LEAVE MANAGEMENT SYSTEM USING WEB SERVICE WORKER AND CHUNKING OF IMAGE SUBMISSION

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ARTICLE INFO	ABSTRACT
Corresponding Author: **Jasmin Jeanette C. Mama[1]** [1,]*College of Information Technology Mindanao State University Marawi City, Lanao del Sur, Philippines. email:jasnette.mama@msumain.edu.ph*	Filing leave of absence is typical to any employee. Employees may be required to submit applications and must be fully accomplished before approval. The aim of this project is like a document tracking system for leave application through a web application. A responsive web application for leave management system where the applicant will know the status of his/her request. The administration will then be notified if there are requests submitted to them. What makes this project efficient is the incorporation of the service worker, a cutting-edge technology, in web development. A service worker is a type of web worker. It is essentially a JavaScript file that runs separately from the main browser thread, intercepting network requests, caching or retrieving resources from the cache, and delivering push messages. [1] Since service workers run separately from the main thread, workers are independent of the application they are associated with. Some parts of the project are usable offline using the HTTP request. Since leave applications may have image attachments, this system will make it possible to submit images by chunks. Chunking of images is important because there are instances where uploading may fail due to large files or slow internet connection. The use of web service workers provides the accessibility of the application even offline. While chunking of images makes it possible to submit images even on slow connectivity. The implementation of online leave management is geared toward making leave application simple and convenient and is readily accessible for both the management and the employee.

INTRODUCTION

A leave of absence is a right granted to an employee not to report for work with or without pay as may be provided by law and as the rules prescribed in Rule XVI of Executive

Order no. 292. [2] the Philippine labor code stipulates mandatory type of leaves as service incentive leave (sil), maternity leave, paternity leave, and parental leave for solo parents, leave for victims of violence against women and their children and special leave for women. While the customary type of leave such as vacation leave and sick leave are considered non-mandatory.

this capstone project is primarily intended for dep ed bayugan city division. the district is composed of 66 schools, where 56 are from primary schools and 10 from the secondary level in which the majority are located in remote places. Presently, application for leave in the area is done manually by filling-up form and submitting it by foot to the division office. due to the cost and additional time spent in filing the leave, an online leave management system would be of great help to the employees to accessed and file it online anytime, anywhere. With the advent of technology, today's employees use diverse tools to work together. for most organizations, email is still the primary method of communication. Throughout time, employees have learned to adapt the use of technology from smart phones to personal computers which become the number one tool for solving everyday office problems. [3]

The normal work in a day is 8 hours. under the existing laws, there are leave benefits that an employee may avail discussed in

Table 1: Types of Leave of Absence

Type of Leave	Description	Remarks
1. Sick Leave (SL)	granted on account sickness or disability of the employee or any member of their family (parents, brothers, sisters, children, spouse, and even house help who are living with them)	▪ more than 5 days (shall be accompanied by a medical certificate) ▪ more than 6 days after the SL shall be deducted from the employee's salary
2. Vacation Leave (VL)	Granted for personal reasons, the approval of which is contingent upon the necessities of the service	Vacation leave without pay is considered a gap in the service.
3. Five (5) Days Forced/Mandatory Leave (FL)	Employees with ten (10) days or more vacation shall be required to go on vacation leave whether continuous or intermittent for a minimum of five (5) working days annually	▪ Forced leave shall be forfeited if not taken during the year. ▪ Those with accumulated vacation leave of less than ten (10) days shall have the option to go on forced leave or not
4. Special Privilege Leave (SPL)	Leave of absence which may be availed of for a maximum of three (3) days annually to mark special milestones and/or attend to filial and domestic emergencies such as birthday, anniversary, mourning, PTA	▪ non-cumulative and non-convertible to cash ▪ on emergency cases shall be filled within the day upon return to work, and the supervisor/office should be

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		meeting, etc.	informed of the reason for availing such leave.
5.	Maternity Leave (ML)	Every woman in the government service whohas rendered an aggregate of two (2) or more years of service, shall in addition to the vacation and sick leave granted her, be entitled to maternity leave of sixty (60) calendar days with full pay	Passage of Expanded Maternity Leave increasesleave days from 60 to 105 days.
6.	Paternity Leave (PL)	Every married male employee is entitled to paternity leave of seven (7) working days foreach of the first four (4) deliveries of his legitimate child	non-cumulative and non-convertible to cash
7.	Parental Leave (Solo Parent Act)	Seven (7) days leave granted to a parent who has the sole custody and responsibility of the child and who has rendered at least (1) year ofservice regardless of employment status	To avail the Parental Leave, the solo parent shall submit to the HR a solo parent identification card or certification issued/validated by the DSWD within the month of January every year
8.	Rehabilitation Leave	Granted to employees for disability on account of injuries sustained while in theperformance of duty	The duration, frequency, and terms of availing this leave shall be based on the recommendation of medical authority i.e. may be half-day basis, intermittent schedule or less than six (6) months, but not to exceed six (6) months and their absences shall not be deducted from the sick and vacation leave credits
9.	Ten (10) days leave (Violence Against Women and their Children Act of 2004)	Any woman employee in the government service, regardless of employment status and/or whose child is a victim of violence and whose age is below eighteen (18) or above eighteen (18), but unable to care of oneself, is entitled to avail of the ten (10) days leave	It may be on a continuous or intermittent mannerto cover the days they have to attend to medical and legal concerns
10.	Special Leave Benefits for Women	Any female employee shall be entitled to a special leave of a maximum of two (2) months with full pay based on her gross monthly compensation, provided she has rendered at least six (6) months aggregate service in any or various government agencies for the last	The special leave may be availed for every instance of gynecological disorder requiringsurgery

