Eklavya Summer Internship 2018

Project Report

Analyze Students Response to H5P Submissions in Drupal 8

Computer Science And Engineering Department

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Certificate

The project entitled Analyze Students Response to H5P Submissions in Drupal 8 submitted by Nikhil Kumar Yadav, Yash Thakur, Mayukh Mukherjee, Sutanay Bhattacharjee is approved for Summer Internship 2018 programme from 16th May 2018 to 6th July 2018, at Department of Computer Science and Engineering, IIT Bombay.

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Declaration

We on behalf of Drupal Team, declare that this written submission represents our ideas in our own words and where others ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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1 Acknowledgement

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We hope that we can build upon the experience and knowledge that we have gained and make a valuable contribution in the upcoming future.

2 Abstract

H5P is an open source content collaboration framework. It is easy for everyone to create, share and reuse interactive content online. It currently integrates with Moodle, Wordpress and Drupal. It allows to create and store result in Moodle, Wordpress, Drupal but it does not provide any visual analysis of the results of the interactions done by the user.

By this project we aim to create a solution for the above mentioned problem by creating a module for Drupal 8. This will help the content creators to keep track of a users performance.

3 Getting Started

3.1 Introduction

Drupal is an open source Content Management System used for website development. It accommodates a variety of content types ranging from audio, video to image and text, and is a powerful platform for creating and delivering interactive content to users, all around the globe. Educational content creators use this platform for online education too.

H5P stands for HTML 5 Package. It enables users to develop interactive content. One can create interactive videos, quizzes and a whole bunch of interesting kinds of stuff for massive open online courses with H5P. It is already integrated into Drupal, WordPress and Moodle platforms. H5P uses xAPI to capture user interactivity with the exercises created using H5P. H5P module for Drupal, WordPress and Moodle only stores basic results such as minimum, maximum scores, question ID, content ID, time-taken etc. One might be interested in how the user performs in accomplishing a particular question i.e. how many times question is being attempted or interacted before it is submitted etc.

There are various users worldwide who interact with the educational content present online. If content creators have a better track of the interactions made with their work, it can help them in improving content quality. The purpose of the project is to improvise Drupal 8 for achieving the same. Our project, a custom module for Drupal 8- VizH5P implements the extension of Drupal 8 services, which aims to provide educational content creators with a more critical insight into their work.

VizH5P is a custom module for Drupal 8 that captures and stores user-experience data from H5P interactive exercises and send the information to the database and analyse the result through data visualisation.

3.2 Purpose

H5P provides users with various kinds of contents, but it has a drawback of losing the detailed interaction data and provide a less informative representation of the result. VizH5P aims to fill these holes.

Content creators can be benefited if they have an insight into what are the experiences of a user with the content. Our focus is to benefit the teachers who put up educational content. VizH5P visualize H5P results for easy analysis of the result and stores result's metadata.

Our objective is to create a custom module for Drupal which retrieves and stores user activities and displays them in a graphical manner for easy analysis of the responses. The module will capture interaction data like the number of attempts, the time duration between them, correctness of the solution etc. The module is designed to run for activities like quizzes, MCQs, true/false etc.

4 Installations

4.1 Installing Drupal 8

To install Drupal 8 it is required to setup web server with a database and PHP. The server could be your personal computer, or at an online web host.

For 'local' and 'online' Linux based servers using Apache and MySQL, the software that is needed to run Drupal is known as an "AMP stack", though Microsoft based servers and databases also come in a set known as a stack.
AMP stack

- **A**pache (or another web server)
- **M**ySQL
- **P**HP

4.1.1 Drupal 8 for Ubuntu

Prerequisites
First install curl and tasksel
`$ sudo apt install -y curl tasksel`
Next install Ubuntu LAMP stack using tasksel command and enable rewrite mode:
`$ sudo tasksel install lamp-server`
`$ sudo a2enmod rewrite`
Next, install additional PHP module Drupal requirements:
`$ sudo apt install php-fdomdocument php-gd`
To enable "Clean URLS"
Next, install additional PHP module Drupal requirements:
edit /etc/apache2/sites-enabled/000-default.conf
And add this line below the line **DocumentRoot /var/www/html**
<Directory /var/www/html/>
Options Indexes FollowSymLinks
AllowOverride All
< /Directory >
To apply the changes restart your Apache web server:
`$ sudo systemctl restart apache2`

Download Drupal
Download the latest the version of Drupal from
https://www.drupal.org/download
Extract it into /var/www/html/drupal by giving command
`$ sudo tar -zxvf drupal*.gz -C /var/www/html/drupal`
`$ sudo mv drupal-8.4.5 /var/www/html/drupal`
Then run the commands below to set the correct permissions for Drupal to function properly.
`$ sudo chown -R www-data:www-data /var/www/html/drupal/`
`$ sudo chmod -R 755 /var/www/html/drupal/`

Configure Database
In this section we will create a new MySQL database Drupal and assign a user access to it to a new user admin with password pass:

```
$ sudo mysqladmin create drupal
$ sudo mysql -e "CREATE USER 'admin'@'%' IDENTIFIED BY 'pass';"
$ sudo mysql -e "GRANT ALL PRIVILEGES ON drupal.* TO 'admin'@'%' WITH GRANT OPTION;"
```

Install Drupal
Now go to *http://localhost/drupal*. You will see a installation page. Choose your language and continue. Then select standard installation to have commonly pre configured features or select minimal to setup a site without pre configured features. Then click save and continue.
Now write the details of the database you created in mysql. And then click save and continue.
Wait for sometime as drupal gets installed.
Then at last enter your website name and new administrative user credentials.
These steps will install drupal 8 in your pc.
To access drupal go to *http://localhost/drupal*.

