study is collaboration and open interactions with designers, advisors, and collaborators based on their feedback and any changes that occur throughout the development. It promotes flexible planning, structural growth, first conveyance, ongoing transition, and facilitates rapid and adaptable response to change.



Figure 2: **Agile Development Methodology**

Figure 2 shows the representation of the framework lifecycle in an agile development methodology. The agile process requires less preparation, and the activities split into small increments. The agile process is for short-term projects with a team effort that meets the life cycle of software development (Sharma, 2012). By using customer feedback to agree on ideas, iteratively improves software This approach provides opportunities for assessing the path throughout the development lifecycle This performs by generic workflows, such as sprints or cycles to the end of which teams will deliver a material increment that is potentially transmittable. This approach focuses on the replication of abbreviated work cycles and the functional yields of the product.

The developers did the following phases of the Agile Methodology:

**Requirement Analysis.** Define the requirements for the iteration based on the product backlog, sprint backlog, customer and stakeholder feedback.

The gathered system features are from conducting research and interviews with industry experts in the related fields. The UI designer and the programmer must define the code specifications needed to fulfill the requirements of the project. The technical writer then takes note of changes and checks the document with all team members present. The database designer verifies if the features are compatible with the materials. The project manager must report the improvements made by the team to the team's advisor.

Initially, the team members will make the primary manuscript and background researches on learning centers, educators, and job-seekers to lay out the things to do. In every iteration, the team members assigned to work on the obstacles will analyze the issues and come up with a possible solution. They will consult on resolutions with the other members. At the end of each day, the team members will report on their progress.

**Plan Phase.** Phase of preparation involves creating a set of plans that helped guide the team through the phases of project implementation and closure. The plans produced during this process helped developers manage time, cost, performance, change, risk, and issues to ensure the project was delivered on time and within budget by the developers.

The team will determine schedules, preparations, and plans of actions to handle changes during the iteration. In every sprint cycle, the organizations made will be directed towards the fulfillment of its intentions. Itemized priorities and time constraints are the focus of budget allocation by the project manager. The team will establish communication routes for questions and issues that may arise.

**Design Phase.** The specifications evaluated and defined by the designers were used in the design phase to make design choices using various diagrams. The UI designer assigned is to creates the user interface. The programmer and database designer must describe the device element interface mechanism. The project manager will monitor the progress of the members' tasks. From the selected sprint backlog, the team determines which designs to tackle from the manuscript. There will be a parallel development of mobile and web applications.

**Development Phase.** This step requires testing usability and reliability for all aspects of the product. The software testing checks if it meets all the specifications set out in the evaluation of requirements and if it handles the information correctly.

The developers checked the software, analyzed it, and identified the issues and updated or modified it beyond the steps or requirements that were set up. Until deployment, all parts of the operation underwent a continuum of individual evaluation through different testing methods to ensure its efficacy and efficiency.

**Release.** Before releasing it to the market, developers carried out several activities to test the application. It allows the system to work within each operation of the deployment phase with tolerable performance and specific processes. Using the guidance given in the deployment document, developers then installed the application in the server environment.

**Track and Monitor.** This phase happens after the program was sent out to the customers/clients in this process. Developers maintain tracking, monitoring, and providing IT support services to include system and software updates and enhancements if appropriate. Feedback gathered from monitoring generates a list of improvements and bug fixes for the next iteration.

Another sprint cycle happens at the end of the previous. A sprint review with all members determines the set of activities for the next iteration. It will include adjustments from leftover unfinished tasks, additional features requested, and feedback from monitoring.

## Planning/Conception-Initiation Phase

The segment discusses the high-level decisions on why a project is valuable and what the requirements are. It helped the researchers keep track of assigned tasks, meeting deadlines, the progress of each requirement, and the budget for project work plans.

## Business Model Canvas

The Business Model Canvas is a visual representation, commonly used by strategic managers, of existing and emerging business models.

**Table 2**

BUSINESS MODEL CANVAS

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Key Partners** | **Key Activities** | **Value Proposition** | | **Relationships** | **Customer Segment** |
| -Learning centers administration  -Educators currently teaching in learning centers  -Job seeking educators | -Design and develop an intelligent school management software geared towards the needs of learning centers, educators, students | - System can be used by any type of learning center  - System could automate basic operations of administration with integrated artificial intelligence  - System has additionalsupport to the educators and students | | - Customer service hotlines  - User Feedback  - Email | - Learning center administration  - Educators in learning centers  - Students in learning centers  - Educators seeking employment |
| **Key Resources** | **Channels** |
| - Web domain and host  - Developers  - UI/UX designers  - Researchers | - On-location Visits  - Company Website  - Social Media Marketing  - Word of mouth |
| **Cost Structures** | | | **Revenue Streams** | | |
| - Customer acquisition costs  - Research and Development  - Marketing and Advertising  - Hosting, Operations and Maintenance | | | - Subsciption based on feature packages  - Ad Revenue from free or trial users | | |

Table 2 illustrates the system’s Business Model Canvass. The Business Model Canvass is essential in building a flourishing business market. It gives concrete ideas to the researchers about the target market of the project and the cost of developing it. The Value Proposition shows the importance it gives to the public. Channels are a way for the group to interact simultaneously with customers and investors to sell the program. Customer relationships ensure that the entities involved are supporting our business relationship. Revenue streams will demonstrate how we can earn revenue from the services provided.

## Program Workflow

Defining, managing, automating and optimizing business processes is a software workflow. Progressions of measures (tasks, events, interactions) involving a cycle of work, involving two or more individuals, and generating or adding value to the activities of the organization.



Figure 3: **User Activity Program Workflow**

Figure 3 shows the program workflow for general user activities. The administrative account creation and authentication starts with the registration of learning centers to the system. Job seekers register for an account to build their profile resume. The hiring module involves the learning center and job-seeking educator which could produce an employed educator. Only learning center and employed educator accounts can log in to most of the functionalities of iLearnCentral. Interested students/parents can inquire by creating a free account and browse through services offered by learning centers. Enrolment would involve input from both learning center and the student/parent. The scheduling is processed by iLearnCentral to produce calendars and notification to the employed educator and student/parent.



Figure 4: **Hiring Module Program Workflow**

Figure 4 details the hiring module from Figure 3. Job-seeking educators build their hiring profile or resume. After which the system processes their qualifications and determine a list of hiring learning centers from open job vacancies on which they apply for. They can also browse through other job vacancies available. On the other hand, learning centers receive recommended list of job-seeking profiles which fit their requirements.



Figure 5: **Enrolment Module Program Workflow**

Figure 5 shows the program workflow for the enrolment module. The student or parent will see a course list from the system provided by the chosen learning center. With the selected course/s, they can process enrolment by providing the required information. The system will calculate fees needed with the student/parent choosing methods of payment. Offline payment goes directly to the learning center, who would then record the transaction. Paying online is an option using various methods of online payments.



Figure 6: **Scheduling Module Program Workflow**

Figure 6 shows the workflow for the scheduling module. The administrative staff would input class details for scheduling. The students and educators have time available when they can have a class. Schedules depend on matches with class courses and educator’s open loads. There should be a consideration for the classrooms available and the learning center’s open business hours. Any changes to the schedule should automatically adjust schedules and notify all persons involved.