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	twelve (12) months before undergoing surgeryfor a gynecological disorder	
11. Study Leave	Time-off from work not exceeding six (6) months with pay for the purpose of assisting qualified employees to prepare for their bar or board examinations or complete their master's degree	
12. Terminal Leave	Refers to the money value of the total accumulated leave credits of an employee based on the highest salary rate received before or upon retirement date/voluntaryseparation	
13. Special Emergency Leave	5 days leave granted to those employees directly affected by natural calamities anddisasters	

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The project will support the different types of leave stipulated in the law. Some users are expected to be using their mobile phones when applying for a leave, which is why this project will be adjusted to work on mobile devices. Other users will also use desktop computers, and the desktop version of the application is the default view of the application.

The following are the procedures in the filing, processing, and approval of leave applications:

1. Employees are required to file leave applications using CSC Form No. 6 which should be fully accomplished in duplicate original copies.

2. The supervisor recommends the approval or disapproval of the application.

3. The authorized official approves the application following the rules on the delineation of functions/delegation of authority.

4. The Personnel Division processes the application, including certification as to leave balance.

5. A copy of the processed application is released to the employee concerned every end of the month and the other copy is retained at the Personnel Division for file copy.

On the other hand, the leave administration has the following specifications and computation:

- Employees who render work during the prescribed hours are entitled to 15 days vacation leave and 15 days sick leave credits annually or 1.25 days vacation and sick leave credits monthly, with full pay.

- Application for leave of absence except for emergency sick leave shall be filed in advance, whenever possible, five (5) days before the effectively of the leave.

- Application for leave for thirty (30) calendar days or more shall be accompanied by an Office Clearance from money and property accountabilities.

- Employees who are absent without approved leave shall not be entitled to receive their salary corresponding to the period of their unauthorized leave of absence.

- Employees who are continuously absent without approved leave for at least thirty (30) working days shall be considered AWOL and shall be separated from service or dropped from the rolls without prior notice. The employee, however, is informed at their last known address appearing on their 201 files of their separation from the service, not later than five (5) days from its effectively.

- If the number of unauthorized absences is less than thirty (30) days, a written return-to-work order shall be served to them at their last known written address on record. Failure on their part to report for work within the period stated in the order shall be a valid ground for dropping them from the rolls.

METHODOLOGY

Filing a leave using this application is now hassle-free with the use of desktop computers and mobile devices. The applicant may initially submit the application on the web even on offline or no internet connection, and then the system will continue the submission of the application once the device is connected to the internet through the use ofweb server worker embedded in the system.

This project also makes use of image chunking submission, where the image is divided into smaller sizes so that uploading will not be a problem in instances where the internet is very slow. These smaller sizes of images will be uploaded one by one until all the images are submitted.
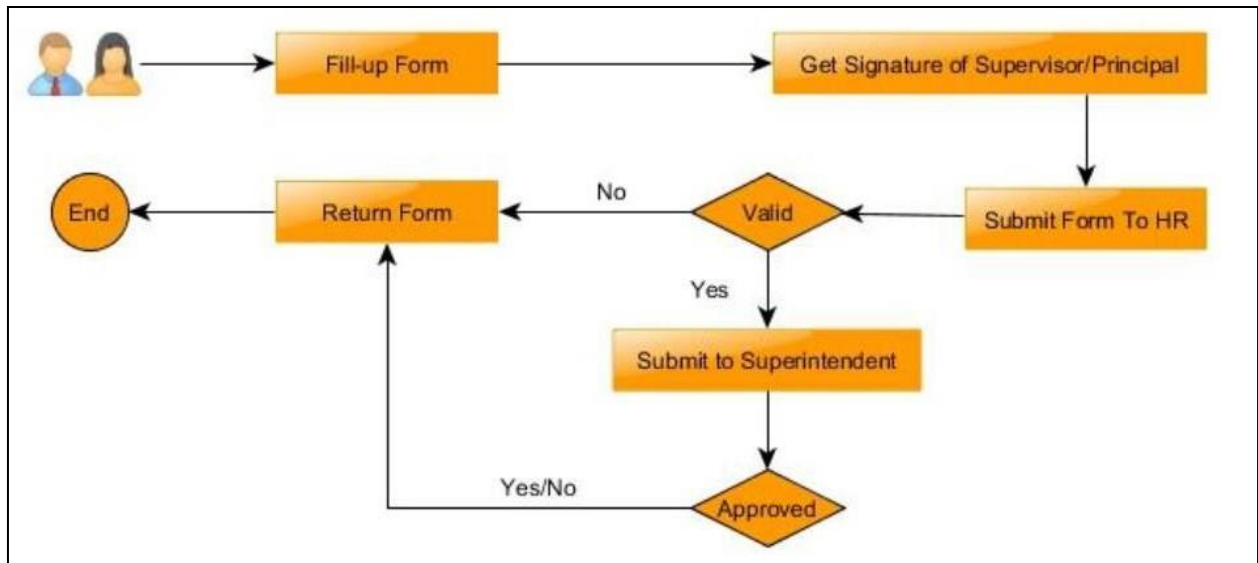
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Fig. 1: Existing Workflow for Application of Leave

