Dee Hwa Liong Academy Grade Management System

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Abstract

Dee Hwa Liong Academy currently uses spreadsheet files to keep student records. In result, the academy faces several difficulties, which include tedious process for storing student records, long preparation time, and lack of security. Dee Hwa Liong Grade Management System will lessen the time needed for grade submission and deliberation, and it will also provide security features for the class records. The system will also eradicate the need of using flash drives and facebook messenger for submission of grades. Tracking late submissions of grades will also be easier since there will be deadline feature which will be set for each teacher in the system. The application will also provide security for students' records since grades will not be easily modified and an edit log will also be available. In addition, this application will also keep parents up to date with their child's performance.

Keywords: information system, web-based application, k to 12, grade management system

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I. Introduction

A. Background of the Study

The Philippines recently implemented a comprehensive reform on its basic education known as the K to 12 program [1]. The K to 12 program encompasses kindergarten and 12 years of basic education - six years primary education, four years Junior High School and two years Senior High School [2]. With this program, the Philippines is slowly matching the global standards in secondary education. The main objectives of the program are to better prepare students for higher education, to gain eligibility for domestic and overseas educational institutions, and to provide immediate employability upon graduating [1].

With the new educational program, a new curriculum was introduced together with its subjects. The kindergarten curriculum framework applies the goals of the k to 12 program and implements the general principles of the National Early Learning Framework. Students in grades 1 to 10 will encounter an improved, context-based, and spiral progression learning curriculum with several subjects. On the other hand, Senior High School (SHS) is two years of secondary education with specialization. A student will choose a career track - Academic, Technical-Vocational-Livelihood, and Sports and Arts. The chosen career track will define a student's subjects [1].

The new program with new curriculum will also include changes in the grading system. The Department of Education (DepEd) provided teachers a free copy of Electronics Class Record (ECR) Templates [3]. The templates provide grade computation consistent with DepEd Order No. 8, s. 2015, referred to as the Policy Guidelines on Classroom Assessment for the K to 12 Basic Education Program.

ECR templates are MS Excel based. It has three (3) components for grades: Written Work, Performance Tasks, and Quarterly Assessment. By downloading and comparing the different ECR templates, the templates differ at least each grade level. The ECR also changes when Senior High students are being handled. Some of the changes include following a different set of weights for each component compared to grades 1 to 10.

Class records are one of the most important things kept by teachers. This holds all the class performance of the students a teacher handles [4]. At present creating an online or web-based class record system is possible. Teachers and school administrators

are also updated with technology [4]. They can use laptops, computers and even phones easily. Keeping class records or records, in general, is commonly done with the use of spreadsheet applications [4]. Even though spreadsheets have proven to be a useful tool for keeping records, creating an application with better management capabilities is possible.

B. Statement of the Problem

Dee Hwa Liong Academy is an eduational institution that implements the K to 12 program. This academy uses spreadsheet to keep student records. In result, the academy faces several difficulties, which include tedious process for storing student records, long preparation time, and lack of security.

The academy suffers long preparation time for creating spreadsheet files for each teacher. These excel files are called Electronic Class Record (ECR), an excel file provided by DepEd which includes lists of student's grades in each component (Written Work, Performance Task, and Quarterly Assessment) per subject. Before the classes start, the Information Technology (IT) head gets all enrolled students, their corresponding section, and the subject load of each teacher from the registrar's office. The IT head manually generates a teacher-centric spreadsheet file from these data for each teacher, adding the teacher's current load with corresponding students enrolled in that subject. The weight of each component is also manually changed depending on the guidelines that was given by DepEd. The load of each teacher can vary, thus spreadsheet files contain multiple class records. The said preparation will be repeated twice a year for Senior Highschool teachers and once a year for non-SHS subject teachers.

After a five-day examination period, the teachers are given a two-week time window to fill up the scores of their handling students for each subject. After making sure that a teacher has already submitted all their completed class records, an individual delibration is taken place. This delibration process includes a face-to-face meeting with the IT head and registrar, running down all the student scores, and checking for possible incorrect or missing fields. Late submission of grades can cause a delay of the group deliberation. One of the difficulties that the IT head and registrar also encounter is the lack of security in the spreadsheet files. The submission of grades is usually done through flash drive or via facebook messenger. In effect, these excel files can easily be duplicated (losing track

of the most updated file) and a possible modification can be done without the permission of certain authorities. Moreover, these records are also prone to data corruption.

After checking every class records of all teachers, the IT head then manually generates section-centric spreadsheet files which contain lists of students under a given subject. Each file also includes the condensed grade of each student as well as their grade for each corresponding subjects. This process involves linking multiple teacher-centric class records to a single spreadsheet file.

Generating student-centric report cards can be a tedious process most especially for SHS students. The problem arose when the academy's population started to increase, thus also increases the number of students with backlog subjects. The IT head has to personalize the report cards for irregular students, since they have a different set of currently taking subjects.

C. Objectives of the Study

The main goal of the study is to develop a web-based application for record keeping of students' grades with the following functionalities:

1. The application will have a **System Administrator** who will be able to:
    (a) Login and logout
    (b) Change administrator password
    (c) View and update profile
    (d) Create user accounts
    (e) Delete an account
        i. Account deletion will only happen if the owner of the account is no longer affiliated with the school or is suspended from work and other reasons for deactivation.
    (f) View the edit/update log of the class records
        i. This is a read-only log. Its sole purpose is to keep track of all the changes happening in the class records submitted.
2. The application will have a **Director**'s account. The director will be able to:

(a) Login and logout

(b) View and update profile

(c) Change his/her password

(d) View grades from each subjects

i. These class records will also provide student information, name, student number, and section. The name of the teacher will also be included. The administator has also the option to view the records in teacher-centric, section-centric, or student-centric

(e) View condensed grades of each section

i. Condensed grades will not only show grades. It will also give information about the teachers assigned to each subject and the adviser of the section being viewed.

(f) View list and number of students who passed/failed

(g) View list and number of honor students

3. A **Registrar**'s account will be able to do the following functionalities:

(a) Login and logout

(b) View and update profile

(c) Change his/her password

(d) Set deadline for submission of grades

i. Deadline for submission of grades will be set to be able to see who submitted late since a fine is to be collected for every day, after the due date, without submission. Deadline alerts will be automatically sent by the system, during 5 days and 3 days before the deadline and during the deadline day. Different deadline for teachers is possible especially if one teacher has more load compared to others.

(e) View student records

i. The student record view can be teacher-centric, section-centric, and student-centric

(f) View and produce report cards

(g) View school information, Elementary Learners Data, Elementary Learners Age Profile, Junior High School Learners Data, JHS Learners Age Profile, Senior High School Repeaters Age Profile, SHS Learners Data by Track, SHS Learners Data in Technical-Vocational-Livelihood Track Specializations, Total Number of Enrollees, Number of Enrollees by Sex, Age, Grade Level, and etc., needed by DepEd and Private Educational Assistance Committee (PEAC).

(h) Add/Update the names of sections

(i) Add students to a section

(j) Add subject load to teachers

(k) View grade submission logs of teachers

4. A **Cashier**'s account will be able to do the following functionalities:

   (a) Login and logout

   (b) View and update profile

   (c) Change his/her password

   (d) View students currently enrolled

   (e) Disable a student account

      i. Holding a student account account will only happen if the student has unpaid balance.

5. **Teacher**'s account will be able to do the following functionalities:

   (a) Login and logout

   (b) View and update profile

   (c) Change his/her password

   (d) Input and update class records

   (e) View class records

   (f) Submit grades

   If the teacher is also an adviser, additional functionalities will be available:

(a) View condensed grades of the section he/she is handling

(b) View his/her advisee's report cards in pdf format

A pdf file will be available once the condensed grades have been finalized.

6. **Student** account will be able to do the following functionalities:

(a) Login and logout

(b) View and update profile

(c) Change his/her password

(d) View report cards from past grade levels to present

7. **Parent/Guardian** account will be able to do the following functionalities:

(a) Login and logout

(b) View and update profile

(c) Change his/her password

(d) View student's report cards from past grade levels to present

D. Significance of the Project

Using spreadsheets are proven to be a useful tool for keeping student records. But it also has disadvantages which includes long preparation time and integrity of files. Difficulties in generating subject-centric and student-centric class records from multiple teacher-centric class records also arise. It also has security problems; the file can be manipulated and modified by anyone without any permission.

Dee Hwa Liong Academy Grade Management System will lessen the time needed for post-enrollment processes, grade submission, and deliberation. The system will also eradicate the need of using flash drives and facebook messenger for submission of grades. Tracking late submissions of grades will also be easier since there will be deadline feature which will be set for each teacher in the system. The application will also provide security for students' records since grades will not be easily modified and an update log will also be available.

In addition, this application will also keep parents up to date with their child's performance and will provide a more efficient way of keeping track of students with backlog subjects and with honors.

E. Scope and Limitations

1. The system will be created based on the process followed by Dee Hwa Liong Academy.

2. The system will only cover the Kinder2 to Grade 12 students.

3. The deliberation of grades will still be done personally by the registrar, subject teachers, advisers, and possibly, by the director and principal.