4.1.2 Drupal 8 for Windows

First install XAMPP This will install apache , mysql , php and phpmyadmin for you
To install XAMPP, one can download it via the below provided link
https://www.apachefriends.org/download.html
To begin installation, Open/double-click .exe file. Now follow the steps,

1. On opening the file, a XAMPP setup wizard will initiate:
2. Click next, a screen will appear where you can choose the components you wish to keep, on clicking next here you will be getting default components provided by XAMPP.
3. Select the location in your system where you wish to install the XAMPP.
4. Click on next to begin installation
5. On successful completion of Installation, following screen should appear.

Keep the box checked (Do you want to start the Control Panel now), Click on finish to complete the process, control panel screen will automatically launch.

The above steps would concluded the installation of a local web server in your system, Apache and MySQL is running as we can see from the control panel. To check type *127.0.0.1/dashboard/* or *localhost/dashboard/*

Now since we have a local web server in our system, we can begin with Drupal 8 installation. We can download the latest Drupal 8 package from thelink: *https://www.drupal.org/download* . Now follow the steps again,

1. Copy the drupal .zip file in "C:\xampp\htdocs" folder. The path should look like this
2. Extract .zip file.

3. On your web browser, type 127.0.0.1/drupal-8.0.1, where drupal-8.0.1 is the extracted folder name. The step to copy and paste the default.settings.php into settings.php and similarly create a Files folder under sites/default and give read write execute permission for all type of user. One can choose the language of installation by clicking on the drop down box where default language is English.

4. Click on next and a profile selection page is opened, Standard profile is the default profile.

5. Click on Save and Continue

6. To install drupal 8, we need a database which can be created by visiting URL localhost/phpmyadmin/serverdatabases.php. And then write the details of the database you created in phpmyadmin.

Click on save and continue. Installation should start.
After installation, configure site page will open which will need some details from us viz site name/site email address/username/password/Country/Time zone and update notification check boxes.
Then at last enter your website name and new administrative user credentials.
These steps will install drupal 8 in your pc.
To access drupal go to *http://localhost/drupal*.

4.2 Installing H5P Module

4.2.1 Download and Installation

1. Log in to your Drupal site, click on the Manage drop-down button on the menu bar, drops down various options, click on **Extend**.

2. You are redirected to a new page, and on selecting the List tab, you get an option of "**Install new module**". Click on that button.

3. Next, it provides you with two options, installing from a URL or by uploading it from your local machine, you can get H5P module zip/tar.gz file as follows:
   Go to this link- *https://www.drupal.org/project/h5p*
   Scroll down to the end of the page, under the Downloads heading you get the zip and tar.gz file of the latest version of Drupal 8. You can download it, and upload the file on **"Install new module"** page, or copy the URL and paste it on the same. Click on **Install** button.

4. Once the module gets installed to make sure it is enabled, scroll down the list modules and check if under the H5P sub-heading **H5P** and **H5P Editor** are checked. If not, select both and click on the **Install** button at the end of the page. Now your module is enabled.

4.2.2 Setting Up H5P Module

1. In order to set up H5P module[3] for your use follow the following steps: Under the **Manage** drop-down button, select **Structure**.

2. Select **Content types**.

3. On the **"Content types"** page, in the **Basic page** field click on **Manage fields** button.
4. You are redirected to a new page, under the **Manage fields** tab, select **Add field** button.
5. In the **Add a new field** drop down section select **Interactive Content - H5P**, it asks for a label name, fill that then select **Save and continue**.
6. Next, keep the default settings and select **Save field settings**.
7. On the next page, select **Save settings**.
8. Now you are again redirected to **Manage fields** page, select **Manage form display** tab, scroll down and in front of the label name you earlier provided, there is a drop down button present. Select **H5P Editor** and click on **Save**.
9. Now you H5P module is set up for content creation, and to be operated upon by vizh5p.

4.2.3 Creating H5P Content

We can very easily create and play with the H5P content types. Below we are listing the steps required to create a content type, say Multiple Choice Question

1. First, we have to ensure that the **H5P module** is installed in **Drupal 8**. When our module is fully set up, we can start creating H5P content.
2. We click on the **Content tab** at the top and then the add content button.
3. We click on the **Basic page** and here we can see the H5P editor.
4. We click on **Select Content-Type** to open the H5P hub. Once we open the H5P hub, we will get the list of all content types that are available for installing.
5. We then click **Get** on Multiple Choice Question content type to proceed to the Content-type details page.
6. We then click on **Install** button to install the selected content type.
7. The content type is now installed and ready for use.
8. We click **Use** button to open the editor and start creating the content.

4.3 Installing VizH5P

1. Go to this link- "*https://github.com/ekv18drupalteam/VizH5P*"
2. Click on the **Clone or download** button of green colour.
3. Next click on **Download ZIP**. It will download the zip file with README and module zip.
4. Under the Downloads you will get your **VizH5P-master** zip file. Extract it and you will find **README** and **vizh5p zip**(module).

5. Now log in to your Drupal site, click on the Manage drop-down button on the menu bar, drops down various options, click on **Extend**.

6. You are redirected to a new page, and on selecting the List tab, you get an option of "**Install new module**". Click on that button.

7. Next, it provides you with two options, installing from a URL or by uploading it from your local machine. Click on the **Choose File** button and head to your Downloads again and select **vizh5p.zip** file under **VizH5P-master** folder.

8. Click on the **Install** button.

9. Once the module gets installed to make sure it is enabled, scroll down the list modules and check if under the **CUSTOM** sub-heading VizH5P is checked. If not, select it and click on the **Install** button at the end of the page. Now your module is enabled.