The workflow of the existing manual filing of leave is depicted in figure 1. The applicant normally fills out the form, secure signature from the principal, and then submits to HR for verification. If the application is valid, the applicant may submit the form to the division superintendent then the superintendent may give approval or in some case disapproval and finally return the form to the applicant.
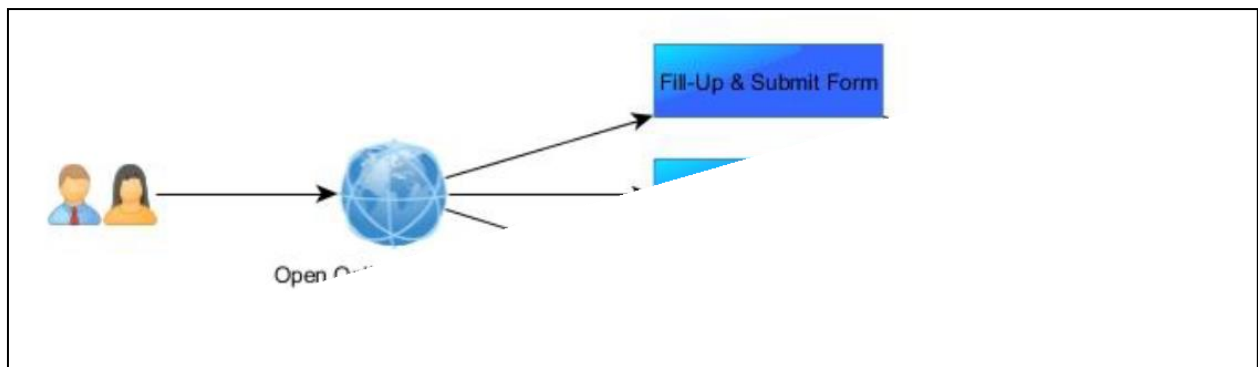

Fig. 2: Proposed Workflow for Application of Leave

On the other hand, figure 2 shows the proposed workflow of the web application. The applicant will apply for leave on the web, then waits for the reply. The applicant would automatically be notified if the application has been approved or disapproved through the web.

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PIECES EVALUATION FRAMEWORK

The project uses the PIECES evaluation framework in identifying the problems encountered in the existing system.It evaluates the existing system based on the categories based on Performance, Information, Economic, Control, Efficiency, and Service [5]. Table 2 shows the result of evaluation using the framework.

Table 2: PIECES Evaluation of the Existing System

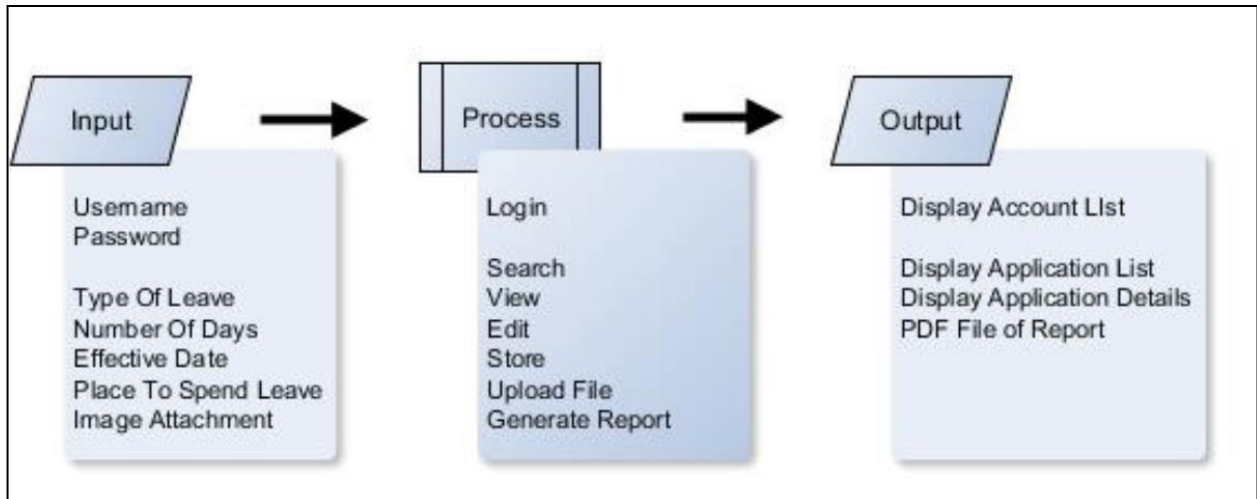| Performance	**Throughput** – submitting the application manually from office to office lessens the maximum rate of production in applying for a leave, since it takes time to submit the application form from school principal to human resource office to the division superintendent.
	Response Time – due to a busy workload, an applicant may wait for some time.
Information	**Stored Data** – stored data is not well-organized because it is manual and paper-based.
Economics	**Costs** – money is needed for transportation costs upon submission of the application to the head office.
Control	Manually checks for verification
Efficiency	Requires effort to manually submit an application
Service	The manual system is inflexible

CAUSES AND EFFECT ANALYSIS

After the PIECES evaluation, the cause and effect were performed, so that the proposed system would address the problem encountered and proposed solutions.