Figure 7: **Teaching Assistance Module Program Workflow**

Figure 7 shows the program workflow for the teaching assistance module. It involves assisting educators with their day to day activities, including lesson plans, record keeping, and tracking student's progression.

## Validation Board (Stages 1 and 2)

Table 3 shows the different problems that our customers encountered. It also shows the solution to the problem being solved by the researcher. Table 3 also contains the most risky assumption, the methods and the criteria for success, the results and the decision, as well as the learning.

**Table 3**

VALIDATION BOARD

|  |  |  |  |
| --- | --- | --- | --- |
| Experiments | 1 | 2 | 3 |
| Customer | Learning Center Administration | Employed Educator | Job-Seeking Educators |
| Problem | Small and medium learning centers still using manual transactions to support common management processes i.e. hiring, enrolment, and scheduling | Variation of lessons for different students handled, maintaining schedules, and keeping records | High turnover of educators in learning centers leading to constant demand amidst particular qualifications. |
| Solution | A dynamic learning center management system supporting different types of learning centers, i.e. day care, music, language studies | Adding a module for educators employed by a center to keep track of lessons, update schedules, and integrate records to the system. | Data pool of job-seeking educators sifted and recommended to fit learning centers' particular needs and vice versa. |
| Riskiest Assumption | Learning Center have no IT support | Learning center provide resources i.e. internet connectivity to employees | Educators uses the system to look for employment in learning centers |
| Method and Success Criteria | Interview | Interview | Survey |
| Results and Decision | Persevere | Persevere | Persevere |
| Learning | Learning centers differ considerably with provided services and management procedures. However, some similarities occur, such as hiring, enrolment, and schedules, giving them commonality. | Educators can follow standard lessons or build theirs based on it. But with variable student levels, they should keep track of progress for each under their purview. | Most job-seeking educators join learning centers to gain experience for higher-paying jobs. They are less likely to stay with learning centers offering low salaries leading to them finding other opportunities. |

## Gantt Chart / PERT Chart

This section presents a Gantt chart showing the work done or activities completed in specific time frames in relation to the amount planned for the specified periods. Every activity is performed in three different colors: red means that the activity is still incomplete, yellow means that the activity is still on the way, and green means that the activity is already finished. The chart serves as a guide for the advocates to decide how long a project will take, classify the resources needed, and schedule the order in which the complete tasks of the researchers are to be performed.

**Table 4**

GANTT CHART

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Task ID | Task Name | Task Lead | Start Date | End Date | August 2015 | | | | September 2015 | | | | October 2015 | | | |
| 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 1 | Title Consultation |  | Aug 16 | Sep 16 |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | Project Proposal recommended |  | Sep 16 | Sep 16 |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | Discussion with adviser | Jephunneh | Sep 19 | Sep 23 |  |  |  |  |  |  |  |  |  |  |  |  |
| 4 | Preliminary research of the project | Cristian | Sep 23 | Sep 26 |  |  |  |  |  |  |  |  |  |  |  |  |
| 5 | Writing of Chapter 1 | Cristian | Sep 23 | Sep 26 |  |  |  |  |  |  |  |  |  |  |  |  |
| 6 | Consultation with adviser on Chapter 1 | Jephunneh | Sep 27 | Sep 27 |  |  |  |  |  |  |  |  |  |  |  |  |
| 7 | Preparing of Transmittal Letter/s | Rhea Shane | Sep 16 | Sep 23 |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 | Preparing of Questionnaires | Rhea Shane | Sep 16 | Sep 23 |  |  |  |  |  |  |  |  |  |  |  |  |
| 9 | Interviews/Surveys | Rhea Shane | Sep 23 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | Finalizing of Chapter 1 | Cristian | Sep 27 | Sep 28 |  |  |  |  |  |  |  |  |  |  |  |  |
| 11 | Writing of Chapter 2 | Cristian | Sep 29 | Oct 2 |  |  |  |  |  |  |  |  |  |  |  |  |
| 12 | Consultation with adviser on Chapters 1 and 2 | Jephunneh | Oct 2 | Oct 2 |  |  |  |  |  |  |  |  |  |  |  |  |
| 13 | Finalizing of Chapter 2 |  | Oct 2 | Oct 4 |  |  |  |  |  |  |  |  |  |  |  |  |
| 14 | Writing of Chapter 3 | Rhea Shane | Oct 7 | Oct 17 |  |  |  |  |  |  |  |  |  |  |  |  |
| 15 | Consultation with adviser on Chapters 1, 2, and 3 | Jephunneh | Oct 18 | Oct 18 |  |  |  |  |  |  |  |  |  |  |  |  |
| 16 | Consultation with Technical Editor | Rhea Shane | Oct 18 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 17 | Writing of Initial and Final Pages | Jephunneh | Oct 14 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 18 | Final consultation with adviser | Jephunneh |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 19 | Compiling and finalizing of Manuscript | Rhea Shane | Oct 22 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20 | Poster design & preparation | Cristian | Oct 17 | Oct 20 |  |  |  |  |  |  |  |  |  |  |  |  |
| 21 | Presentation preparation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 22 | Proposal presentation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## Functional Decomposition Diagram

This section demonstrates the functional relationship between the various components of the decomposed project into critical modules to clearly illustrate and simplify various activities.



Figure 8: **Functional Decomposition Diagram**

## Analysis / Design Phase

The stage of analysis includes the concept of the specifications needed to accomplish the method. Each step determines the problem to be solved by the customer.

## Use Case Diagram

Use case diagram shows the graphic representation of the mechanism of iLearnCentral and potential sequences of interactions between systems and users in a specific environment related to a specific target.

Figure 9: **Use Case Diagram**

Figure 9 shows the use case diagram for iLearnCentral. It shows the outside view of the system and the requirements needed. It identifies the system's influencing external and internal factors and their interactions.

The learning center is a factor in most of the internal modules. Account management involves all actors with varying degrees of complexity for each actor. Job hiring only concerns with the learning center and the job-seeking applicant. Enrolment processing is between the learning center and the students/parents. Determining schedules need the interaction between the learning center, student/parent, and assigned educator. Lastly, teaching assistance is a module for employed educators to utilize.

## User Interface Diagram

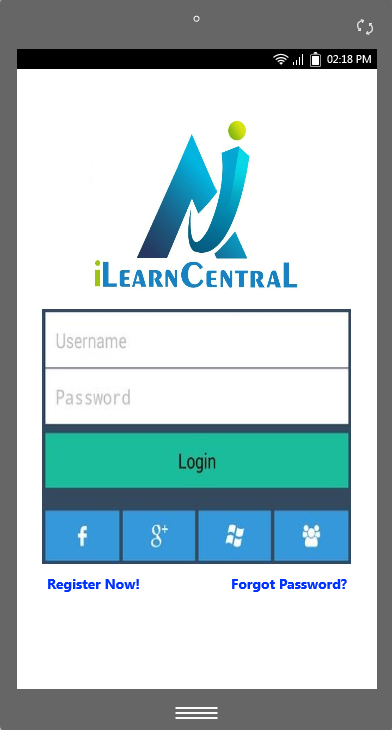


Figure 10: **Home Page**

Figure 10 shows the Home Page. User can enter their credentials to login. This page also provides new users to register and current users to retrieve their password in case they lost it.