4. Character traits of students will also be included in the system.

5. The system will be created to solve bottle neck problems of the grade management system of Dee Hwa Liong Academy. These bottle neck problems include the preparation and distribution of class records per subject teacher, produce a condensed class record per section, and formatting of grades for printing.

6. The system will be fully online, no offline counterpart, and accounts cannot be requested through the system. Accounts will be created by the system administrator.

F. Assumptions

Listed below are the assumptions for the Dee Hwa Liong Academy Grade Management System

1. Active student users are assumed to be officially enrolled by the school registrar. Enrollment is done outside the system.

2. React.js and Express.js will be used for developing the web application therefore the server to be used by the client must support a node.js server environment.

3. The grading system is provided by the academy and follows the K to 12 program grading system.

II. Review of Related Literature

Web-based information system plays a vital role in the educational institutes or colleges in order to maintain a record of the students easily. As far as the matter of students' academic career is concerned, it is very important to manage the accurate record and up-to-date information so that they can easily access it. Information system deals with all types of details of the students like course registration, notifications, semester calendar, academic record, exam components, exam slip, timetable, attendance details, students' feedback and many more as per the needs of any institution. It is very convenient not only for students but also for the director, registrar, teachers, and parents to access the academic record of students instantly by just one click. It does not only save time but also the problems faced by the staff. They do not need to use any ink and paper in order to do any sort of work related to that institution.

According to Gehlawat (2017), the school administrative processes and the official procedures of school such as grade management and enrollment period can be done in a more efficient way by the use of management information systems. The development of information technologies has provided a huge contribution to educational organizations. The implementation of information systems in universities can result in a significant decreased use of paper and turning most of the school office documents in an electronic format. Thus the schools are encouraged to employ information system to improve the performance of administrative services. Information technology provides several potential uses in educational organizations. It can range from simple interactive software for classroom teaching up to automation of system administrator processes such as admission and grade management [5].

Information and Communication Technologies (ICT) continues to innovate and improve the efficiency of several systems all around the world. In the education system, it is said that the exposure of students to application of ICT has a major role in learning process for university students both outside and inside the campus setting. Majority of universities that have implemented a system which fully adopted ICT have recorded significant advancement in the improvement of teaching, research, learning methods, and development. [6]. Hu discusses the importance of Student Information System for students. He also added that the technical modernization and campus network construc-

tion is an important way to achieve the current student data management information construction. The role of this system is associated mainly with the instructor, administrator, and student [7].

Mostly the institutions are rated on the availability of services as well as satisfaction provided to the users. In order to fulfill the needs and expectations of the students, the Web-based student information system plays a vital role. Therefore, in many universities students are assisted by in the form of registration, issuance of the transcripts of certificates, and financial recording. Student Information Management System (SIMS) software proves beneficial not only for students but also for administrators. Moreover, SIMS keeps students aware of any important event, activities etc. [8]. However, Asogwa et. al. (2015) observed that the revolution of technology, there are many universities in which the staff are still using the same old method for administrative purposes. Student information system has helped students to view their grades by just entering their roll number in student login panel of university. They do not need to waste their time by standing for hours in a queue [9].

93.5% of the processes which includes grade management and admission into exclusive private schools are performed manually using paper and ink. [10]. Fujo et. al. (2018) discussed the limitations and problems of having a manual system which include loss of forms which can caused by misplaced documents, long preparation time, finding an appropriate school and subjects an applicant can get admission, and disfigurement of forms handled by the student throughout the process for admission. Consequently, the published paper was submitted on an ongoing research work to design and implement a Tanzania Central Processing Admission System (TCPAS) that provides major changes towards the maintenance of admission costs, possible forging of documents for admission qualifications, encourage the use of a paperless system for admission, ability to reach more students which are geographically distant to the school, and centralization of the school data. Researchers have observed that one of the greatest achievements of Tanzania is the web based admissions system. They have done a great job in order to monitor and control the quality for admission into technical and tertiary education.

The electronic class record which was developed for the faculty members of the Lyceum of the Philippines University-Laguna International School is proven to follow the grading standards of the institution. By using the system, class record can easily be

managed and processes including computation of grades can be done in an efficient and convenient way. It also provides accuracy, reliability, security, use-friendliness, flexibility, and validity. But one of the system's limitation is the class record, which is made using Microsoft Excel, lacks security features including tracking down personnel who edited the file. The end users and administrator suggest locking the file once it is submitted. [4]

A key component of e-UP Project, one of the flagship project of the University of the Philippines Administration, is the establishing of multiple web-based information systems which include our own Student Academic Information System (SAIS), Financial Management Information System (FMIS), Supplies Procurement and Campus Management Information System (SPCMIS), Human Resource Information System (HRIS), and Executive Information System (EIS). The system also aims to provide a platform that solves the existing problems which involve human errors due to manual operations. It also aims to harmonize, integrate, and interoperate the ICT systems and across all Constituent Universities (CUs). The implementation of such system will also allow for the improvement on the efficiency of its core functions. [11]

The University of Calabar had faced challenges which were identified in the students' data processing in the Department. They include the long preparation time and the release of final grades to students to check their performance. There were also excessive paper works, poor management of student records, and poor data and security features of student records and files. It was also stated that there is also the problem of lack of information to properly guide students during the admission process of students which could possibly result to presumptions in offering and dropping courses. Uzede et. al. stated that developing an Information System (IS) such as Students' Record Management Information System (SRMIS) provides data in the form of prebuilt documents that helps the decision-making processes of the users. It can also lessen the processing time which includes result generation, that is, Cumulative Grade Point Average (CGPA) computation in the University of Calabar. This allows efficient and convenient access to students' information such as grades and student records. It also can enable the implementation of layers of security by allocating access privileges and monitoring of mischievous acts of altering scores in the result sheet.[12]

The emergence of online student information system is an evolution that has im-

proved the process of managing student data and records. It also becomes a symbol of modernity in universities. Web based student information systems also has a major role in providing the requirements of effective management of students' catalog and records in educational organizations. The implementation of Mzuzu University Student Online Management System (SOMS) resulted to the increase of performance in the school's registration process and it also provide access to examination results amongst the student community. Lubanga et. al. also discussed the seamless transfer of information between the university management and the students with the help of internet technologies [13].

III. Theoretical Framework

A. Assessment of Students

Dee Hwa Liong Academy handles students from Nursery, Kinder1, Kinder2, and Grades 1 to 12.

1. Nursery and Kinder1

Nursery and Kinder1 use a progressive curriculum, and the basis for assessing a student is a checklist. Checklists are called Developmental Assessment Scale. This scale is divided into four development skills - Physical Development, Self-help Skills, Socio-emotional Development, and Pre-academic Development. Physical development is further divided into gross motor development and fine motor development. On the other hand, pre-academic development is divided into reading readiness, language development, computer literacy, number readiness, music, art and P.E. (MAPE), and Chinese. Each skill under these development skills are graded according to a scale. All traits are observed by the students' adviser. The legends for this checklist are excellent (E) - excellent knowledge, very good (VG) - notable knowledge, good (G) - satisfactory knowledge, average (A) - fair knowledge, present (P) - observed, and not observed (OB) - not yet observed. Grades of nursery and kinder1 pupils are combined and deliberated quarterly.

2. Kinder2, Grades 1 to 10

Kinder2 and Grades 1 to 10 use the K to 12 curriculum. Teachers are given ECRs to input students' scores for each component. The basis for assessments are written work, performance tasks, and exams. The spreadsheet file has columns for formative tasks. Formative tasks are used to check if students are ready for graded seatwork and activities. Usually, formative tasks are not part of a student's grade but are recorded in the class record. Written work is divided into two, quizzes and others, while performance tasks comprise of oral participation, individual work, group work, individual project, group project and other output by students. In addition to these classroom activities, a quarterly exam is also used and recorded to check a student's performance. Similar to nursery and kinder1 students, grades are combined and delibarated quarterly.

3. Grades 11 to 12

Class records for grades 11 to 12 are similar to kinder2 and grades 1 to 10. The only difference is instead of combining the grades quarterly, it is done per semester. Each semester, two exams are taken by students: midterm and final exam.

Character traits are also graded by teachers. 50% of the character trait grades comes from the adviser while the remaining 50% will come from the subject teachers. The character traits to be observed are *makadiyos, makatao, makakalikasan,* and *makabansa.* Character traits are graded with a scale: always observed (AO) - 100, sometimes observed (SO) - 90, rarely observed (RO) - 80, and not observed (NO) - 70.

Sometimes, attendance is included in a student's grade. Student's attendance and tardiness are recorded daily by teachers.

B. Teacher-centric Grade Sheet

A teacher-centric class record is a spreadsheet file which contains lists of students currently handled by the teacher. The spreadsheet contains multiple tabs. Each tab represents the subject currently handled by the teacher. It contains a list of students taking that subject and their corresponding scores for each component. The final grade is automatically computed for every addition or adjustment of scores.