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Table 3: Cause and Effect of the Existing System

	Problems/Opportunities	Cause and Effect	System Objectives	System Constraints
Performance	Throughput and response time	*Cause*: Process needs effort and time *Effect*: Longer response time and lesser throughput	Increase response time and throughput with faster and more accessible application	Needs internet connection to submit an application
Information	Stored data could be lost anytime	*Cause*: The data is paper-based *Effect*: Could be lost anytime if not kept in an organized manner	Make an efficient storage system, i.e. database	Old data will not be included in the new database
Economy	Cost of transformation to submit an application	*Cause*: Long distance to travel *Effect:* Teachers need to spend money on transportation	Make the application submission available on the web	Internet connectivity is needed to submit an application
Control/ Security	Manually checks for verification	*Cause*: Takes time to check manually *Effect*: Waiting time for approval	The web application enables easy searching.	Old data will not be included
Efficiency	Excessive work time for manual-based	*Cause*: Takes time to submit from office to office *Effect*: Needs more time to finish the task	Make the system that acts as a document tracking system	Constantly checking the status of the application
Service	Inflexible System	*Cause: more effort and time needed to complete the task* *Effect: tedious for the applicant*	Make the system available online	Internet connectivity

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DESIGN

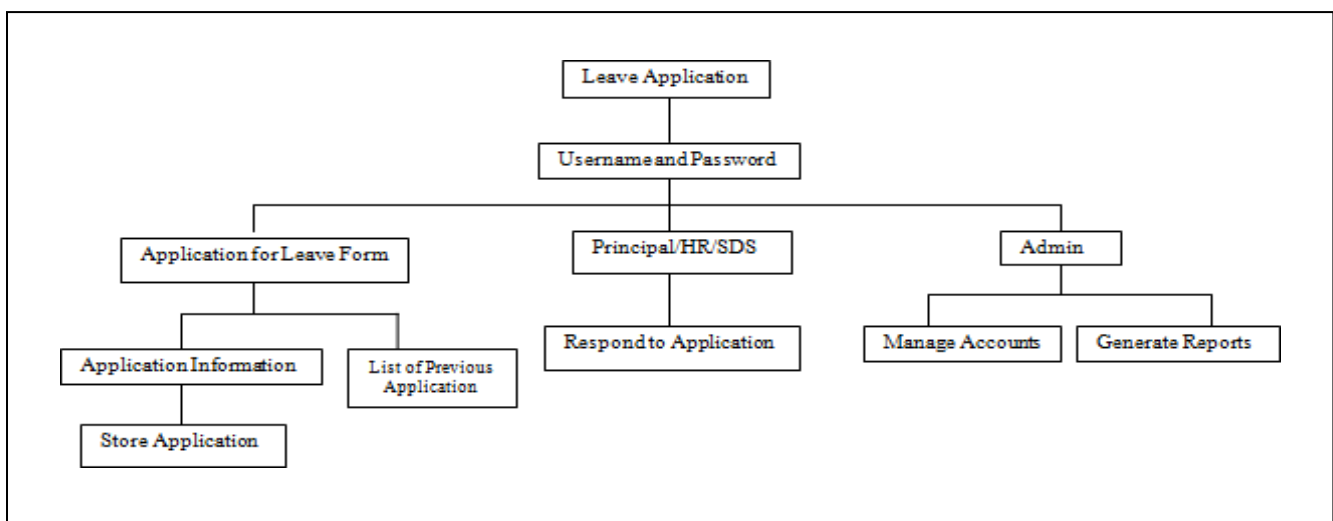This section provides modeling tools that describe the system and processes including developer and user specifications and software testing plans

Fig. 3: Hierarchical Input-Process-Output

Figure 3 explains the hierarchical input-process-output of the leave application. Once the application is opened, the login page will prompt which requires username and password. The module for the leave application is where the user can

fill out the form and submit. The user can also search for previous applications. Furthermore, Principal/HR/SDS accounts are redirected to a module where pending approval of applications is listed. On the otherhand, admin accounts can manage the account and generate accounts.

Fig. 4:Input-Process-Output

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The above figure demonstrates how the system works. When the system is opened, the login page will be displayed which requires username and password. Once the user is successfully logged-in, the user can explore and search for previous or existing leave, and consequently apply for leave.

Furthermore, once logged-in if the system detects that the username and password belong to the Principal, or Human-Resource, or SDS, the systems redirects the user to the module where lists of applicants will be displayed and be able to assess the application details, as well as approved and disapproved applications.