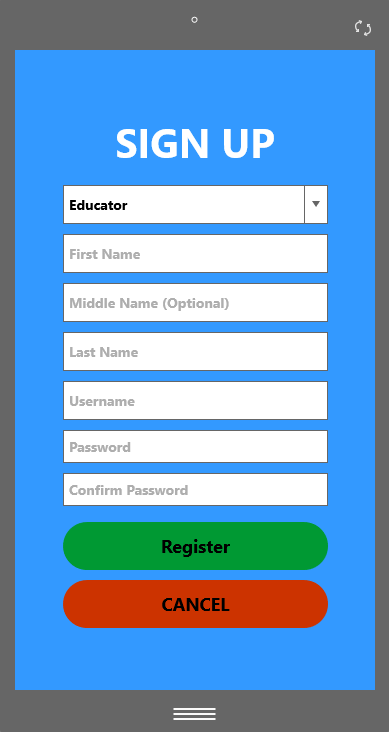
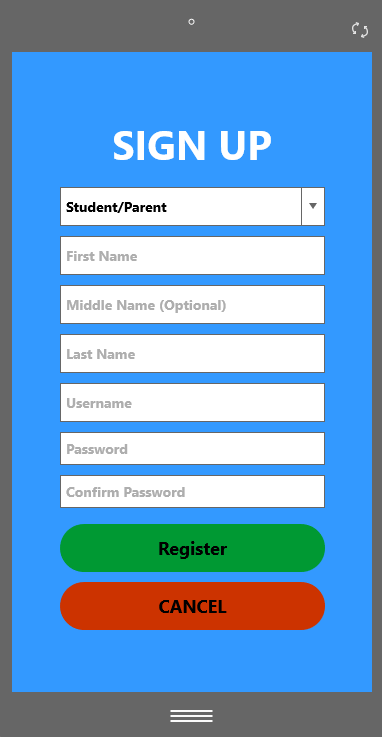
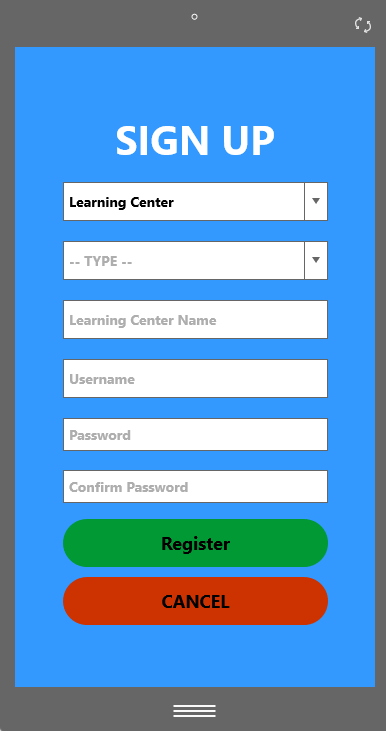
  

Figure 11: **SIGN UP/REGISTRATION**

There are three type of users – Educator, Student/Parent and Learning Center. The signup page for Learning Centers is different from the Educator and Student/Parent because they will be ask to specify the type of learning center that they have. The pages show required information for the registration – First Name, Middle Name, Last Name, Username and Password. Once filled out, users can click on ‘Register’ button to complete the registration or to cancel by clicking the ‘Cancel’ button.

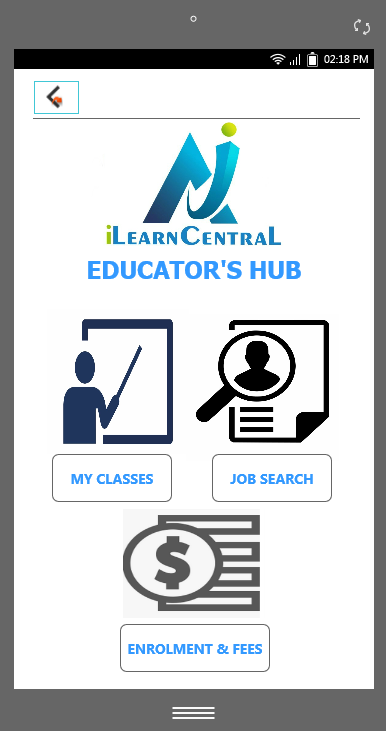


Figure 12: **Educator’s Hub**

Figure 12 shows the Educator’s Hub. Here, educators can check his classes, search jobs and check status of current Students’ enrolment and fees.

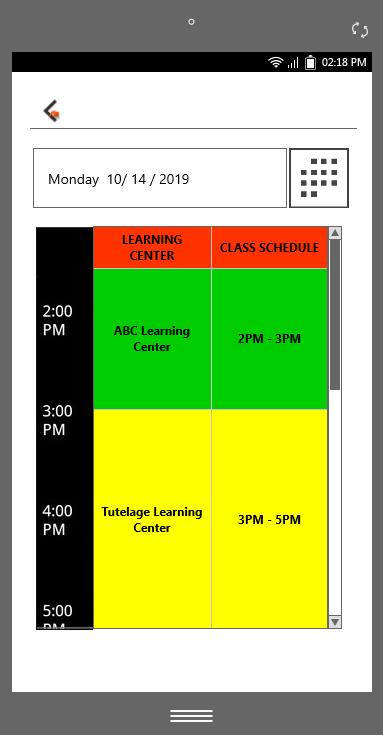


Figure 13: **Educator Classes**

Figure 13 shows the list of educator’s classes and schedule. The table includes the current date, name of the learning centers, time of classes.

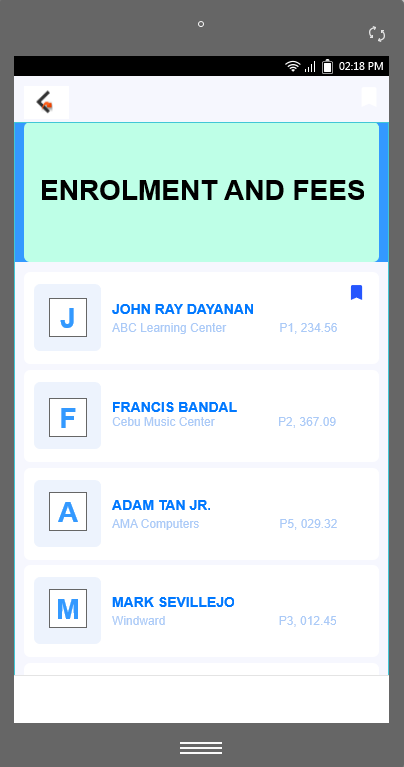


Figure 14: **ENROLMENT & FEES**

Figure 14 shows the list of the students, the learning centers that they are attending and the amount they need to pay the educator.