C. Condensed Grade

Condensed grade is a term used to descibe the average grade of the student. It is obtained from the section-centric class record.

D. Section-centric Grade Sheet

A section-centric class record is a spreadsheet file which contains a list of students under a given subject. The first column has the student names. The remaining columns are populated by the grades of each student from a given subject. The last column contains the condensed grade.

E. Student-centric Grade Sheet

A student-centric class record is used for the printing of report cards. It is a spreadsheet file which contains a list of subjects the student is currently taking. The list of subjects is then followed by their corresponding grades.

F. Grade Submission

Submission of grades are done per semester for SHS students, and quarterly for kinder2 to grade 10. Submission of grades is done through messenger or passing a flash drive to the registrar.

The registrar also keeps track of the submission date of the teachers. This is done manually by writing down the date the teacher submitted his/her class record(s).

Character traits and attendance sheets will also be checked by the registrar.

G. Individual Deliberation of Grades

Deliberation of grades is done after the teacher has submitted his/her class records. It is always done personally with the registrar and the IT head. This is to ensure that all grades are correctly collected and final adjustments have been made before the creation of the condensed grades.

The registrar will talk and review the students' grades with the subject teacher. If no issues were raised during the talk, the registrar will accept the class record to be added to the condensed grades according to the sections, generating section-centric records. Adding students to the class record will also be done during the discussion with the subject teacher.

H. Group Deliberation of Grades

Group deliberation is done for the section-centric class records. In this deliberation, the subject teachers, adviser, and registrar will sit down together to talk about a section's class record. Grade clarifications and student's behaviors are also discussed during the deliberation

Grade adjustments are still possible in this process. The teacher can readjust the student scores, component weights, and the transmuted grade from the teacher-centric class record.

I. Printing of Report Cards

Report card is a teacher-centric record which is reviewed by each adviser to check if there are any errors in the input. It includes the grades for both academic and character traits. It will also include the student's attendance and tardiness record.

Report cards are created based on the condensed grade file. These cards are printed on a normal sheet of paper for the first three quarters. For the final quarter, it is printed on a card. These cards are distributed to parents quarterly.

J. Node.js

Node.js is an open source run-time environment. This was built in Chrome's V8 JavaScript engine [14]. It provides a long term efficiency through event-driven and non-blocking I/O model and server-size JavaScript [15]. Unlike apache web servers which uses PHP as a default language, this allows the creation of Web Applications and server connections using Javascript and a collection of external "modules" that manages various core functionality.

K. Express.js

Express.js covers the core Node.js *http* module (http://nodejs.org/api/http.html) to provide extensive functionalities and features [16]. This framework consists of many plugin modules called *middleware* [16]. Express acts as a foundation for a custom-built framework which fits the web application project.

L. React.js

React.js is a javascript library for building modern user interfaces [17]. It was created by Facebook and independent contributors and organizations. One of the key features of this library is the use of a "Virtual Document Object Model" or "Virtual DOM". It enables developers to build a whole web application as if the entire webpage is rendered on each individual page but only web components that actually change. It also uses Javascript XML (JSX), which is an extension to the Javascript syntax. Its syntax is similar to the Hypertext Markup Tool (HTML), which makes it similar to existing web developers.

M. MySQL

My Structured Query Language (MySQL) is an open-source relational database management system (RDBMS), and has around 6 million installations worldwite. [18]. This is available as free software and is under GNU General Public License (GPL) [19].

Some of the advantages of MySQL includes portability, good security features, flexible table structure, can be integrated with various programming languages, and small RAM usage [19].

IV. Design and Implementation

A. Context Diagram

The web application will have seven access levels such as the system administrator, director, registrar, cashier's office, teachers, parents/guardians, and students. A context diagram is shown below in Figure 1.