However, the admin user can do the overall functionalities such as managing user account and generate reports.
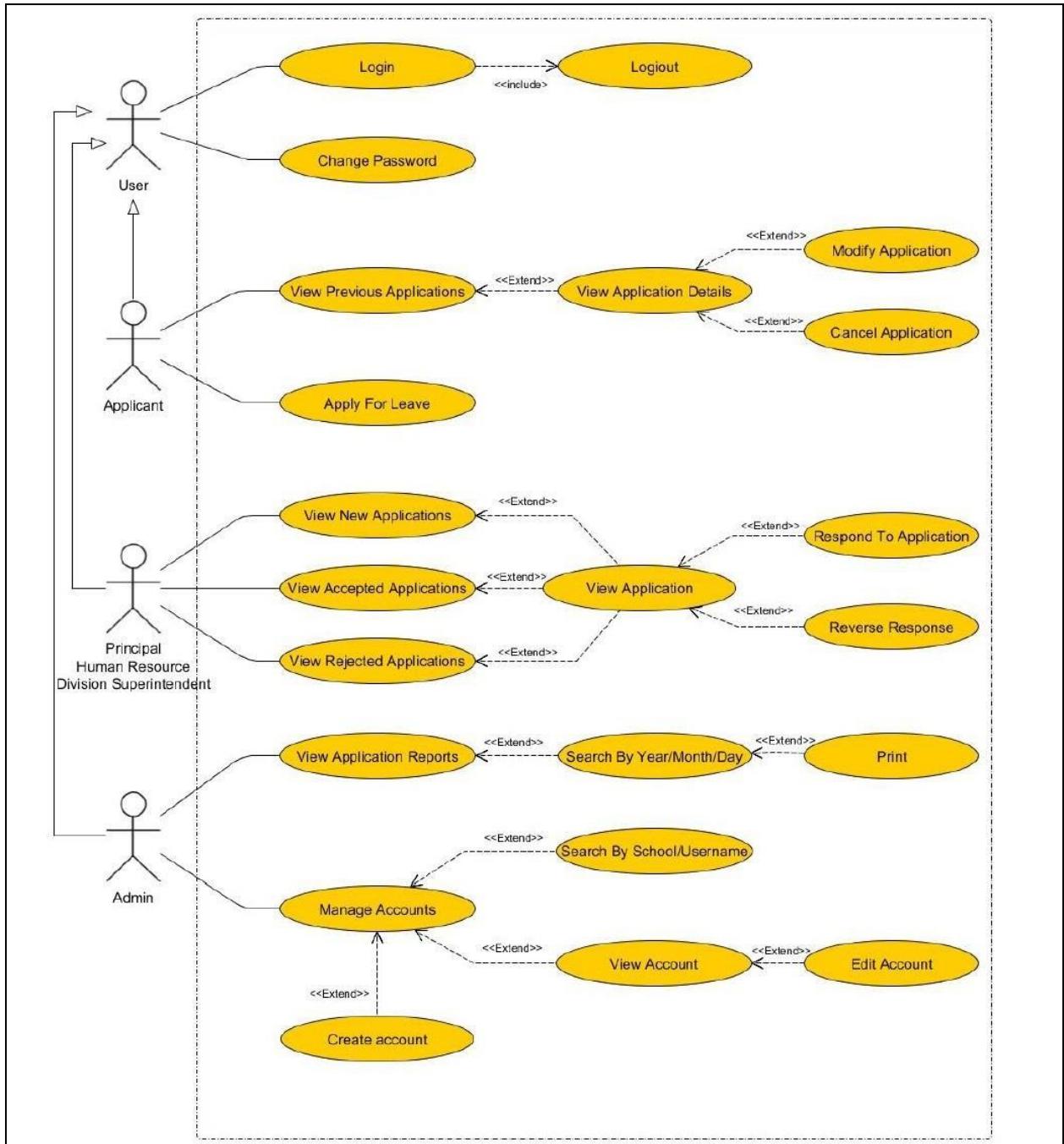

Fig. 5: Use Case Diagram

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The use case diagram depicted in figure 5 illustrates that user privileges depend upon the account type. The applicant can apply and/or view previous applications for leave, as well as view details, modify, and/or cancel the application. Users such as principal, HR, and superintendent all have the same view of the page which is responsible for responding to leave applications. Finally, the admin is responsible for managing the account and printing of reports.

RESULTS AND DISCUSSIONS

In this section, the web service worker and chunking of image submission are discussed.

WEB SERVICE WORKER

A web service worker is a type of modern web programming. It is a java script registered in every browser that accessed it. This technique stays registered even when the browser is offline and can load content even with no connection. The service worker decides whether to show the remote version or the custom offline version. This technique has become a huge part of the modern web area of progressive web applications. A website with a service worker will cache pages so that if a user viewing the site and the connection went out the pages will still load.