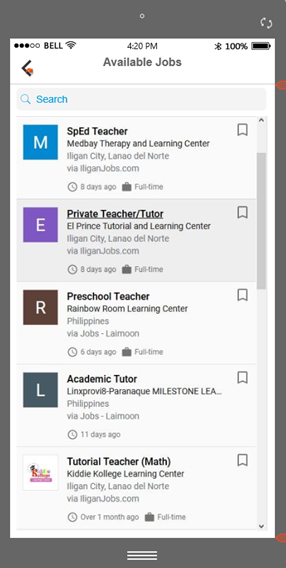


Figure 15: **Job Search**

Figure 15 shows the list of available learning center jobs. Educators can select and apply for the jobs that they are qualified.

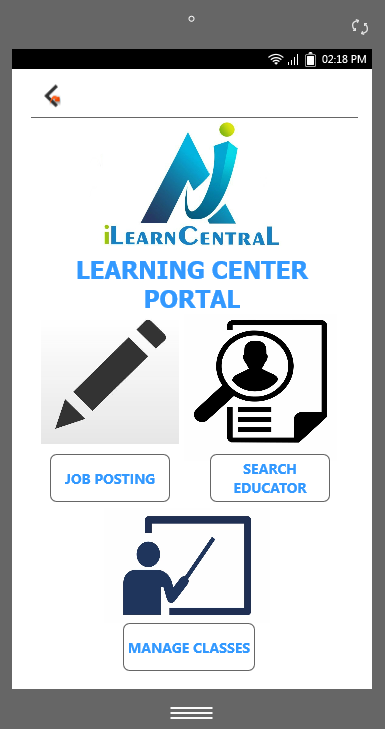


Figure 16: **Learning Center Portal**

Figure 16 shows the learning center portal. Here, Learning Centers can post jobs, search for educators and manage classes.

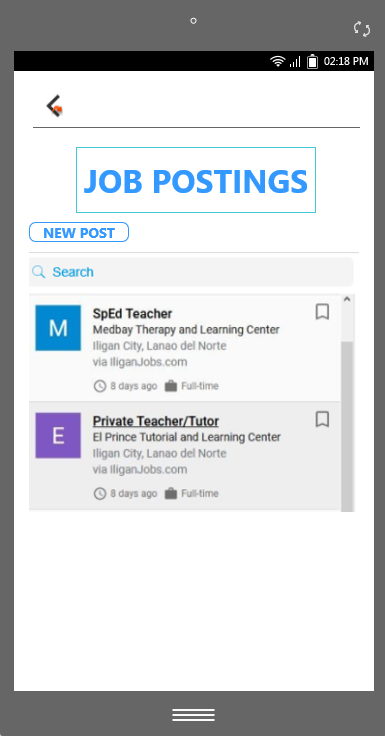


Figure 17: **Job Postings**

Figure 17 shows the jobs posted by a Learning Center. Learning Centers also have the option to add new job posting by clicking on the ‘New’ button.

## Database Design

The database to use is NoSQL due to the advantages it provides with data volume, velocity, and variety. It allows for better adaptability to changes in schema when using agile development. It is scalable and accessible to multitudes of users, which is necessary to a cloud-based system.

This section shows the designed NoSQL schema. The designing process follows the Query Driven Design that optimizes access instead of storage. It is by no means the final structure of the schema as changes will arise during the development process.

A document-oriented database, one of the main categories of NoSQL databases, is a computer program designed to store, retrieve, and handle document-oriented information, also known as semi-structured data. It is inherently a subclass of the key-value store and relies on an internal structure in the document to extract metadata that the database engine uses for further optimization. The current list of features in the documents presented in this section are basic details and more will be added or altered depending on the progress during development phase.

**Table 5**

USER DOCUMENT

|  |  |
| --- | --- |
| User | |
| PK | username |
|  | password |
|  | emailAddress |
|  | accountType |
|  | securityQuestions [ ]   |  | | --- | | question | | answer | |
|  | accountStatus |

Table 5 is the document database design for all user accounts. The collection of users is solely for account management. Depending on the type of account type, the system will proceed differenctly. The security questions are the means to provide validation in the event of resetting or retrieving forgotten passwords.

**Table 6**

LEARNING CENTER DOCUMENT

|  |  |
| --- | --- |
| LearningCenter | |
| PK | centerID |
| FK | accounts [ ]   |  | | --- | | username | | accessLevel | | status | |
|  | businessName |
|  | serviceType |
|  | businessAddress   |  | | --- | | buildingNo | | buildingName | | streetName | | subdivision | | barangay | | district | | city | | province | | country | | zipCode | |
|  | contactEmail |
|  | contactNumber [ ] |
|  | companyWebsite |
|  | operatingDays [ ] |
|  | openingTime |
|  | closingTime |
|  | coursesOffered [ ] |
|  | subscriptionType |
|  | subsciptionEndDate |

Table 6 is the definition of learning center document. It is considered the entity profile of a learning center.

**Table 7**

EDUCATOR DOCUMENT

|  |  |
| --- | --- |
| Educator | |
| PK | educatorID |
| FK | username |
|  | name   |  | | --- | | firstName | | middleName | | lastName | | extension | |
|  | birthday |
|  | employmentStatus |
| FK | centerID |
|  | position |
|  | address []   |  | | --- | | houseNo | | streetName | | subdivision | | barangay | | district | | city | | province | | country | | zipCode | | currentAddress | |
|  | email |
|  | phoneNo |
|  | gender |
|  | maritalStatus |
|  | religion |
|  | citizenship |

Table 7 is the definition of educator document. It is considered the entity profile of an educator. It represents the basic details for both employed or job-seeking educator. The employment status and accompanying centerID determines the state of an educator.

**Table 8**

RESUME DOCUMENT

|  |  |
| --- | --- |
| Resume | |
| PK | resumeID |
| FK | educatorID |
|  | careerObjective |
|  | educationalHistory [ ]   |  | | --- | | educationLevel | | schoolName | | schoolAddress | | course | | major | | yearStart | | yearEnd | | graduated | |
|  | employmentHistory [ ]   |  | | --- | | companyName | | companyAddress | | position | | dateStart | | dateEnd | |
|  | skills [ ] |
|  | qualities [ ] |
|  | interests [ ] |
|  | awards [ ] |
|  | references [ ]   |  | | --- | | referenceName | | affiliation | | position | | contactInfo | |

Table 8 is the definition of resume document. It is the accompanying resume of an educator account. It provides the usual information a job seeker provides to an establishment.

**Table 9**

STUDENT DOCUMENT

|  |  |
| --- | --- |
| Student | |
| PK | studentID |
| FK | username |
|  | name   |  | | --- | | firstName | | middleName | | lastName | | extension | |
|  | birthday |
|  | address []   |  | | --- | | houseNo | | streetName | | subdivision | | barangay | | district | | city | | province | | country | | zipCode | | currentAddress | |
|  | email |
|  | phoneNo |
|  | gender |
|  | maritalStatus |
|  | religion |
|  | citizenship |
| FK | centerID |
|  | enrolmentStatus |
|  | enrolmentHistory [ ] |

Table 9 is the definition of student entities. Essentially, the student is the entity with the account for the system. However, for minor students such as daycare, parents handle the account for them. Parents do not have an independent role in the system currently and are not part of the entities.