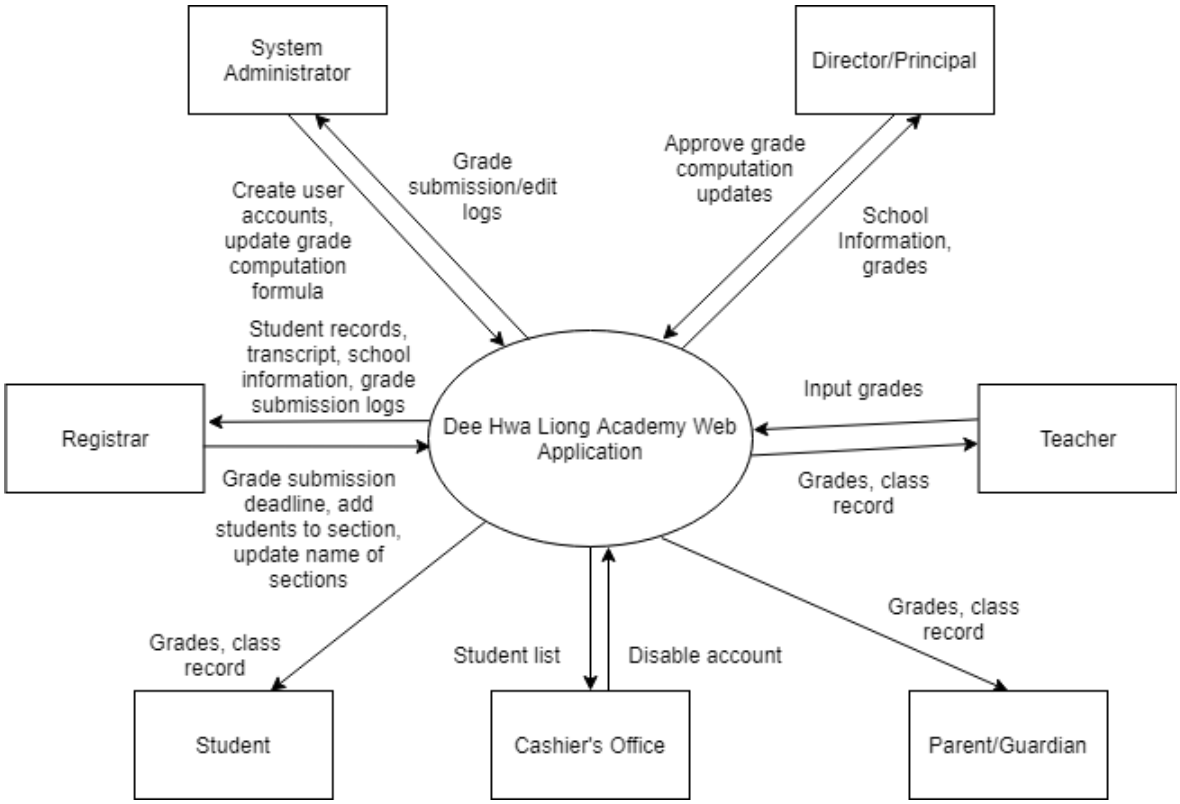

Figure 1 - Context Diagram, DHLA Grade Management System

B. Data Flow Diagram

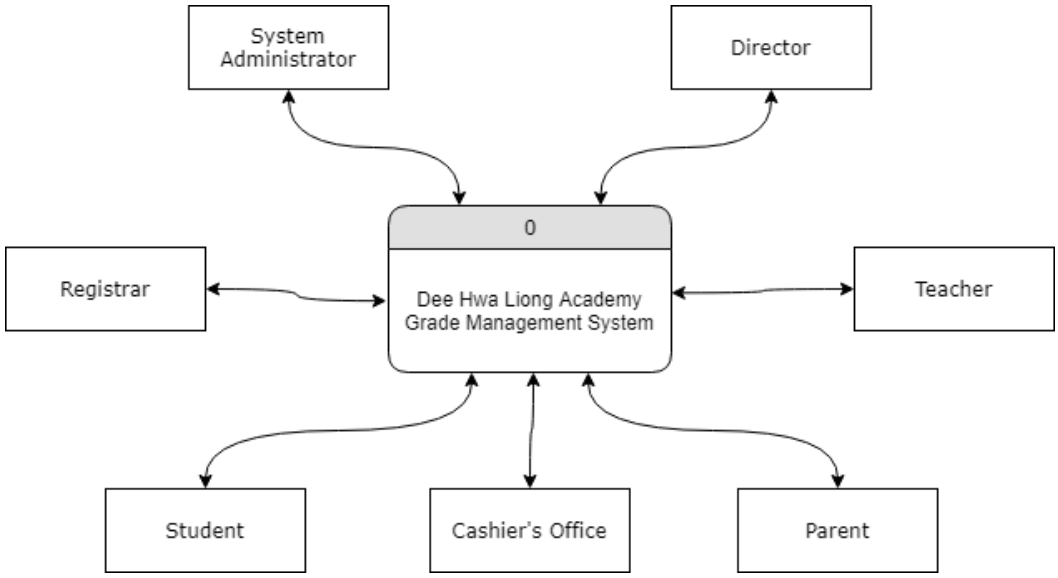

Figure 2 - Top Level Data Flow Diagram, DHLA Grade Management System

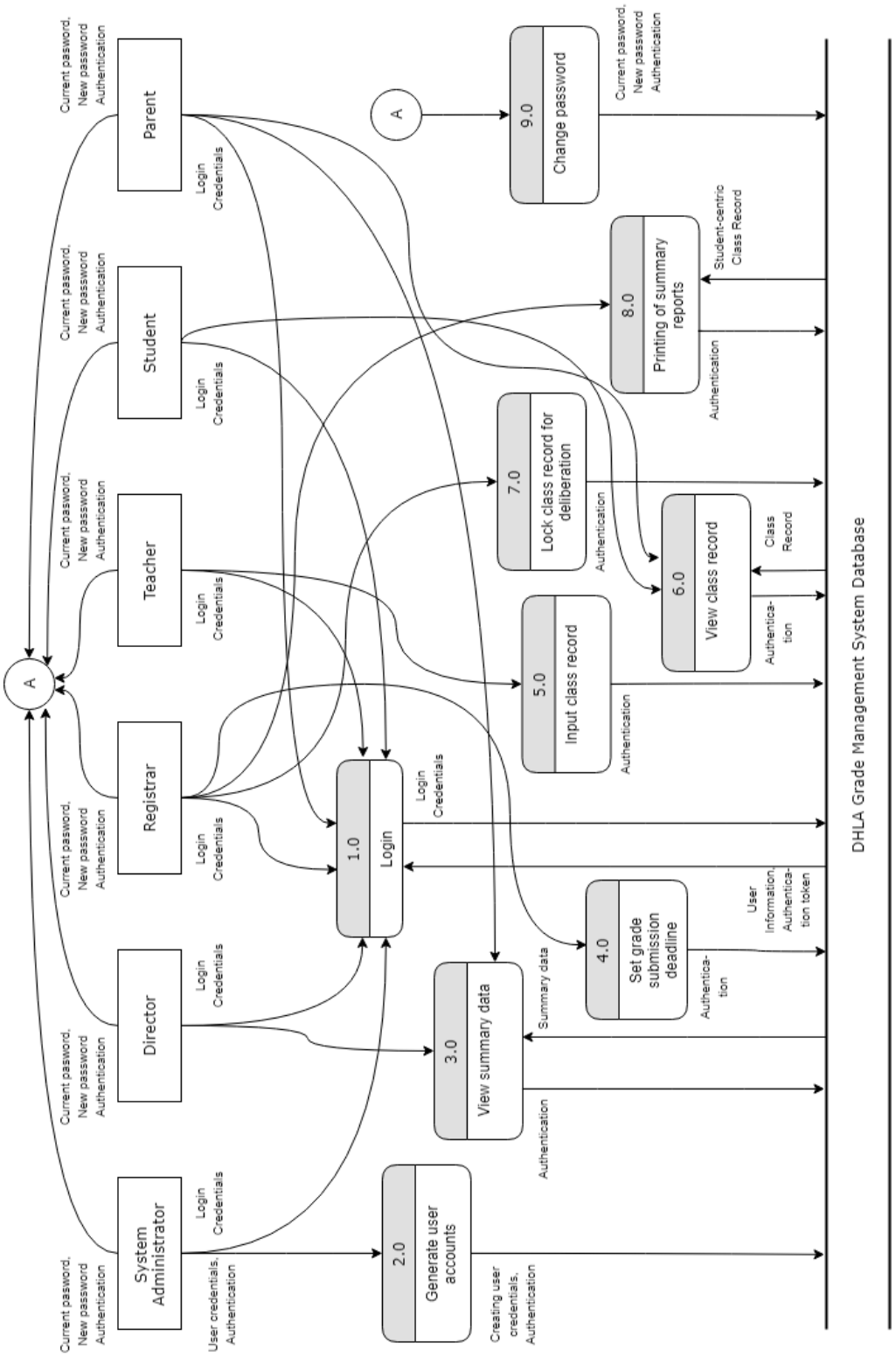

Figure 3 - Level 1 Data Flow Diagram, DHLA Grade Management System

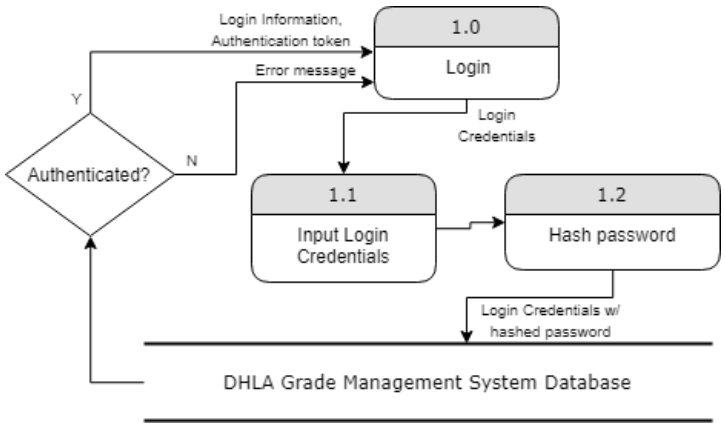

Figure 4 - Level 2 Data Flow Diagram for Process 1.0, DHLA Grade Management System

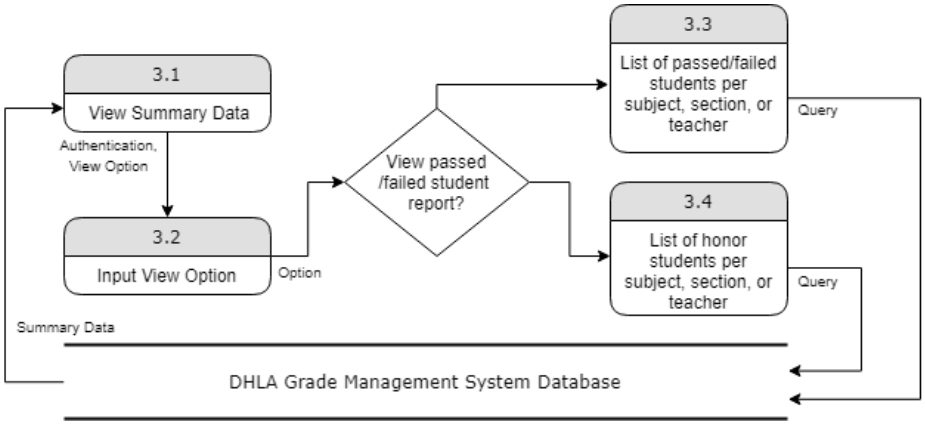

Figure 5 - Level 2 Data Flow Diagram for Process 3.0, DHLA Grade Management System

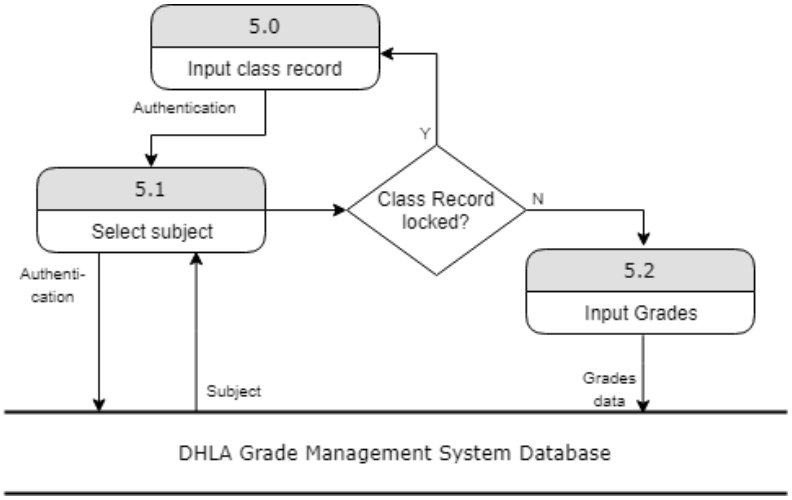

Figure 6 - Level 2 Data Flow Diagram for Process 5.0, DHLA Grade Management System

C. Activity Diagrams

All accounts will have a login and logout function. Each user account can also change the account's password. The password change is done within the system. No external links will be provided for password change. Profiles for each account will be available and can be updated.

The system administrator is the one managing the system.

The user can create accounts for the other users such as director, registrar, teachers, and students. All account creation will not have any creation requests.

The administrator is the only one with access to the activity logs of the condensed class record. The activity log records every information changes that occur to class records in the system. This activity log cannot be edited nor deleted, it is only readable. The administrator can also search the log using date, time, teacher's name, section, school year, grade level, and/or class record name.

Activation and deactivation of accounts is also a functionality of the administrator. An account can be deactivated if the user is no long affiliated with the school.

Since DepEd may issue a change in the grading process of schools, updating grade computation formula is also included in the function of the administrator. Such changes can only occur if the school director approves these changes.

As mentioned earlier, some changes or updates can only occur if the director approves it.

The director is the one who directs and shapes the curriculum and the teaching process of a school.