According to Walton (2018) [6] from the performance perspective, service workers can control the caching assets. A website that incorporate service worker that can handle cache resources will load substantially faster for returning visitors.
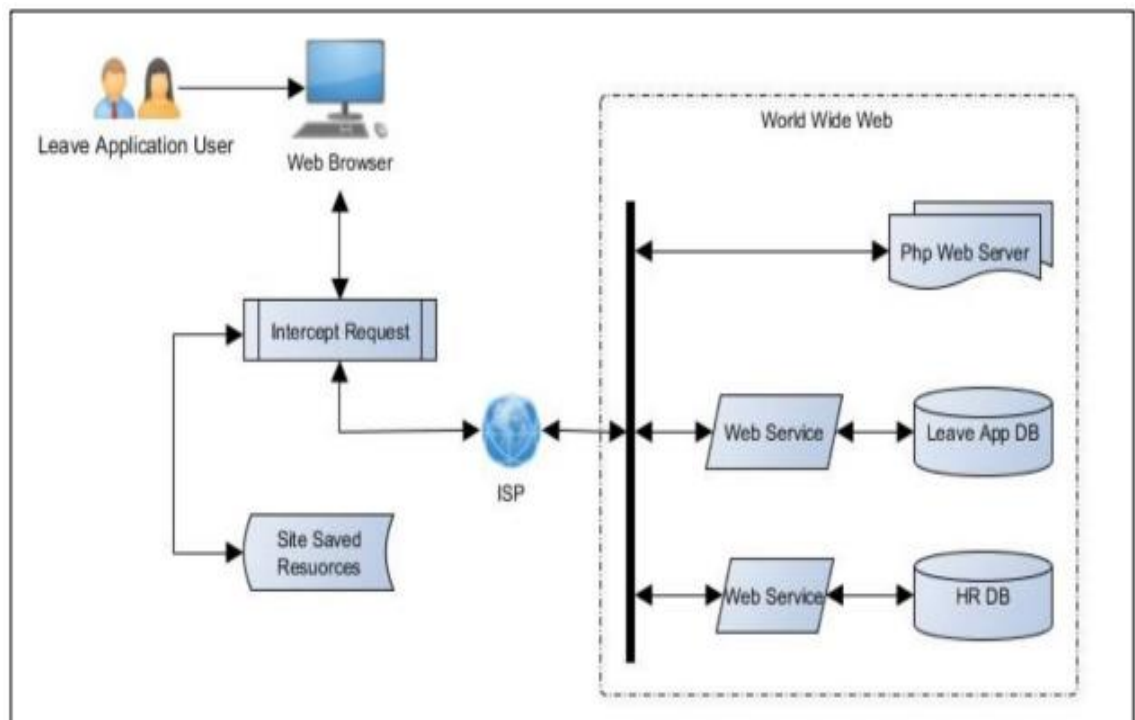

Fig. 6: Architectural Design of Leave Management System

Since the Leave Management System is an online app, the user must use a browser to access the system. Figure 5 illustrates the architectural design of the system. The web application makes use of the service worker, a new technology

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on the web where it is functional even in slow connections or offline, it is programmable that run in the background of the browser. When the user first accesses the website, the service worker will be installed automatically and it will only run

the next time the user accesses the site. The service worker can also intercept any incoming request and be able to respond to the request. When the user accesses the leave application, the service worker will intercept the incoming request and reply to it with the site resources requested that is already in the cache.
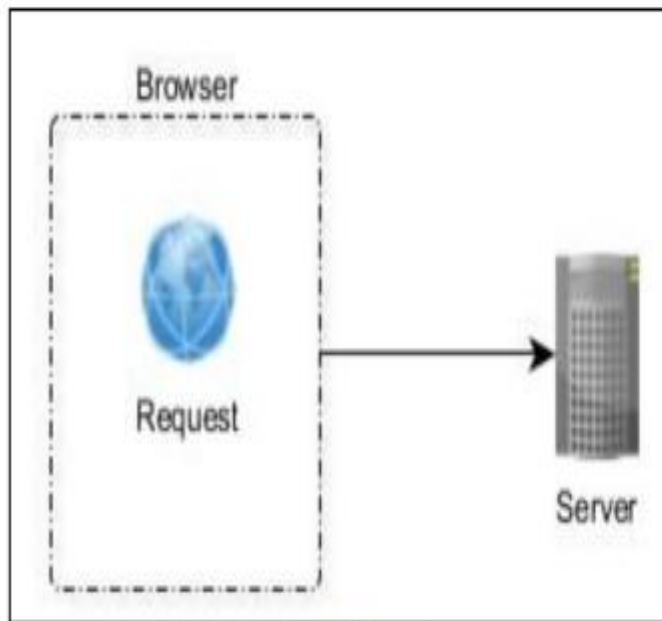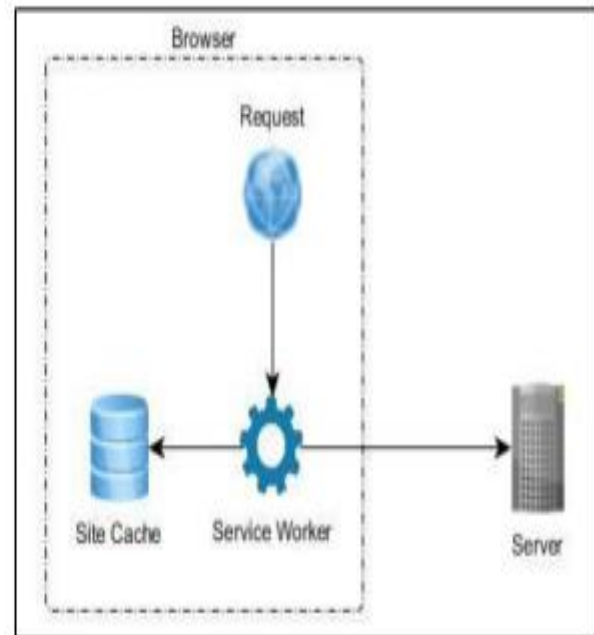