**Table 10**

JOB VACANCY DOCUMENT

|  |  |
| --- | --- |
| JobVacancy | |
| PK | vacancyID |
| FK | centerID  status |
|  | position |
|  | jobDescription |
|  | jobType |
|  | educationalRequirements   |  | | --- | | educationalLevel | | degrees [ ] | | majors [ ] | | minimunUnits | |
|  | qualifications [ ] |
|  | skills [ ] |
|  | incentives [ ] |
|  | responsibilities [ ] |
|  | requirements [ ] |
|  | applicationMethod [ ] |

Table 10 shows the data needed for a job vacancy. The job vacancy has to be made by a learning center. It has data on the position to be filled and all pertinent information required to qualify a job-seeker to the job.

**Table 11**

JOB APPLICATION DOCUMENT

|  |  |
| --- | --- |
| Job Application | |
| PK | jobApplicationID |
| FK | educatorID |
| FK | vacancyID |
|  | applicationDate |
|  | applicationStatus |
|  | preferredMethod |
|  | message |

Table 11 is the specifications for the job application document. The document store focuses on information collected when a job-seeker applies for a job vacancy listed.

**Table 12**

COURSE DOCUMENT

|  |  |
| --- | --- |
| Course | |
| PK | courseID |
| FK | centerID |
|  | courseName |
|  | courseDescription |
|  | tuition |

Table 12 shows the courses or services offered by a learning center. The courses will be the basis for enrolment and classes.

**Table 13**

ENROLMENT DOCUMENT

|  |  |
| --- | --- |
| Enrolment | |
| PK | enrolmentID |
| FK | centerID |
| FK | studentID |
|  | enrolmentDate |
|  | dateClassStart |
|  | dateClassEnds |
|  | noOfHours |
|  | enrolmentStatus |

Table 13 is the specifications for an enrolment event. The data composed of information about the actual enrolment. Details of learning center and students are taken from the Ids.

**Table 14**

PAYMENT DOCUMENT

|  |  |
| --- | --- |
| Payment | |
| PK | paymentID |
| FK | enrolmentID |
|  | tuition |
|  | additionalFees |
|  | balance |
|  | payments [ ]   |  | | --- | | paymentDate | | amount | | paymentMethod | | validated | |
|  | status |

Table 14 is the database for payment events. A single payment account for each enrolment event. Every account can have multiple payments.

**Table 15**

CLASS SESSION DOCUMENT

|  |  |
| --- | --- |
| ClassSession | |
| PK | classID |
| FK | courseID |
| FK | enrolmentID |
| FK | educatorID |
|  | date |
|  | timeStart |
|  | timeEnd |
|  | roomNo |

Table 15 is the data for each class session where an educator and student meet up. It is the actual session with day and time scheduled for the class.

**Table 16**

SCHEDULE REQUEST DOCUMENT

|  |  |
| --- | --- |
| ScheduleRequest | |
| PK | scheduleRequestID |
|  | restrictionType |
| FK | educatorID |
| FK | studentID |
| FK | centerID |
| FK | classID |
|  | scheduleDate |
|  | timeStart |
|  | timeEnd |

Table 16 is an entry of schedule request. The request can vary from available time and date to restricted times or date. The requestor may be a student or educator. It will be the basis for automatic scheduling of classes where requests are honored.

**Table 17**

LESSON PLAN DOCUMENT

|  |  |
| --- | --- |
| LessonPlan | |
| PK | lessonID |
| FK | courseID |
|  | topic |
|  | overview |
|  | objective [ ] |
|  | materials [ ] |
|  | activities [ ] |
|  | procedures [ ] |

Table 17 is the database for lesson plans. Lesson plans are premade from other sources, produced by learning centers, and customized by educators

**Table 18**

STUDENT RECORD DOCUMENT

|  |  |
| --- | --- |
| StudentRecord | |
| PK | studentRecordID |
| FK | enrolmentID |
|  | lessonPlansCovered [ ] |
| FK | classSession [ ]   |  | | --- | | classSessionID | | remarks | |
|  | studentScores [ ]   |  | | --- | | testTitle | | score | | perfectscore | | testDate | |

Table 18 represents the student records meant for educators to keep track of student progress and data. It can be linked to lesson plans and history of sessions attended. Test scores if applicable are also recorded.

## Entity-Relationship Diagram

This segment shows the relationship between iLearnCentral entities involved.



Figure 18: **Entity Relationship Diagram**

Figure 18 shows the entity-relationship diagram, graphically demonstrating the interactions of entities, activities, events, and relationships across all modules of the system.

## Data Dictionary

This section describes the types of data, properties and field sizes shown in the tables in the previous section. The tables below are data dictionaries for each table in the database.

**Table 19**

USER DOCUMENT DATA DICTIONARY

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Key Name | **Data Type** | **Field Size** | **Null** | **Description** | |
| username | VARCHAR | 20 | NOT NULL | | name of user used to log in |
| password | VARCHAR | 20 | NOT NULL | | value used to verify the identity of a user |
| emailAddress | VARCHAR | 30 | NOT NULL | | valid email address for verifying account |
| accountType | VARCHAR | 20 | NOT NULL | | determines the user account designation |
| securityQuestions | LIST |  | NOT NULL | | array of security questions used for validating user identity |
| question | VARCHAR | 50 | NOT NULL | | single security question |
| answer | VARCHAR | 20 | NOT NULL | | answer to a security question |
| accountStatus | VARCHAR | 20 | NOT NULL | | the state of the user if they are validated, etc |

**Table 20**

LEARNING CENTER DOCUMENT DATA DICTIONARY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key Name | **Data Type** | **Field Size** | **Null** | **Description** |
| centerID | LONG | 20 | NOT NULL | primary key for learning center document |
| accounts | LIST |  | NOT NULL | array of user accounts in a learning center entry |
| username | VARCHAR | 20 | NOT NULL | foreign key for name of user used to log in |
| accessLevel | VARCHAR | 10 | NOT NULL | access levels to determine how a user can use the learning center's features |
| status | VARCHAR | 10 | NOT NULL | status of a user account in learning center |
| businessName | VARCHAR | 100 | NOT NULL | complete business name of a learning center |
| serviceType | VARCHAR | 50 | NOT NULL | type of service provided by learning center |
| businessAddress |  |  |  | address of business |
| buildingNo | VARCHAR | 10 | NULL | building number part of the address |
| buildingName | VARCHAR | 20 | NULL | building name part of the address |
| streetName | VARCHAR | 20 | NULL | streetName part of the address |
| subdivision | VARCHAR | 20 | NULL | subdivision part of the address |
| barangay | VARCHAR | 20 | NOT NULL | barangay part of the address |
| district | VARCHAR | 10 | NULL | district part of the address |
| city | VARCHAR | 20 | NOT NULL | city part of the address |
| province | VARCHAR | 20 | NOT NULL | province part of the address |
| country | VARCHAR | 20 | NOT NULL | country part of the address |
| zipCode | INT | 4 | NOT NULL | zip code part of the address |
| contactEmail | VARCHAR | 30 | NOT NULL | official learning center email address |
| contactNumber | VARCHAR | 20 | NOT NULL | contact numbers for learning center |
| companyWebsite | VARCHAR | 30 | NULL | website to visit and learn more about learning center |
| operatingDays | LIST |  | NOT NULL | days the learning center is open |
| openingTime | TIME |  | NOT NULL | time the learning center opens |
| closingTime | TIME |  | NOT NULL | time the learning center closes |
| coursesOffered | LIST |  |  | list of courses offered by the learning center |
| subscriptionType | VARCHAR | 10 | NOT NULL | determines the current subscription |
| subscriptionType | DATE |  | NULL | date when a subscription ends and reverts to limited |