5 Web Technologies Used

5.1 Drupal 8

Drupal is an open source website development platform. It is a CMS that manages user-content worldwide and makes it easier for them to organize their content. It follows HTML5, YAML standards, and modern OOP patterns. Its framework is derived from that of Symfony-2 and includes Web technologies such as CKEditor, Twig, jQuery, Backbone.js, and Guzzle.

This project uses Drupal 8. Drupal accommodates various content types such as audio, video, text, image etc. We have targeted a major portion of incorporated H5P contents, to work upon.

Drupal services can be easily extended by adding custom modules to it. H5P module of Drupal 8 provides various types of content ranging from interactive videos, quizzes to MCQs etc. Our custom module is designed to operate upon this content and analyse user interaction with it.

5.2 H5P

H5P is an open source cross-platform software and stands for HTML5 Package. It is a plugin for existing Content Management System, which aims to provide users with an easy way of creating interactive content like Presentations, Interactive videos, Games, Quizzes etc. Currently, its supported by Drupal, MOODLE, WordPress and Tiki platforms. In order to make it easy to integrate it with new platforms, the developers have ensured to minimize platform specific code and backend code.

H5P is a community-driven project to create richer online content and improve online learning experiences. It aims to facilitate sharing of accessible content and to make it easier for creators to deliver and publish their content.

Its content is responsive and mobile friendly, which means that users will experience the same rich, interactive content on computers, smartphones and tablets alike.

5.3 JSON

JSON or JavaScript Object Notation is a data format used for storing and exchanging of data between the browser and server. It is a lightweight data-interchange format. While exchanging of data, we can convert a Javascript object into JSON and send JSON to the server. As well as, we can convert JSON received from the server into Javascript objects. We can also convert Javascript object into JSON and send it to the server. In our module, XAPI[1] captures user activity and interaction in JSON format. Sample format of our JSON is as follows:

The image(see Figure 1) stores the detailed information about user interaction data such as users name, object type, activity type, result.

5.4 Experience API

The Experience API as the name suggests is a software tool used for tracking a person's interaction and experience with various applications. It is an open source tool with its data format as Javascript Object Notation (JSON) as mentioned in above section. Our module implements X-API in order to capture each interaction of a user with the content and delivers the information in the

```
actor:
        mbox:"mailto:user@example.com"
        name:"administrator"
        objectType:"Agent"
context:
        contextActivities:{category: Array(1)}
object:
        definition:
        extensions:{http://h5p.org/x-api/h5p-local-content-id: 2}
        interactionType:"choice"
        name:{en-US: "Not Available"}
        type:"http://adlnet.gov/expapi/activities/cmi.interaction"
        id:"http://localhost/drupal/h5p/2/embed"
        objectType:"Activity"
result:
        completion:true
        duration:"PT9.65S"
        response:"1"
        score:{min: 0, max: 1, raw: 1, scaled: 1}
        success:true
verb:
        display:{en-US: "answered"}
        id:"http://adlnet.gov/expapi/verbs/an
```

Figure 1: Generating JSON through xAPI

form of JSON object. Every time there is an event, an object is delivered. The objects provided are further converted to string format for passing them on into our module.

6 VizH5P

A custom module[2] for Drupal 8 to Analyze Students Response to H5P Submissions

6.1 Components Of VizH5P

1. **vizh5p.info.yml**
   This file provides with the basic profile of the module. It stores the metadata about the module. Our vizh5p.info.yml consists of the name of the module, description statement, Core (Version of Drupal), Package: Custom Module.

2. **vizh5p.routing.yml**
   Routing file is loaded next after the vizh5p.info.yml file. The purpose of this file is to determine what to execute when a certain path/route is encountered. The file states the function calls to be made on encountering specific routes.
   vizh5p.routing.yml has 3 components:

   - vizh5p.plot: States the URL that calls the function to build form.
   - vizh5p.post: States the URL that passes on the JSON objects, captured by xAPI, to the controller and stores it to Drupal's database.
   - vizh5p.get: States the URL used to pass the data received from the form and provide it to the controller to retrieve the data from the database.

3. **vizh5p.module**
   This file implements "hooks". Hooks are specially named functions defined by a module or can be predefined by Drupal-core. Their purpose is to provide a way for modules to add to, or alter the core behaviour of Drupal. According to their respective definitions, they are discovered and called at specific times. vizh5p.module implements a hook that executes a Javascript code snippet, only on pages with H5P contents on them.

4. **vizh5p.install**
   This file comprises of the structure of the MySQL table which shall store the result and interaction data, in Drupals database. The table is created in Drupal's database when this file is loaded.

5. **vizh5p.services.yml**
   The services of the module are defined in a file named vizh5p.services.yml. When this file is placed in the root of the module, it automatically gets detected and is used by Drupal. The service is a parent to the actual service, which is provided by instantiating the class defined in the service file.

6. **vizh5p.libraries.yml**
   vizh5p.libraries.yml is used to add any additional asset(CSS or javascript) to a page. It stores the location and type of code(CSS or JS) to be added.[7]

7. **vizh5p.links.menu.yml**
   Through vizh5p.links.menu.yml, it is possible to add a menu link to VizH5P module. The

custom menus are a list of common links that are displayed as the main navigation of the site.