Fig. 7: Normal HTTP request-response

Fig. 8: HTTP request-response with the service worker

The two figures above show the difference between web applications that uses a service worker (figure 8.) versus a normal web application (figure 7) with no service worker embedded.

Figure 6 shows how HTTP request-response normally happens when the user accesses a browser, types a URL and then press enter, the URL entered becomes a request which the browser will try do. The browser will then be able to receive the response. If the connection does not exist, the browser will simply show a "No Internet Connection" message.

On the other hand, figure 7 shows how HTTP request-response happens when there is a service worker. When a user types a URL in the browser and press enter, the browser will try to check if a service worker exists in the domain. If it exists, the service worker will check if the resources requested are available offline and returns the request to the user. However, if the resources requested need to be accessed online, the service worker will fetch the resources and return them to the browser.

The leave management system incorporates the following code snippets that

use the web service worker.

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Table 4: Code Snippet for Submission of Leave Application

```
function reSubmitLeaveApplicationUntilFinish() {
   var db;

    timeoutHolder = setInterval(function () {

    openDatabase().onsuccess = function (event)
      {db = event.target.result;
      db.transaction(["leave-applications"])

        .objectStore("leave-applications")

      .get(1)

      .onsuccess = function (event) {
        if( event.target.result ) {

            var url   = event.target.result.url;
            var data  = event.target.result.data;

            resubmitLeaveApplication(url, data).then(function () {
               dbDelete(1);

               clearInterval(timeoutHolder);

               self.registration.showNotification("Successfully submitted Leave Application. Checking attachments", { icon: 'assets/images/icon.ico' });
               submitFileAttachments();

            }, function (err) {

               console.log("Failed to submit... retrying in background...");

            });
         } else {

            clearInterval(timeoutHolder);
            thereWasFileAttachmentCursor = false;
            submitFileAttachments();
```

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The code shown in Table 4 runs when the leave application is submitted. The code keeps on running and checks every two (2) seconds even if the website is not open. If the leave application submission is interrupted or the internet is disconnected while the user is filling-up the form, the code will resubmit the application until the user is finally connected to the internet.

Table 5: Code Snippet for Leave Application with Attachment

```
function submitFileAttachments() {
  resubmitCheckerContinue =
  true;

  fileAttachmentsInterval = setInterval(function () {

   if(resubmitCheckerContinue) {

     resubmitCheckerContinue = false;

       openDatabase().onsuccess = function (event) {
       var db = event.target.result;

       var request = db.transaction(["file_attachments"], "readwrite")

         .objectStore("file_attachments");

       request.openCursor().onsuccess = function (event)
         {var cursor = event.target.result;

       if (cursor) {
         thereWasFileAttachmentCursor =
         true;var data = {

           append: true,

           filename:
           cursor.value.filename,content:
           cursor.value.content

         };

       var key = cursor.value.id;
       POSTAppendFileAttachment(data).then(function () {
```

The code snippet depicted in Table 5 runs when theirs is an attachment during the submission of leave application. Italso checks if theirs is a pending attachment and continuously runs even if the website is not opened. It checks every200