This user will be the one in charge of approving changes for grade computation formula. Furthermore, he can also view grades of each subject and the condensed grades. Viewing of summary reports is also possible.

Summary reports will get all the information needed from the database of the system.

The school registrar is in charge of keeping student records.

The school registrar will be able to set the deadline for submission of grades. Different deadlines may be set for different teachers due to their workload differences. Deadline alerts will be automatically sent, by the system, during 5 days and 3 days before the deadline and during the deadline day.

Since a school registrar keeps student records, they can view record from past school years and produce TORs. Viewing of summary reports will also be possible. Summary reports may be requested by the principal, director, and/or the DepEd and PEAC.

School registrars can update the student list of each section by adding or removing students from the class list. They can also update the section name and view the submitted grade of teachers.

Another activity log will be present under this user, which is the submission logs of teachers. This will be used to check the teachers who failed to comply with the deadline set by the registrar.

A school will never be a school without its teachers. In this system, there are two types of teachers: teacher-only and teacher/advisers.

Both types can input and update the grades of students. Their class records will be automatically be available after they input the class and subjects they are handling in their profiles.

Both teacher-only and advisers can also submit the grades through the application to create the condensed grades sheet. Before submitting the grades, the teacher must be sure that there are no errors with the record. A save function will be available to save changes made in the class record.

The difference between teacher-only and teacher/adviser, teacher/adviser can view the condensed grades of their advisees from the profiles. In addition, teacher/adviser can view his/her advisees' report carrds after the condensed grades have been finalized.

Finally, the student, this user can only do simple things such as view grades from his/her past grade levels to present.

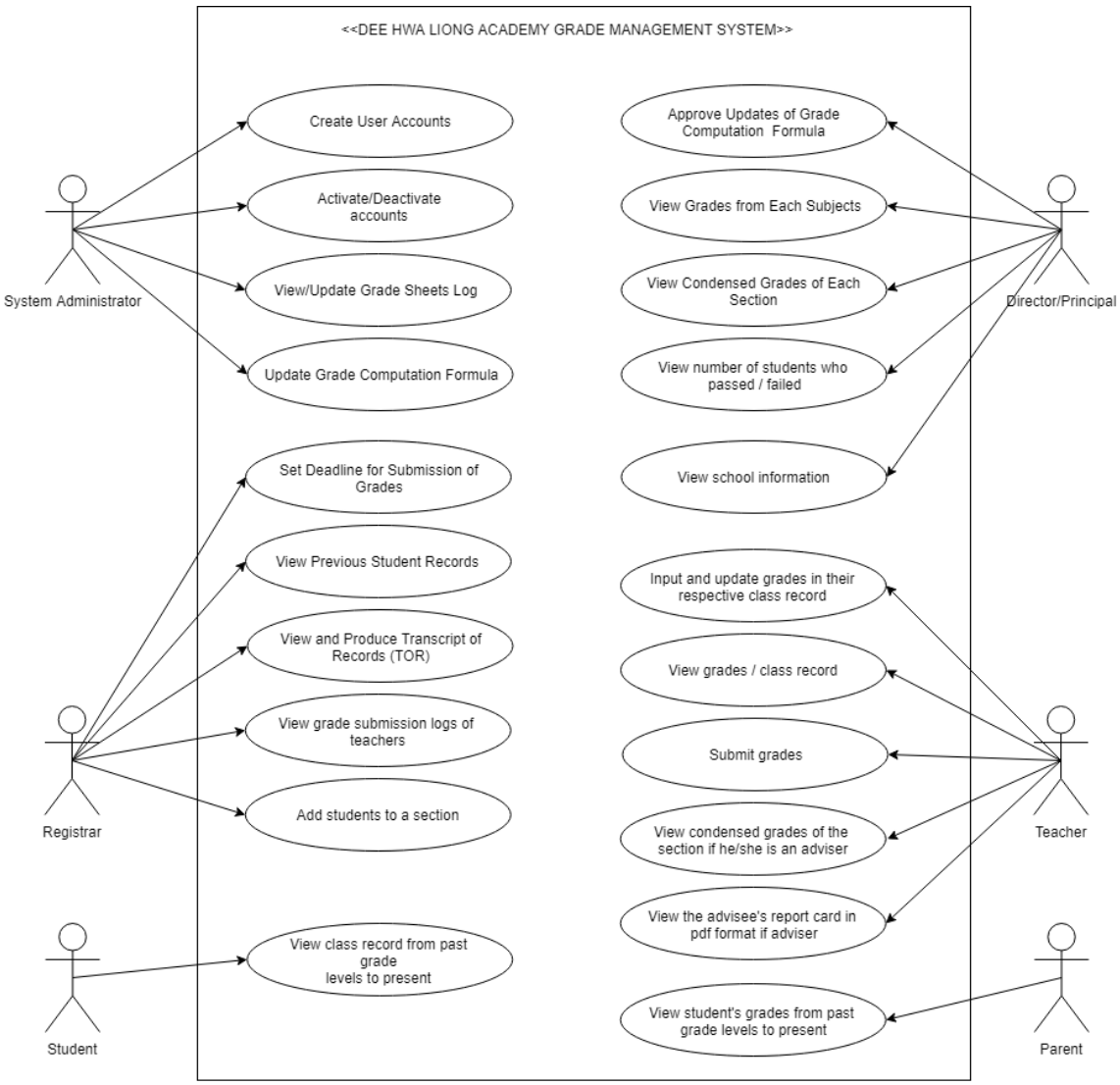

Figure 4 - Use Case Diagram, DHLA Grade Management System

D. Database Design

1. Entity Relationship Diagram (ERD)

Figure 1 shows the relationship among the user account, student, parent guardian, teacher, and nonacademic tables. The user account table contains the login credentials and basic information such as first name, last name, middle name, etc. of the user. System administrator, registrar, and principal/director fall under the nonacademic table.

Figure 2 shows the relationship among the class record, category, grade, teacher, section, grade level, and subject. The class record table contains the collection of grades of students in a section. The category table shows the type of activity being recorded in the class record. The grade table contains an individual grade of the student, and other important information such as date, category, and entry number. The section table shows the section name of the class record. The subject table contains the subject code and the subject name of the class record.

Figure 3 shows the relationship among the grade, student, category, and class record. The grade table contains an individual grade of the student, and other important information such as date, category, and entry number. The category table shows the type of activity being recorded in the class record. The class record table contains the collection of grades of students in a section.

Figure 4 shows the relationship among the attendance log, teacher, and the student. The attendance log table contains the atendance information of a student in a specific day. The table also contains the studentID of the student and the teacher recording the attendance.

Figure 5 shows the relationship among the advisory table, grade level, teacher and section. The advisory table contains the section being handled by the adviser. It also contains other information such as the grade level of the students being handled, the section, school year, and academic term. The teacher can only have an exact one advisory section.

Figure 6 shows the relationship among the component weight table, category, and subject. The component weight table shows the weight of each component from each subject. The category table shows the type of activity being recorded in the class record.

Figure 7 shows the relationship among the subcomponent weight table, section,

teacher, category, sub category, and subject. The subcomponent weight table shows the weight of each subcomponent of a component from each subject currently handled by the teacher. The category table shows the type of activity being recorded in the class record.

Figure 8 shows the relationship among the class, subject, teacher, and section. The class table shows the subject being handled by the teachers. Teachers can have multiple load since they can teach multiple sections throughout the academic year. They can also teach multiple subjects.

Figure 9 shows the relationship among submission deadline and teacher. The submission deadline table contains the deadline date for the submission of grades of the teacher set by the registrar. Teacher can only have exactly one submission deadline.

Figure 10 shows the relationship among student load and student. The student load table contains the load of the students in a given quarter. The students can have multiple student loads.