8. **src**
   Src folder contains:

   (a) Controller files

   (b) Form page generator files

   (c) Database connection files

   Drupal 8 uses the Symfony HTTP Kernel, a system which gets the request and asks other systems to produce the requested output (a response object) and sends the response back to the client. The output is generated by a piece of code called the controller.
   In VizH5P ajax calls had been placed which sets the URL and according to the URL routing file invokes the PHP function. Php function in controller reads data from database using database service and sends it to ajax call from where the call came.
   The Form folder contains the file that implements "build form" and attaches the javascript library to the form. The form shall provide with the options for displaying results.
   There is another file in src folder called DBLogic which provides connection to the database and manages all the database queries for addition, fetching all the rows and fetching selected rows.

9. **JavaScript**
   JavaScript related to VizH5P module is placed in a folder named js. js folder contains three files

   - **Plotly-latest.min.js**:- It is a minimized version of the plotly library which was added for graph visualisation.
   - **Capture.js**:- It captures xAPI statement and send the JSON object to php controller through the AJAX call.
   - **Graph.js**:- It shows up the table and the graph according to the content-ID and username selected.

7 Workflow

7.1 Overview

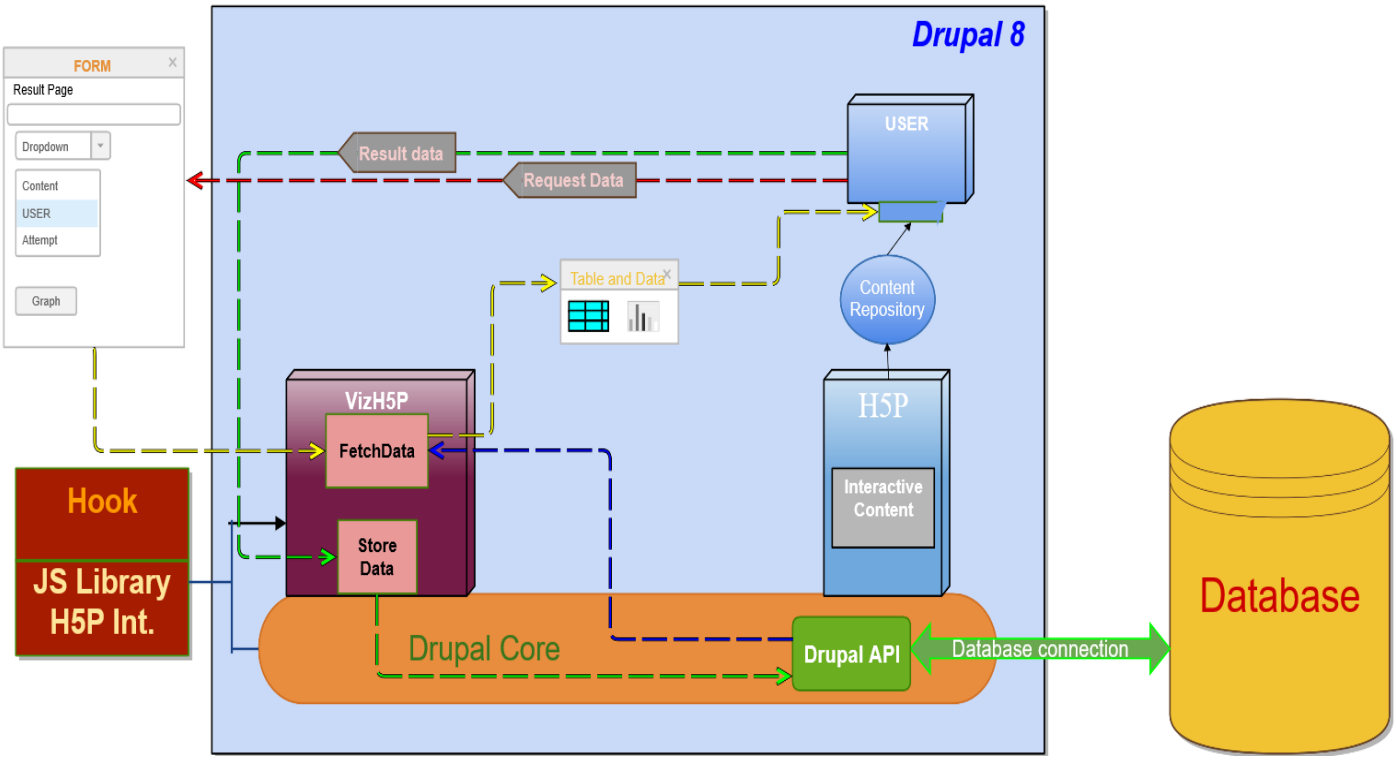

Figure 2: Workflow Diagram

The figure(see Figure 2) is an overview of the functionality of VizH5P. Drupal 8 is the platform on which user is working. Two modules depicted here are H5P and VizH5P, that user shall work with. Hooks are used for implementing communication between modules. VizH5P implements a hook for attaching external libraries. Drupal core looks for hook implementations in all the enabled modules and seeks contributions from all of them. When it finds the particular hook implemented by VizH5P it attaches the external libraries and executes them.

Firstly, the user interacts with H5P contents like quiz, interactive videos, MCQs etc. On interaction, that data is captured by VizH5P and stored in the database. This is implemented by capturing interaction data from the web page and passing it to VizH5P, through Ajax call. VizH5P calls for a service that enables Drupal core to implement connection with the database which has VizH5P modules table. Data is then stored in the table. Next, user requests for retrieval of result data. The user provides with some details of the data that he/she wants like question id, the name of the user whose interaction data is required, attempt number etc. These details are filled in through a form, which completes data retrieval. Requested data is then fetched from the database through the same service mentioned above. After fetching data, it is displayed to the user in a tabular and graphical manner for analysis.

7.2 Workflow Explained

7.2.1 Capturing xAPI Events

This section guides us through the path of capturing the data about interaction with H5P content, then, possible approaches to pass on the data to our module in order to store it in Drupals database.