**Table 21**

EDUCATOR DOCUMENT DATA DICTIONARY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key Name | Data Type | Field Size | Null | Description |
| educatorID | LONG | 20 | NOT NULL | primary key for educator |
| username | VARCHAR | 20 | NOT NULL | foreign key for name of user used to log in |
| name |  |  |  | name of educator |
| firstName | VARCHAR | 50 | NOT NULL | first name of person |
| middleName | VARCHAR | 20 | NULL | middle name of person |
| lastName | VARCHAR | 20 | NOT NULL | last name of person |
| extension | VARCHAR | 10 | NULL | extensions to name such as Sr., Jr., III, IV, etc. |
| birthday | DATE |  | NOT NULL | birthdate of educator |
| address | LIST |  |  | addresses of an educator |
| houseNo | INT | 10 | NULL | house number part of the address |
| streetName | VARCHAR | 20 | NULL | street number part of the address |
| subdivision | VARCHAR | 20 | NULL | subdivision part of the address |
| district | VARCHAR | 10 | NULL | district part of the address |
| city | VARCHAR | 20 | NOT NULL | city part of the address |
| province | VARCHAR | 20 | NOT NULL | province part of the address |
| country | VARCHAR | 20 | NOT NULL | country part of the address |
| zipCode | INT | 4 | NOT NULL | zip code part of the address |
| currentAddress | BOOLEAN |  | NOT NULL | tag determining if the address is the current one |
| email | VARCHAR | 30 | NOT NULL | email address of educator |
| phoneNo | VARCHAR | 15 | NOT NULL | contact no of educator |
| gender | char | 1 | NOT NULL | gender of educator (F, M) |
| maritalStatus | VARCHAR | 10 | NOT NULL | marital status of an educator |
| religion | VARCHAR | 30 | NULL | religion of the educator |
| citizenship | VARCHAR | 30 | NULL | citizenship of the educator |
| employmentStatus | VARCHAR | 10 | NOT NULL | status of employment in respect to learning centers in the system |
| centerID | INT | 10 | NULL | foreign key for centerID employing this educator |
| position | VARCHAR | 20 | NULL | position for employed educators in a learning center |

**Table 22**

RESUME DOCUMENT DATA DICTIONARY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key Name | Data Type | Field Size | Null | Description |
| resumeID | LONG | 20 | NOT NULL | primary key for resume document |
| educatorID | LONG | 20 | NOT NULL | foreign key to distinguish the owner of resume document |
| careerObjective | VARCHAR | 500 | NULL | short description for career objectives in a resume |
| educationalHistory | LIST |  |  | list of educational history of an educator |
| educationLevel | VARCHAR | 20 | NOT NULL | determines the level of education i.e. elementary, college |
| schoolName | VARCHAR | 100 | NOT NULL | school name of previous education |
| schoolAddress | VARCHAR | 300 | NOT NULL | address of the school |
| course | VARCHAR | 100 | NULL | course taken |
| major | VARCHAR | 50 | NULL | major taken during the course |
| yearStart | INT | 4 | NOT NULL | starting year in this school |
| yearEnd | INT | 4 | NOT NULL | ending year in this school |
| graduated | BOOLEAN |  | NOT NULL | true if graduated, false if undergraduate |
| employmentHistory | LIST |  |  | list of employment history of an educator |
| companyName | VARCHAR | 100 | NOT NULL | name of previous company |
| companyName | VARCHAR | 300 | NOT NULL | address of previous company |
| position | VARCHAR | 100 | NOT NULL | position or job description of previous company |
| dateStart | DATE |  | NOT NULL | date started with previous employment |
| dateEnd | DATE |  | NOT NULL | date ended with previous employment |
| skills | LIST |  | NULL | list of skills in a resume |
| qualities | LIST |  | NULL | list of qualities in a resume |
| interests | LIST |  | NULL | list of interests in a resume |
| awards | LIST |  | NULL | list of awards in a resume |
| references | LIST |  | NULL | list of references for individual |
| referenceName | VARCHAR | 50 | NOT NULL | name of reference |
| affiliation | VARCHAR | 100 | NOT NULL | company of the reference |
| position | VARCHAR | 50 | NOT NULL | position of the reference in their company |
| contactInfo | VARCHAR | 30 | NOT NULL | contact information of the reference |

**Table 23**

STUDENT DOCUMENT DATA DICTIONARY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key Name | Data Type | Field Size | Null | Description |
| studentID | LONG | 20 | NOT NULL | primary key for the student document |
| username | VARCHAR | 20 | NOT NULL | foreign key for name of user used to log in |
| name |  |  |  | name of student |
| firstName | VARCHAR | 50 | NOT NULL | first name of person |
| middleName | VARCHAR | 20 | NULL | middle name of person |
| lastName | VARCHAR | 20 | NOT NULL | last name of person |
| extension | VARCHAR | 10 | NULL | extensions to name such as Sr., Jr., III, IV, etc. |
| birthday | DATE |  | NOT NULL | birthdate of educator |
| address | LIST |  |  | addresses of an educator |
| houseNo | INT | 10 | NULL | house number part of the address |
| streetName | VARCHAR | 20 | NULL | street number part of the address |
| subdivision | VARCHAR | 20 | NULL | subdivision part of the address |
| district | VARCHAR | 10 | NULL | district part of the address |
| city | VARCHAR | 20 | NOT NULL | city part of the address |
| province | VARCHAR | 20 | NOT NULL | province part of the address |
| country | VARCHAR | 20 | NOT NULL | country part of the address |
| zipCode | INT | 4 | NOT NULL | zip code part of the address |
| currentAddress | BOOLEAN |  | NOT NULL | tag determining if the address is the current one |
| email | VARCHAR | 30 | NOT NULL | email address of educator |
| phoneNo | VARCHAR | 15 | NOT NULL | contact no of educator |
| gender | char | 1 | NOT NULL | gender of educator (F, M) |
| maritalStatus | VARCHAR | 10 | NOT NULL | marital status of an educator |
| religion | VARCHAR | 30 | NULL | religion of the educator |
| citizenship | VARCHAR | 30 | NULL | citizenship of the educator |
| centerID | INT | 10 | NULL | centerID for the current learning center enroled in |
| enrolmentStatus | VARCHAR | 10 | NULL | status of enrolment |
| enrolmentHistory | LIST |  |  | list of enrolmentIDs, foreign key, of instances of enrolment made by the student |