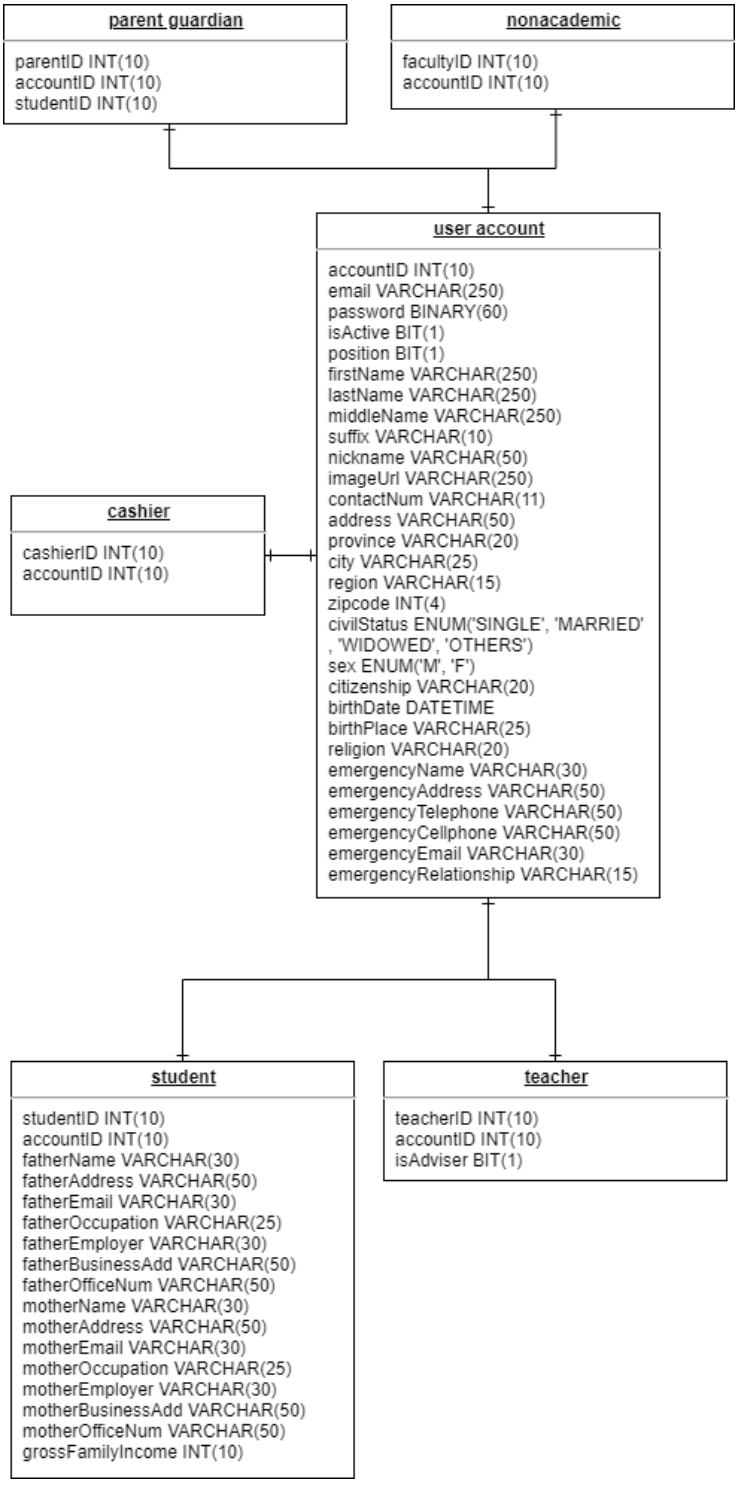

Figure 1 - Entity Relationship Diagram (ERD) (user account)

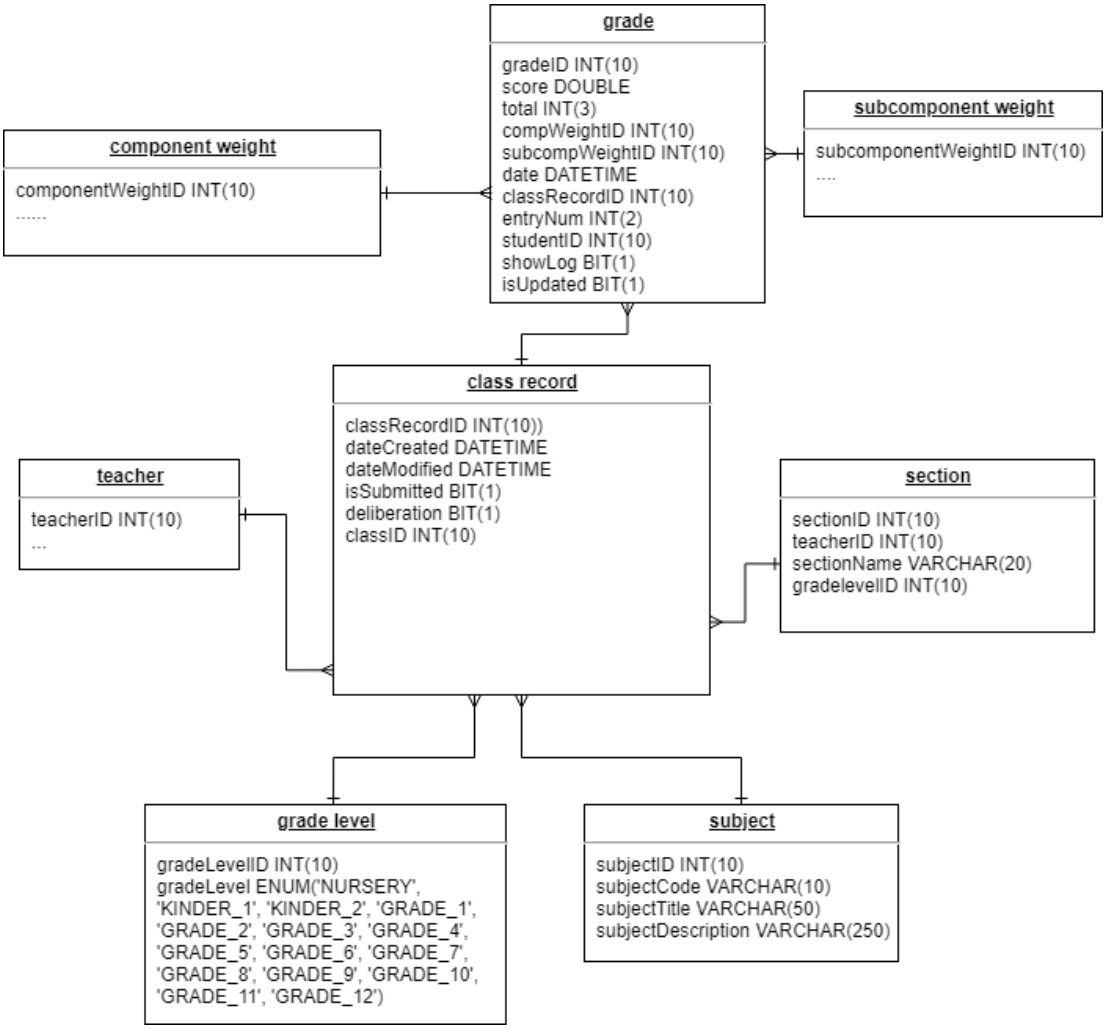

Figure 2 - Entity Relationship Diagram (ERD) (class record)

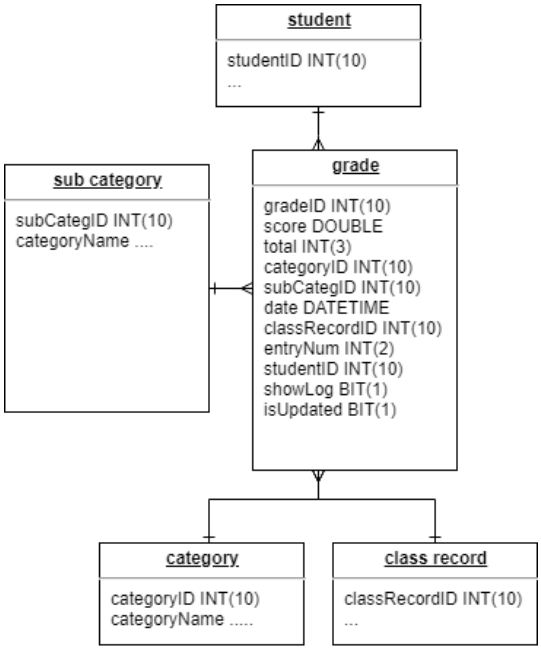

Figure 3 - Entity Relationship Diagram (ERD) (grade)

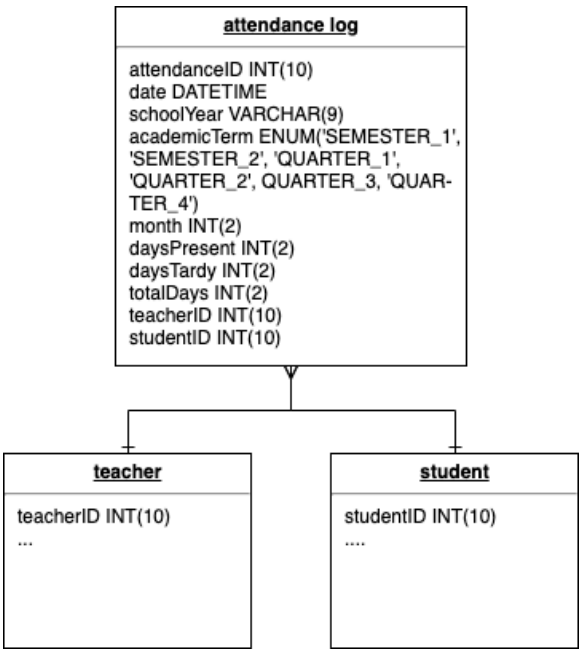

Figure 4 - Entity Relationship Diagram (ERD) (attendance log)