After VizH5P has been installed, it attaches an external library that includes a Javascript, on every page which has H5P content on it. Once the page is loads completely, Javascript is executed. On any kind of interaction activity with H5P content, xAPI statements are generated, which have details of the interactions. Statements are made available through events in Javascript. Format of the data is JSON and it is converted into string format for further transfer.

7.2.2 Generating JSON Through xAPI

After JSON data is fetched by the Javascript, certain fields are to be inserted into the database such as the name of the user, timestamps of different actions taken by the person such as when the user attempted the question, at what time the user started interacting with it, if the user finally submitted the answer and the question ID etc. VizH5Ps database table contains four columns namely contentID, actor (name of the user), timestamp and verb (actions done by the user). Saving the JSON fields into the database can be completed through either of the following approaches:

- REST API
- AJAX Callback

7.2.2.1 REST API At first, the session token is generated through interaction with data. Subsequently a JSON object with URL, view page title and content is being created (node generation). AJAX calls the URL with the session code and posts the JSON data in a string format.Then a function captures csrftoken and xAPI statements, and JSON fields are obtained such as content-ID and name of the actor. After getting success in AJAX call JSON object is returned to the same page. Each time user interacts with the question, there is a content created for that. This overflows the content page of Drupal with numerous contents There are also five extra dependencies only to store JSON data captured by xapi and they are RESTful Web Services, REST UI, Serialization, HAL and HTTP authentication. Therefore this approach is not feasible to store the JSON fields.

7.2.2.2 AJAX Callback After Javascript captures xAPI statements, it stringify the JSON data. Then it creates XMLHttpRequest object which can be used to request data from a web server. Basically, its an AJAX call to a URL, predefined inside VizH5P which draws routing file into the picture. Data is sent to Controller class by POST method through this URL. Then routing file invokes a function of Controller class that makes use of database services to create an object of DBLogic (Drupal 8 database). It inserts JSON data fields which were passed from Javascript into drupal database table by add query service. Subsequently, it returns the JSON response data to AJAX call in the Javascript[6][7].

Figures 5 and 6 represent the structure of the VizH5P table inside database and interaction data stored inside it.