Milliseconds for pending attachment until the fully uploaded. Finally, the function code displays the message successfully uploaded once all attachments are fully submitted and stops checking for further submission.
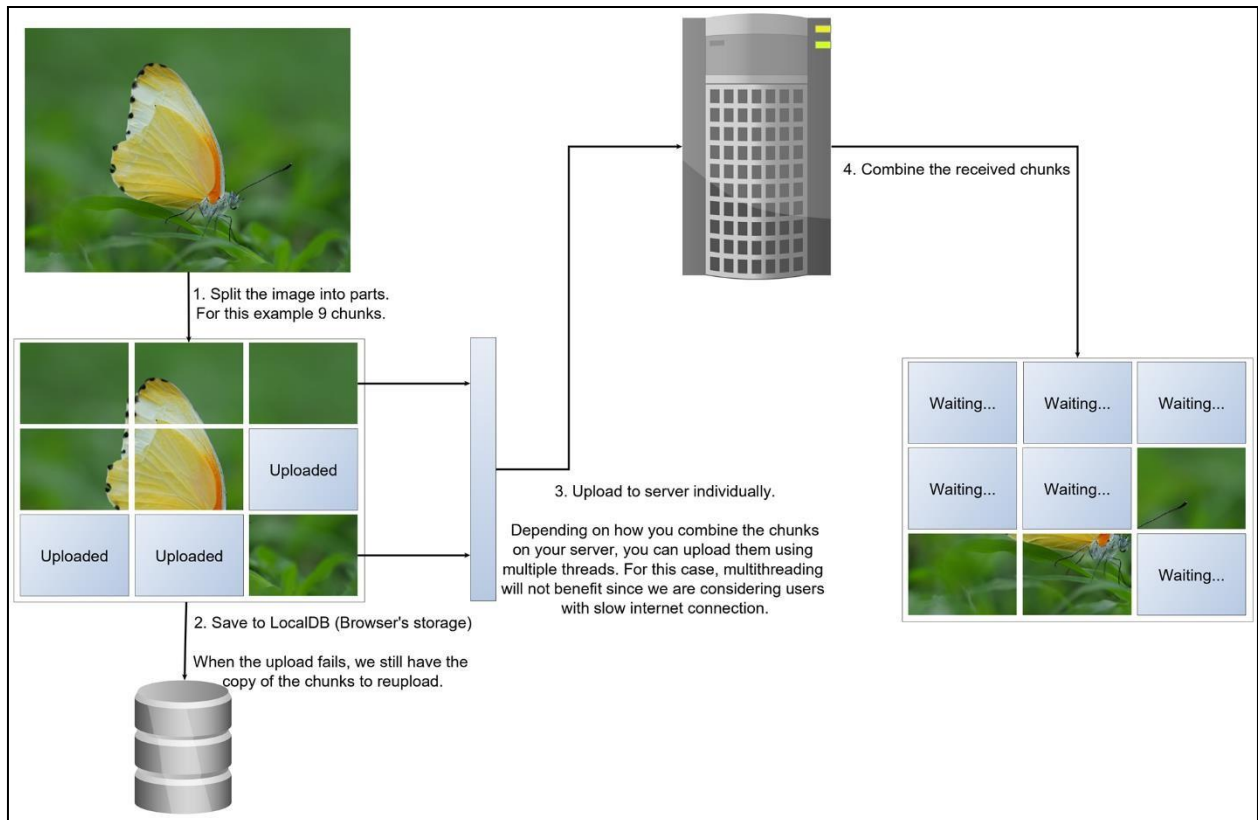
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Fig. 9: Chunking of Image Submission

CHUNKING OF IMAGE SUBMISSION

Another feature that this leave application offers is the use of chunking of images when an applicant submits an application with an image attachment. During the initial testing of this system, uploading a file that is too big in a slow internet connection will always fail. Hence, the researcher tried to find a solution to this by resizing the image into a smaller resolution. Resizing of images is common in JavaScript, by using the canvas element, the image may be resized up to 50% from its original height and width.

After resizing, the image will be divided into chunks. The image can be divided by using image Base64 conversion. Base 64 conversions is a scheme where it is used to convert data into a URL-friendly string. These strings are composed of the standard alphabet characters A-Z, a-z, 0-9 and /, +

with = as a padding character. After the conversion, the code is embedded into your img tag or CSS to display the image. [4]

Since the image is now converted into a URL-friendly string, it can now be easily used and can be read from left to right to get the value of the image. The string can now be divided into parts. In this study, the researcher opted to divide the string into 50,000 characters each chunk, which is approximately 50kb in size.

To explain further, a single character is equal to 8 bits. 1 byte is equivalent to 8 bits, 1 kilobyte is approximately 1,000 bytes. Hence, 50,000 characters are approximately 50 kilobytes. Thus, per chuck is equivalent to 50, 000 characters.

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Table 6: Code Snippet for Chunking of Image Submission

```
function saveAttachmentForLater(filename, dataURI) {
  var roll          = 1;
    var datas       = [];
   var dataChunksLength   = 50000;
  while(dataURI) {
      var      sub      =      dataURI.substr(0,

   dataChunksLength); dataURI  =  dataURI.slice(

   dataChunksLength );

    var data = {
    id : roll++,
       filename:
    filename,   content:
    sub
     };
  datas.push(data);
     if(!dataURI) {
       dbAddFileAttachments(datas);
```

The code snippet presented in Table 6 displays how the chunking of the image is being manipulated. The code enables slicing of an image into 50,000 data chunks length. The loop continuously running until all the data chucks have been submitted.

II.   4.0 CONCLUSION

This project aims to address the challenges faced by the DepEd Bayugan in filing leave due to location issues. Since the World Wide Web is accessible everywhere, the project output will open to a more accessible and efficient leave application. During testing of the system and presentation of the software, the leave management systems established a solution to the problem and were approved by the stakeholders.

Furthermore, the use of web service workers and chunking of images during submission of leave application provided a better web experience to the user.

RECOMMENDATIONS

For the system to be more efficient, the proponent Would like to recommend the following functionalities:

- automatic calculations of leave credits
- add a more advanced searching algorithm
- pack the web application and deploy as Mobile App.
- pack the web application and deploy as Desktop App.
- Add real-time chat app for convenience.

6.0 ACKNOWLEDGEMENT

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