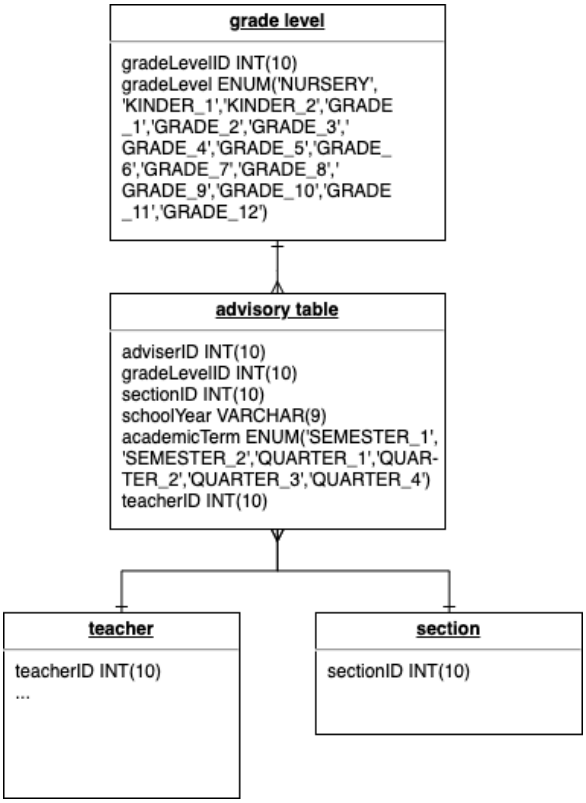

Figure 5 - Entity Relationship Diagram (ERD) (advisory table)

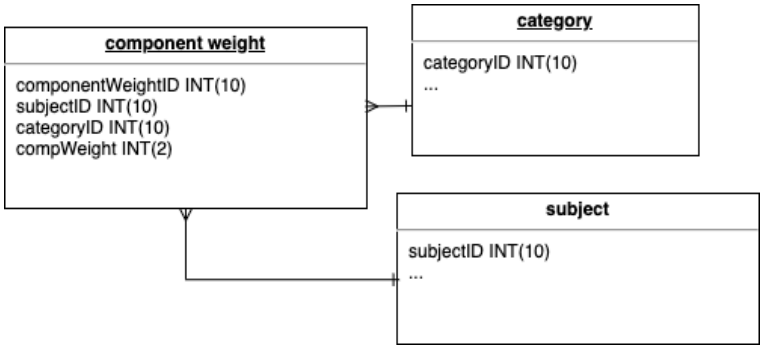

Figure 6 - Entity Relationship Diagram (ERD) (component weight)

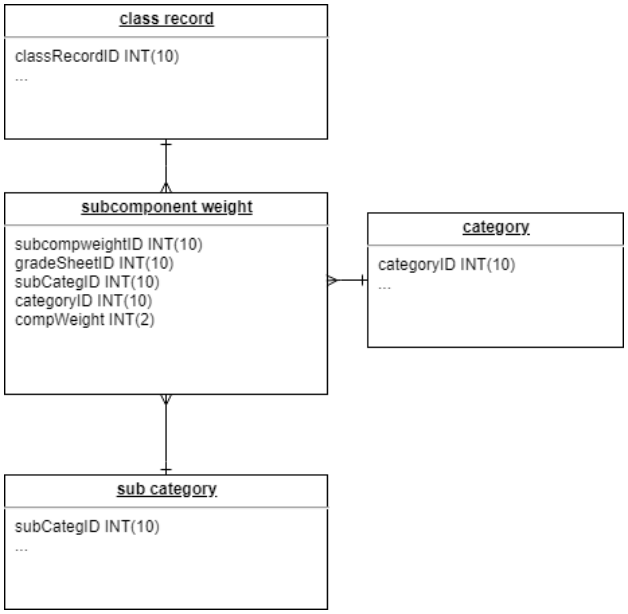

Figure 7 - Entity Relationship Diagram (ERD) (subcomponent weight)

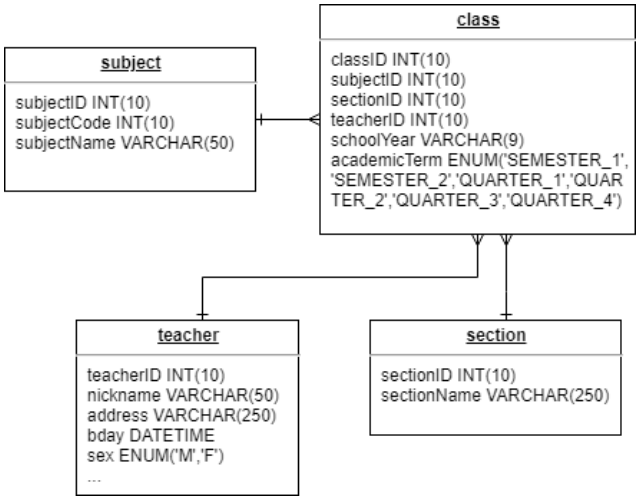

Figure 8 - Entity Relationship Diagram (ERD) (class)

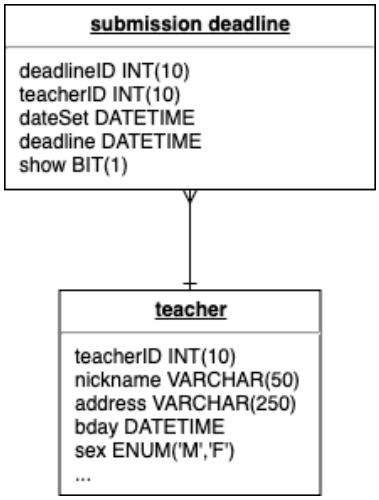

Figure 9 - Entity Relationship Diagram (ERD) (submission deadline)

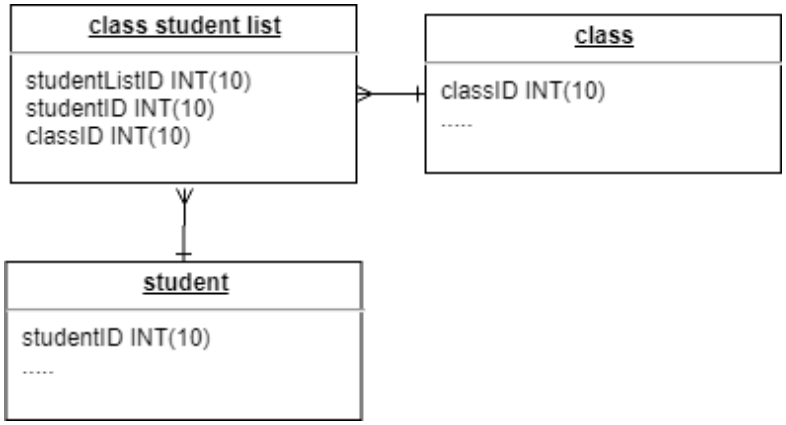

Figure 10 - Entity Relationship Diagram (ERD) (class student list)

E. Data Dictionary

Shown below are the database tables. Primary keys are in bold format.

1. User Account

This table will provide the information needed to login.

user account			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
accountID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of user**
email	VARCHAR(250)		Unique email address of user
password	BINARY(60)		Password of user in the system
isActive	BIT(1)		Denotes if the account is activated (1) or not (0)
position	BIT(1)		Denotes the account type: administrator (0), director (1), registrar (2), teacher (3), student (4), parent (5)
firstName	VARCHAR(250)		First name of the user

lastName	VARCHAR(250)		Last name of the user
middleName	VARCHAR(250)		Middle name of the user
suffix	VARCHAR(10)		Suffix of the user
nickname	VARCHAR(50)		Nickname of the user
imageUrl	VARCHAR(250)		Path to the photo of the user
contactNum	VARCHAR(11)		User's contact number
address	VARCHAR(50)		User's address
province	VARCHAR(20)		User's province
city	VARCHAR(25)		User's city
region	VARCHAR(15)		User's region
zipcode	VARCHAR(4)		User's zip code
civilStatus	ENUM('SINGLE', 'MARRIED', 'WIDOWED', 'OTHERS')		User's civil status
sex	ENUM('M', 'F')		User's sex
citizenship	VARCHAR(20)		User's citizenshipr
birthDate	DATETIME		User's birth date

birthPlace	VARCHAR(25)		User's birth place
religion	VARCHAR(20)		User's religion
emergency-Name	VARCHAR(30)		Contact name of the student in case of emergency
emergency-Address	VARCHAR(50)		Contact address of the student in case of emergency
emergency-Telephone	VARCHAR(50)		Telephone number of the student in case of emergency
emergency-Cellphone	VARCHAR(50)		Cellphone number of the student in case of emergency
emergency-Email	VARCHAR(30)		Contact email of the student in case of emergency
emergency-Relationship	VARCHAR(15)		Relationship of the student in the emergency contact

Table 1: Data dictionary for **user account** table

2. Student

The table will contain information about the student. The gathered information fields came from Dee Hwa Liong Academy's Student Application form.