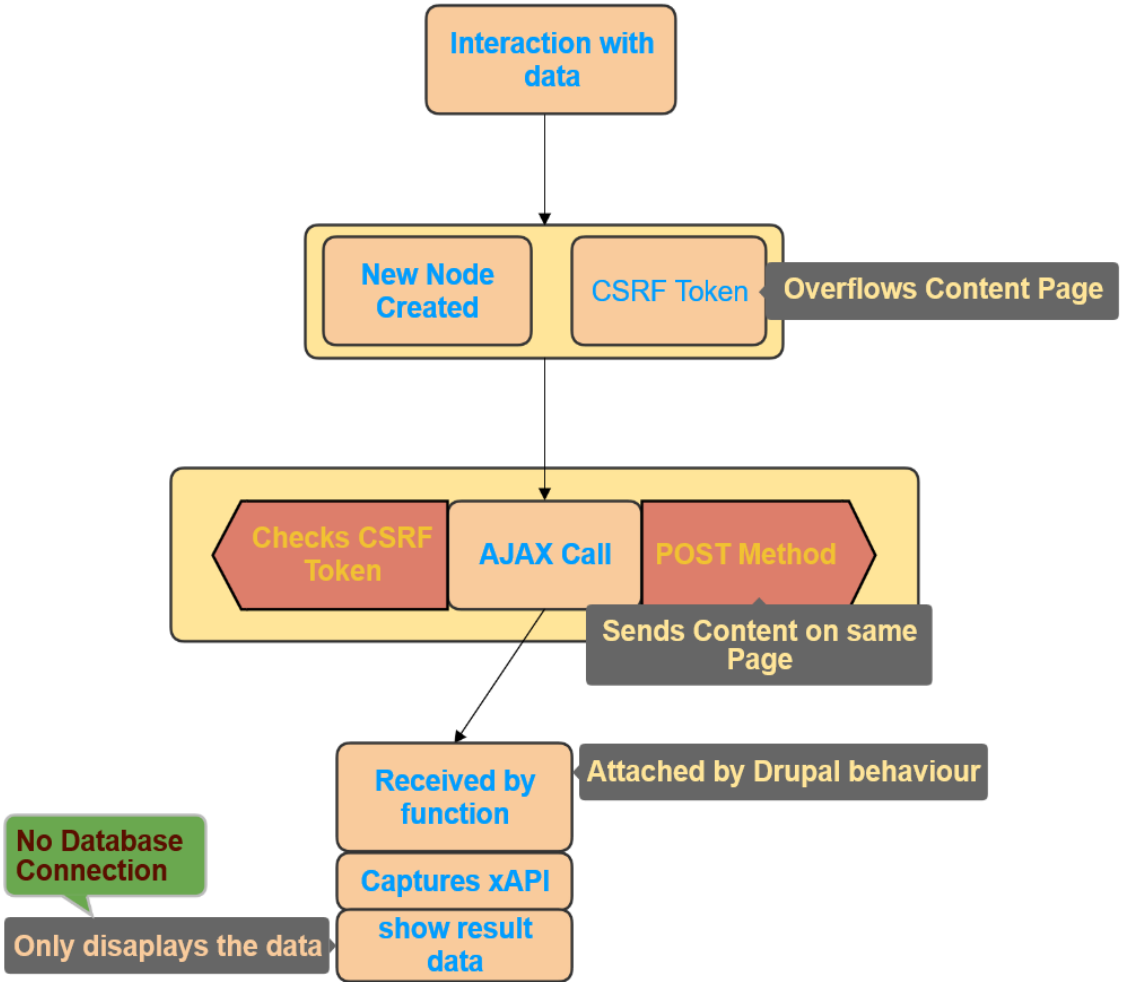

Figure 3: REST API Workflow

7.2.3 Building Form

GraphForm class creates the structure and functional workspace of the form page. It generates the form and also attaches two libraries, one for coupling plotly minimized version library and the other is custom javascript to bring on the graphical and tabular representation of a particular user-performance on a particular question. At first all the data of the table is fetched using database services. Then 3 dropdowns are created, 1st for selecting content_id , 2nd for selecting username based on the content_id selected above and 3rd for selecting attempt number based on the content_id and username selected above. This is done using ajax calls in drupal form. All contentcontent_ids and usernames are shown in sorted order. Then as the attempt number is selected, a table appears showing time, content_id , username and verb of the selected data. This completes the process of data retrieval.

7.2.4 Visualisation

As soon as the username, content_id and attempt number are selected, the Graph.js file, which was attached to the form, comes into the picture. The content_id, the username and the attempt information are embedded into a javascript object rather a JSON object and are sent in string format through AJAX post request. It triggers a URL, stated inside the routing file. Routing

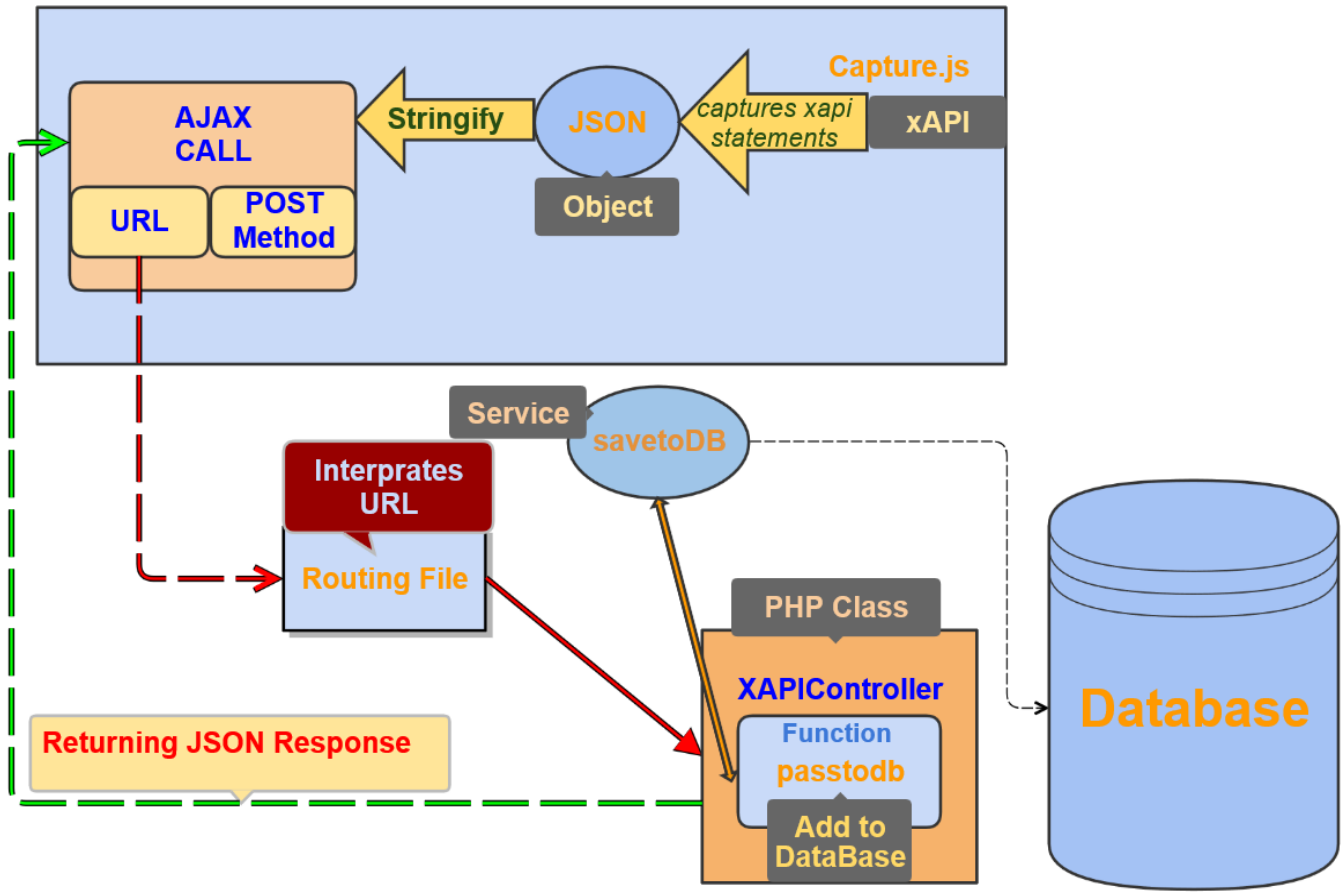

Figure 4: xAPI Workflow

```
mysql> show columns from vizh5p;
+------------+--------------+------+-----+---------+-------+
| Field      | Type         | Null | Key | Default | Extra |
+------------+--------------+------+-----+---------+-------+
| time       | varchar(255) | NO   |     | NULL    |       |
| content_id | varchar(255) | NO   |     |         |       |
| actor      | varchar(255) | NO   |     |         |       |
| verb       | varchar(255) | NO   |     | NULL    |       |
+------------+--------------+------+-----+---------+-------+
4 rows in set (0.05 sec)
```