**Table 24**

JOB VACANCY DOCUMENT DATA DICTIONARY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key Name | Data Type | Field Size | Null | Description |
| vacancyID | LONG | 20 | NOT NULL | primary key for job vacancy entries |
| centerID | LONG | 20 | NOT NULL | foreign key for Learning center creator of job vacancy |
| status | VARCHAR | 10 | NOT NULL | status of the job vacancy i.e. active, cancelled, filled |
| position | VARCHAR | 30 | NOT NULL | position to be filled |
| jobDescription | VARCHAR | 400 | NULL | description of the job position |
| jobType | VARCHAR | 25 | NOT NULL | type of job i.e. full-time, part-time, full-time or part-time |
| educationalRequirements | LIST |  |  | requirements based on educational attainment |
| educationalLevel | VARCHAR | 200 | NOT NULL | educational attainment needed i.e. high school graduate, college level |
| degrees | LIST |  | NULL | degrees earn from school i.e. bachelor of Secondary Education |
| majors | LIST |  | NULL | major taken during from the degrees |
| minimunUnits | INT |  | NULL | minimum number of units required |
| qualifications | LIST |  | NOT NULL | list of qualifications needed |
| skills | LIST |  | NULL | list of skills needed |
| incentives | LIST |  | NULL | list possible incentives to entice applicants |
| responsibilities | LIST |  | NULL | list of possible responsibilities |
| requirements | LIST |  | NULL | list of what requirements applicants need to give |
| applicationMethod | VARCHAR |  | NULL | list of ways to apply |

**Table 25**

JOB APPLICATION DOCUMENT DATA DICTIONARY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key Name | Data Type | Field Size | Null | Description |
| jobApplicationID | LONG | 20 | NOT NULL | primary key for job application |
| educatorID | LONG | 20 | NOT NULL | foreign key to the educator making the job application |
| vacancyID | LONG | 20 | NOT NULL | foreign key for the vacancy applied for |
| applicationDate | DATE |  | NOT NULL | date the job was applied to |
| applicationStatus | VARCHAR |  | NOT NULL | status of the application i.e. pending, accepted, rejected |
| preferredMethod | VARCHAR |  | NULL | what way the application was done i.e. walk-in |
| message | VARCHAR | 10000 | NULL | optional message to the learning center |

**Table 26**

COURSE DOCUMENT DATA DICTIONARY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key Name | Data Type | Field Size | Null | Description |
| courseID | LONG | 20 | NOT NULL | primary key for the course |
| centerID | LONG | 20 | NOT NULL | foreign key for the center offering the course |
| courseName | VARCHAR | 100 | NOT NULL | name of course or class offered |
| courseDescription | VARCHAR | 500 | NOT NULL | description of the course or class offered |
| courseType | VARCHAR | 30 | NULL | if any, the course type |
| tuition | FLOAT |  | NULL | tuition amount for a course |

**Table 27**

ENROLMENT DOCUMENT DATA DICTIONARY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key Name | Data Type | Field Size | Null | Description |
| enrolmentID | LONG | 20 | NOT NULL | primary key for enrolment |
| centerID | LONG | 20 | NOT NULL | foreign key to which center |
| studentID | LONG | 20 | NOT NULL | foreign key to which student |
| enrolmentDate | DATE |  | NOT NULL | date enrolment occurred |
| dateClassStart | DATE |  | NULL | date for start of classes |
| dateClassEnds | DATE |  | NULL | date for end of classes |
| noOfHours | INT | 5 | NULL | number of hours for the course |
| enrolmentStatus | VARCHAR | 20 | NOT NULL | status of the enrolment |

**Table 28**

PAYMENT DOCUMENT DATA DICTIONARY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key Name | Data Type | Field Size | Null | Description |
| paymentID | LONG | 20 | NOT NULL | primary key for payment |
| enrolmentID | LONG | 20 | NOT NULL | foreign key for enrolment |
| tuition | FLOAT |  | NOT NULL | tuition amount |
| additionalFees | FLOAT |  | NULL | amount of additional fees |
| balance | FLOAT |  | NOT NULL | current balance |
| payments [ ] | LIST |  | NULL | list of payments made |
| paymentDate | DATE |  | NOT NULL | date a payment is made |
| amount | FLOAT |  | NOT NULL | amount, partial or full for payment |
| paymentMethod | VARCHAR | 40 | NOT NULL | method the payment is made |
| validated | BOOLEAN |  | NOT NULL | validation for payment |
| status | VARCHAR | 20 | NOT NULL | status of payment, complete or with balance |

**Table 29**

CLASS SESSION DOCUMENT DATA DICTIONARY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key Name | Data Type | Field Size | Null | Description |
| classID | LONG | 20 | NOT NULL | primary key for the class instance |
| courseID | LONG | 20 | NOT NULL | foreign key to the course the class is under |
| enrolmentID | LONG | 20 | NOT NULL | foreign key of the enrolment bases of the class |
| educatorID | LONG | 20 | NULL | educator assigned to the class |
| date | DATE |  | NOT NULL | the date of the class |
| timeStart | TIME |  | NOT NULL | the time it will start |
| timeEnd | TIME |  | NOT NULL | the time it should end |
| roomNo | VARCHAR |  | NOT NULL | the room number assigned to the class |

**Table 30**

SCHEDULE REQUEST DOCUMENT DATA DICTIONARY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key Name | Data Type | Field Size | Null | Description |
| scheduleRequestID | LONG |  | NOT NULL | primary key for schedule restriction request |
| restrictionType | VARCHAR | 50 | NOT NULL | type of restriction i.e. available, restricted |
| educatorID | LONG | 20 | NULL | foreign key to educator requesting the schedule |
| studentID | LONG | 20 | NULL | foreign key to student requesting the schedule |
| centerID | LONG | 20 | NOT NULL | foreign key to learning center requested to |
| classID | LONG | 20 | NULL | foreign key for the specific class if necessary |
| scheduleDate | DATE |  | NOT NULL | the date a schedule is requested |
| timeStart | TIME |  | NULL | a possible start time of schedule request |
| timeEnd | TIME |  | NULL | a possible end time of schedule request |

**Table 31**

LESSON PLAN DOCUMENT DATA DICTIONARY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key Name | Data Type | Field Size | Null | Description |
| lessonID | LONG | 20 | NOT NULL | primary key for lesson plan |
| courseID | LONG | 20 | NOT NULL | foreign key for learning center |
| topic | VARCHAR | 100 | NOT NULL | topic of the lesson plan |
| overview | VARCHAR | 500 | NULL | short description of the topic to plan for |
| objective | LIST |  | NULL | a list of objectives for the lesson plan |
| materials | LIST |  | NULL | a list of materials for the lesson plan |
| activities | LIST |  | NULL | a list of activities for the lesson plan |
| procedures | LIST |  | NULL | a list of procedures for the lesson plan |

**Table 32**

STUDENT RECORD DOCUMENT DATA DICTIONARY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key Name | Data Type | Field Size | Null | Description |
| studentRecordID | LONG | 20 | NOT NULL | primary key for student record |
| enrolmentID | LONG | 20 | NOT NULL | foreign key to enrolment id associated with record |
| lessonPlansCovered | LIST |  | NULL | the lesson plans tackled by the student |
| classSession | LIST |  | NULL | the class sessions the student showed up to |
| classSessionID | LONG | 20 | NOT NULL | foreign key to the class session ID |
| remarks | VARCHAR | 500 | NULL | remarks an educator can give to the student |
| studentScores | LIST |  | NULL | possible scores for student when tests occur |
| testTitle | VARCHAR | 200 | NOT NULL | title for the test |
| score | INT | 20 | NOT NULL | score the student got |
| perfectscore | INT | 20 | NOT NULL | perfect score the student can get |
| testDate | DATE |  | NOT NULL | date the score was taken |

## Network Model

The model of the network shows how the system components communicate via the internet. The diagram shows that the user is able to check and monitor their account through application for possible breaches or errors.