student			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
studentID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of student**
accountID	INT(10)	FOREIGN	Unique identifier of user
fatherName	VARCHAR(30)		Student's father's name
fatherAddress	VARCHAR(30)		Student's father's address
fatherEmail	VARCHAR(30)		Student's father's email
fatherOccupation	VARCHAR(30)		Student's father's occupation
fatherEmployer	VARCHAR(30)		Student's father's employer
fatherBusi-nessAdd	VARCHAR(30)		Student's father's business address
fatherOffice-Num	VARCHAR(30)		Student's father's office

motherName	VARCHAR(30)		Student's mother's name
motherAdd -ress	VARCHAR(30)		Student's mother's address
motherEmail	VARCHAR(30)		Student's mother's email
motherOccu-pation	VARCHAR(30)		Student's mother's occupation
motherEmplo-yer	VARCHAR(30)		Student's mother's employer
motherBusi -nessAdd	VARCHAR(30)		Student's mother's business address
motherOffice -Num	VARCHAR(30)		Student's mother's office

Table 2: Data dictionary for **student** table

3. Parent/Guardian

The table will contain information about the parent/guardian.

parent guardian

FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
parentID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of parent/-guardian**
accountID	INT(10)	FOREIGN	Unique identifier of user
studentID	INT(10)	FOREIGN	Unique identifier of the parent/-guardian

Table 3: Data dictionary for **parent guardian** table

4. Cashier

The table will contain information about the cashier.

cashier			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
cashierID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of cashier**
accountID	INT(10)	FOREIGN	Unique identifier of user

Table 4: Data dictionary for **parent guardian** table

5. Teacher

The table will contain basic information about the teacher.

teacher			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
teacherID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of teacher**
accountID	INT(10)	FOREIGN	Unique identifier of user
isAdviser	BIT(1)		Denotes if the teacher has an advisory class (1) or not (0)

Table 5: Data dictionary for **teacher** table

6. Nonacademic

The table will contain basic information about the system administrator, director/principal, and registrar.

nonacademic			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
facultyID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of nonacademic**

accountID	INT(10)	FOREIGN	Unique identifier of user

Table 6: Data dictionary for **nonacademic** table

7. Section

This table will contain all the names of sections.

section			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
sectionID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of section**
teacherID	INT(10)	FOREIGN	Unique identifer and denotes the adviser of the section
sectionName	VARCHAR(20)		Denotes the name of the section
gradeLevelID	INT(10)	FOREIGN	Unique identifier of the grade level

Table 7: Data dictionary for **section** table

8. Subject

This table will contain all the subjects offered by Dee Hwa Liong Academy.

subject			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
subjectID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of a subject**
subjectCode	VARCHAR(10)		Subject code of the subject
subjectTitle	VARCHAR(50)		Title of the subject
subjectDescription	VARCHAR(250)		Desciption of the subject

Table 8: Data dictionary for **subject** table

9. Grade Level

Grade Level table will contain the grade levels under Dee Hwa Liong Academy.

grade level			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
gradeLevelID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of a grade level**

gradeLevel	ENUM('NURSERY', 'KINDER_1', 'KINDER_2', 'GRADE_1', 'GRADE_2', 'GRADE_3', 'GRADE_4', 'GRADE_5', 'GRADE_6', 'GRADE_7', 'GRADE_8', 'GRADE_9', 'GRADE_10', 'GRADE_11', 'GRADE_12')		Grade level of a student

Table 9: Data dictionary for **grade level** table

10. Category

Category table will tell us what type of activity (formative assessment-seatwork, formative assessment-assignments, written work-quizzes, written work-others, performance task-oral participation, etc.) is being recorded in the class record

category			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
categoryID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of a category**
categoryName	ENUM('FORMATIVE', 'WRITTEN', 'PT', 'QUARTERLY_EXAM')		Name of category

Table 10: Data dictionary for **category** table

11. Subcategory

Subcategory table is a subcomponent of a specific component (formative assessment-seatwork, formative assessment-assignments, written work-quizzes, written work-others, performance task-oral participation, etc.) being recorded in the class record.

subcategory			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
subCategID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of a subcategory**
categoryName	VARCHAR(20)		Name of subcategory

Table 11: Data dictionary for **subcategory** table

12. Class record

This will consist of the grades of the students from every activity to condensed grades.

class record			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
classRecordID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of a class record**

dateCreated	DATETIME		Date when the class record was created
dateModified	DATETIME		Date when the class record was modified
isSubmitted	BIT(1)		Denotes if the grade has been submitted for deliberation (1) or not (0)
classID	INT(10)	FOREIGN	Unique identifier of a class

Table 12: Data dictionary for **class record** table

13. Grade

This represents a grade entry in a class record.

grade			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
gradeID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of a grade**
score	DOUBLE		Student's score

total	INT(3)		The total number of items
categoryID	INT(10)	FOREIGN	Unique identifier of a category
subCategID	INT(10)	FOREIGN	Unique identifier of a subcategory
date	DATETIME		Date when the grade was created
classRecordID	INT(10)		Unique identifier of a class record
entryNum	INT(1)		Denotes the entry number of the grade in the class record
studentID	INT(10)	FOREIGN	Unique identifier of a student
showLog	BIT(1)		Denotes if the grade update will be show in the update log
isUpdated	BIT(1)		Denotes if the grade is the initial input (0) or not (1)

Table 13: Data dictionary for **grade** table

14. Attendance Log

This will hold the record of attendance of each student.

attendance log			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
attendanceID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of an attendance**
date	DATETIME		School date
schoolYear	VARCHAR(9)		School year of the attendance log
academicTerm	ENUM('QUARTER_1', 'QUARTER_2', 'QUARTER_3', 'QUARTER_4')		Academic term of the attendance log
month	INT(2)		Month of the attendance record
daysPresent	INT(2)		Number of days the student is present
daysTardy	INT(2)		Number of days the student is tardy
totalDays	INT(2)		Total number of school days in that month

teacherID	INT(10)	FOREIGN	Unique identifier of a teacher
studentID	INT(10)	FOREIGN	Unique identifier of a student

Table 14: Data dictionary for **attendance log** table

15. Advisory Table

This table will show the section being handled by the adviser.

advisory table			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
adviserID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of an advisory table**
gradeLevelID	INT(10)	FOREIGN	Unique identifier of a grade
sectionID	INT(10)	FOREIGN	Gives the unique identifier of a section if the teacher is an adviser
schoolYear	VARCHAR(9)		School year of the advisory table
academicTerm	ENUM('QUARTER_1', 'QUARTER_2', 'QUARTER_3', 'QUARTER_4')		Academic term of the advisory table

teacherID	INT(10)	FOREIGN	Unique identifier of a teacher

Table 15: Data dictionary for **advisory table** table

16. Class

This table shows the subjects handled by different teachers.

class			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
classID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of the class**
subjectID	INT(10)	FOREIGN	Unique identifier of a subject
sectionID	INT(10)	FOREIGN	Unique identifier of a section
teacherID	INT(10)	FOREIGN	Unique identifier of a teacher
schoolYear	VARCHAR(9)		School year of the teacher's load
academicTerm	ENUM('QUARTER_1', 'QUARTER_2', 'QUARTER_3', 'QUARTER_4')		Academic term of the teacher's load

Table 16: Data dictionary for **class** table

17. Submission Deadline

This table will contain the deadlines set by the registrar.

submission deadline			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
deadlineID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of the submission deadline**
teacherID	INT(10)	FOREIGN	Unique identifier of a teacher
dateSet	DATETIME		When the deadline was set
deadline	DATETIME		Deadline of submission of grades
show	BIT(1)		Denotes if the Registrar will display the deadline to teachers (0) or not (1)

Table 17: Data dictionary for **submission deadline** table

18. Subcomponent Weight

This table will contain the subcomponent weights for each component.

formula			
FIELD	**TYPE**	**KEY TYPE**	**DESCRIPTION**
subcompID	**INT(10), AUTO_INCREMENT**	**PRIMARY**	**Unique identifier of the formula**
sectionID	INT(10)	FOREIGN	Unique identifier of a section
subjectID	INT(10)	FOREIGN	Unique identifier of a subject
teacherID	INT(10)	FOREIGN	Unique identifier of a teacher
subCategID	INT(10)	FOREIGN	Unique identifier of a subcategory
categoryID	INT(10)	FOREIGN	Unique identifier of a category
compWeight	INT(2)		The weight of the component per subject category

Table 18: Data dictionary for **subcomponent weight** table

F. System Architecture

Dee Hwa Liong Academy Web Application will be built under the Node.js server environment. Express.js will be used as a library for fetching data through API calls (using routers). The system will be using React.js library as the main front-end backbone. For the user interface, Ant Design, a design language made for React environment, alongside with Tabler React, an open-source UI framework for building dashboard applications will be used to make the website more responsive. MySQL will be used as the database of the system.

G. Technical Architecture

DHLA Grade Management System will be accessed online. It follows a client-server-database architecture. The main server should have the following specifications (minimum requirements):

System Technical Components

1. Node.js Run-time Environment for the Server (12.1.0 or higher)
2. MySQL (7.2.10 or higher)
3. Google Chrome (70.0.3538.102 or higher)
4. Opera (56.0.3051.104 or higher)
5. Microsoft Edge (42.17134.1.0 or higher)
6. Internet Connection

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