Figure 5: Database Table Configuration

file processes this URL and invokes a function of GraphController class in Controller folder. The function fetches data from the database in a sorted order to match the options which were passed to the controller (username, content_id and attempt number). This is done through database service of Drupal. Once data is filtered according to the options selected, then this information is used to calculate the 12 things. These 4 things are calculated Time taken to interact , Interaction time , Number of interactions and Time taken to answer , across the following Average of all users having the selected content id. The selected user on the selected content id. The selected user on

```
mysql> select * from vizh5p;
+----------------------------+------------+--------+------------+
| time                       | content_id | actor  | verb       |
+----------------------------+------------+--------+------------+
| 2018-06-30 15:35:35.668 | 1          | dummy1 | attempted  |
| 2018-06-30 15:35:38.179 | 1          | dummy1 | interacted |
| 2018-06-30 15:35:40.066 | 1          | dummy1 | answered   |
| 2018-06-30 15:36:16.479 | 2          | dummy2 | attempted  |
| 2018-06-30 15:36:17.797 | 2          | dummy2 | interacted |
| 2018-06-30 15:36:19.596 | 2          | dummy2 | answered   |
| 2018-06-30 15:37:02.756 | 4          | dummy3 | attempted  |
| 2018-06-30 15:37:07.127 | 4          | dummy3 | interacted |
| 2018-06-30 15:37:11.766 | 4          | dummy3 | interacted |
| 2018-06-30 15:37:13.195 | 4          | dummy3 | answered   |
| 2018-06-30 15:37:26.118 | 1          | dummy1 | attempted  |
| 2018-06-30 15:37:28.449 | 1          | dummy1 | interacted |
| 2018-06-30 15:37:30.03  | 1          | dummy1 | interacted |
| 2018-06-30 15:37:32.031 | 1          | dummy1 | answered   |
| 2018-06-30 15:37:45.692 | 2          | dummy2 | attempted  |
| 2018-06-30 15:37:47.694 | 2          | dummy2 | interacted |
| 2018-06-30 15:37:48.916 | 2          | dummy2 | interacted |
| 2018-06-30 15:37:50.18  | 2          | dummy2 | interacted |
| 2018-06-30 15:37:53.085 | 2          | dummy2 | answered   |
| 2018-06-30 15:38:18.719 | 1          | dummy1 | attempted  |
| 2018-06-30 15:38:23.181 | 1          | dummy1 | interacted |
| 2018-06-30 15:38:25.317 | 1          | dummy1 | interacted |
| 2018-06-30 15:38:26.883 | 1          | dummy1 | answered   |
+----------------------------+------------+--------+------------+
23 rows in set (0.00 sec)
```

Figure 6: Interaction data stored in VizH5P table

the selected content id and on the selected attempt. This data is then passed to Graph.js as a JSON response, which uses plotly-latest.min.js(reference) to display this data graphically through histograms.

1. Average of all users having the selected content_id.
2. The selected user on the selected content_id.
3. The selected user on the selected content_id and on the selected attempt.

This data is then passed to Graph.js as a JSON response, which in turns shows this data graphically by making histograms using plotly[8].