Figure 19: **Network Model**

Figure 19 shows the network model of the system. Internet is used for both web and mobile app to interact with the database.

## Network Topology

The network topology illustrates how the system's component work in conjunction with the use of internet connection to access the user's access database.



Figure 20: **Network Topology**

Figure 20 shows the network topology of the system. As shown the user can use both web and mobile app with the help of the internet. They can manage classes, check schedules, post and search jobs, etc.

## Development/Construction/Build Phase

The Development Phase marks the end of the initial process segment and marks the beginning of development. This phase is intended to turn the prototyped system design in the Design Phase into a working system that meets all defined system requirements. Two elements are required to complete this phase successfully: 1) a complete set of design specifications and 2) proper processes, standards and tools.

## Technology Stack Diagram



Figure 21: **Technology Stack Diagram**

**Technology Stack for Mobile**

**Android Studio** is an integrated development environment for the Android operating system. It was built on JetBrains' IntelliJ IDEA software and designed for android development. It comprises both frontend and backend development by using XML and java.

**XML**,meaning eXtensible Markup Language, is a markup language built as a standard way to encode data in internet-based applications. Android uses it in creating layouts and components as Front End for typical applications.

**Java** is one of the languages used in android development. Java's mobile version is called Java ME. Many smartphones and tablets support it. The Java Platform Micro Edition (Java ME) provides a flexible, secure environment for building and running applications that target embedded and mobile devices. Java ME addresses the challenge of running applications on devices that are low on memory, display, and power available.

**Technology Stack for Website**

**ReactJs** is a JavaScript library that is declarative, powerful and scalable to create user interfaces. This allows complex UIs to be constructed from small and isolated pieces of code called "components."

**Bootstrap** is a free and open-source front end development platform for website and web app construction. The architecture for Bootstrap is based on HTML, CSS, and JavaScript (JS) to promote the development of responsive, first mobile sites and apps.

**HTML**, or HyperText Markup Language, is the standard markup language for creating Web pages. It describes the structure of a Web page. Consisting of a series of elements or tags, it tells the browser how to display content.

**CSS**, short for Cascading Style Sheets, a new feature introduced to HTML that provides more control over how pages present to both website developers and users.

**JavaScript** is a scripting language on the client-side. It means that the web browser of the client interprets the source code instead of the webserver. JavaScript functions can run without interacting with the server after a web page loads.

**Node.js** (Node) is an open-source framework for the server-side execution of JavaScript code. Node is useful for developing applications requiring a persistent connection between the browser and the server and is often used for real-time applications such as chat, news feeds, and web push notifications.

**Technology Stack for Database**

**Cloud Firestore** is a repository of NoSQL documents designed for automatic scaling, high performance, and ease of application development.

**Technology Stack for File Management**

**GitHub** is a system used to store a project's source code and record any modifications to that code in its entire history. It allows developers to work more efficiently on a project by providing resources from different developers to manage potentially conflicting changes.

## Software Specification

The section describes the functional requirements used in the study. It includes the programming language, platform for development, and management of the database.

The mobile development uses Android Studio IDE with Java being the back end programming language, and XML for front end builds. The application can run in any android device with Android 5.0 Lollipop version and higher.

The website or web app development involves the use of Node Js for backend support. For the frontend, React js is the primary framework to create the components with Bootstrap providing design beatification. HTML, CSS, and Javascript are additional languages to use when necessitated. Sublime IDE is the preferred environment used to code the web app. However, collaborators may use other applications suitable for the purpose.

Cloud Firestore is the database of choice to support the project. Both mobile and web application connects to Firestore for all data. GitHub supports the collaboration of the members and allows them to code concurrently for more efficient and time-conscious development.

## Program Specifications

Program specifications contain the list of algorithms needed for the system.

**Table 33**

PROGRAM SPECIFICATIONS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Programmer/s** | **Modules** | **Learning Center** | **Educator** | **Parent or Student** |
|  | **Account Management** |
| 1. Registration | \* | \* | \* |
| 2. Authentication | \* | \* | \* |
| 3. Login | \* | \* | \* |
| 4. Profiling | \* | \* |  |
| No. of Points *(1 point per module per user)* | | 1 | 1 | 1 |
|  | **Hiring Module** |  | | |
| 1. Hiring Profile/Resume |  | \* |  |
| 2. Job Searching |  | \* |  |
| 3. Job Posting | \* |  |  |
| 4. Job Suggestion |  | \* |  |
| 5. Hire Suggestion | \* |  |  |
| 6. Hiring | \* |  |  |
| No. of Points *(1 point per module per user)* | | 1 | 1 | 0 |
|  | **Enrollment Module** |  | | |
| 1. Input/Add Course Details | \* |  |  |
| 2. Search/Display Course List | \* | \* | \* |
| 3. Course Selection |  |  | \* |
| 4. Fee Calculation |  |  | \* |
| 5. Enrolment Details and Processes |  |  | \* |
| 6. Payment Scheme Selection |  |  | \* |
| 7. Payment |  |  | \* |
| 8. Record Payment | \* |  | \* |
| No. of Points *(1 point per module per user)* | | 1 | 1 | 1 |
|  | **Scheduling Module** |  | | |
| 1. Input Class Details | \* |  |  |
| 2. Update Class Details | \* |  |  |
| 3. Input Schedules | \* |  |  |
| 4. Schedule Request |  | \* | \* |
| 5. Update Schedules | \* |  |  |
| 6. Generate Calendar of Activities | \* | \* | \* |
| 7. Notification of Changes | \* | \* | \* |
| No. of Points *(1 point per module per user)* | | 1 | 1 | 1 |
|  | **Teaching Assistance Module** |  | | |
| 1. Retrieve Class Details |  | \* |  |
| 2. Suggest Daily Lesson Plan |  | \* |  |
| 3. Keep Student Records |  | \* |  |
| 4. Track Student Progress |  | \* |  |
| No. of Points *(1 point per module per user)* | | 0 | 1 | 0 |
| Number of Modules per User *(equals total no. of points per user)* | | 4 | 5 | 3 |
| Total Number of Modules | | 12 | | |