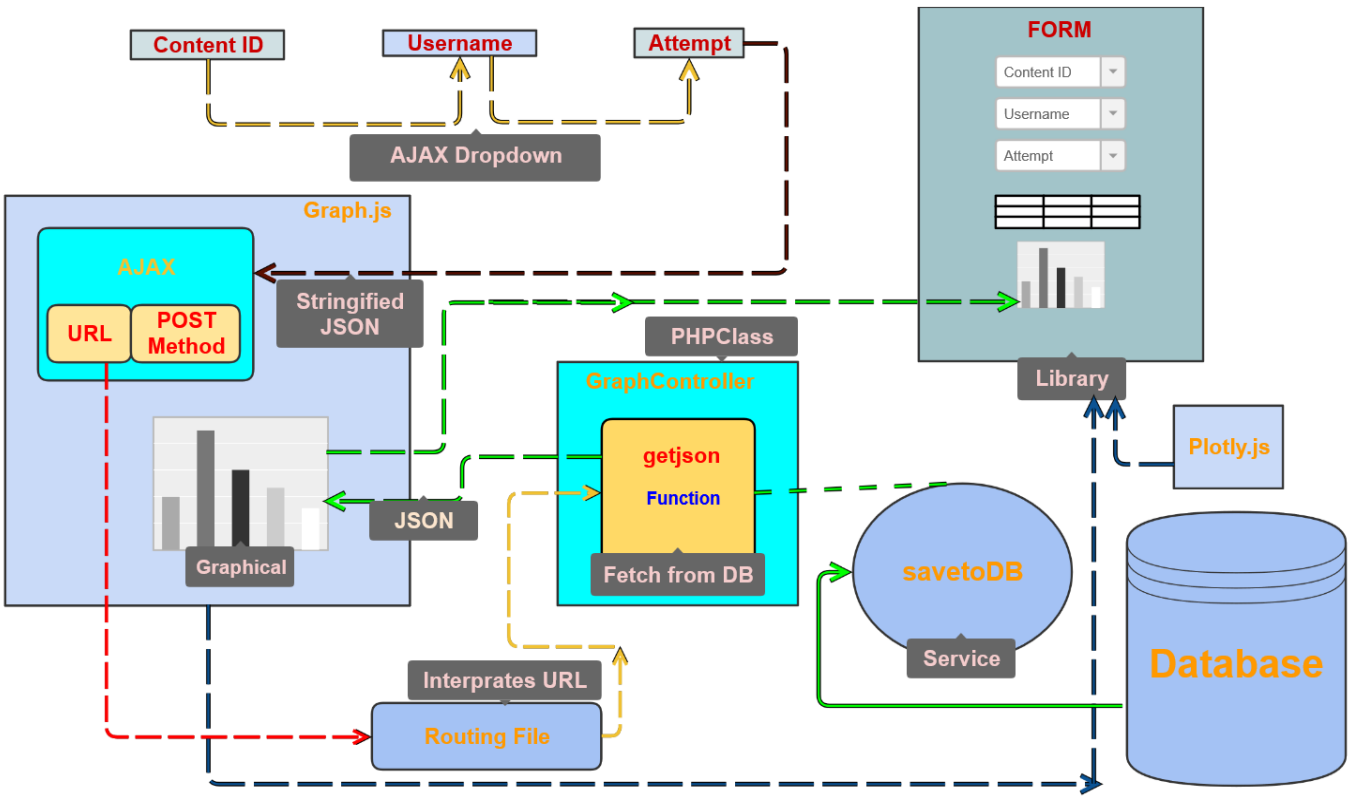

Figure 7: Graph Visualisation Workflow

Figure 8: Result Page

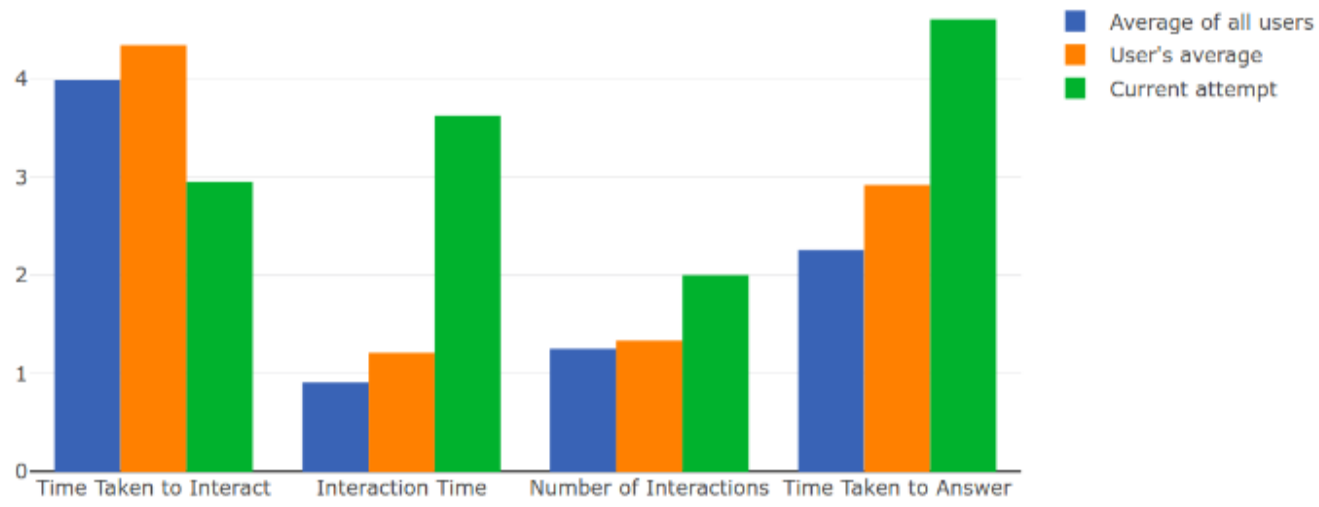

Figure 9: Histogram

Table Data

Time	Content ID	Actor	Verb
2018-06-28 16:42:51.615	1	admin	attempted
2018-06-28 16:42:54.561	1	admin	interacted
2018-06-28 16:42:58.188	1	admin	interacted
2018-06-28 16:43:02.792	1	admin	answered

Figure 10: Display Table

8 Future Work

Further development in the module can include the following:

1. Improvement in Analysis of content:
   VizH5P displays the interaction data in graphical and tabular manner. It provides us with interaction details, for a given activity/question, like average interaction time among users, average accuracy etc. As a part of future work, a rating system for questions or activities can be developed, which rates a question on the basis of interaction data received.

   Also user performances can be be categorised on the basis of their accuracy, response time, number of attempts and content type etc.

2. More structured management of the access provision implemented by VizH5P:
   For now, interaction data of an activity can be accessed by the admin of the website which holds the contents.

   Further developments in VizH5P can target to ensure that the result data of the activities can only be accessed by the users who created them. Also, a system for seeking permission-requests for other users contents results can be added as another feature to the module.

9 References

References

[1] xAPI statements generated on interaction with H5P content *"https://h5p.org/documentation/x-api"*.

[2] Create custom module in Drupal 8 *"https://www.drupal.org/docs/8/creating-custom-modules"*.

[3] Set up H5P for Drupal 8 *"https://h5p.org/documentation/setup/drupal8 "*.

[4] Question asked on Drupal Stackexchange *"https://drupal.stackexchange.com/questions/262815/attaching-pages-in-a-custom-module/"*.

[5] Question asked on Drupal Stackexchange *"https://drupal.stackexchange.com/questions/263343/attaching-into-a-form-using-ajax Attaching javascript library into a form using ajax"*.

[6] Attaching a javascript file on H5P pages in a custom module in drupal 8 *"https://h5p.org/node/254095"*.

[7] Adding stylesheets (CSS) and JavaScript (JS) to a Drupal 8 module *"https://www.drupal.org/docs/8/creating-custom-modules/adding-stylesheets-css-and-javascript-js-to-a-drupal-8-module"*.

[8] Plotly.js: an open source Javascript graphing library *"https://plot.ly/javascript/getting-started/i"*.