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NBA Accredited

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UNIVERSITY OF MUMBAI

Academic Year 2022-2023

A Project Presentation on

Developing Data Analytics Support for Creative Learning Web Framework

Submitted in partial fulfilment of the degree of
Bachelor of Engineering(Sem-8)
in
INFORMATION TECHNOLOGY

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1.Project Conception and Initiation

1.1 Abstract

- Online learning has grown steadily in the last decades and the use of learning analytics has increased in parallel.
- As online education continues to grow, instructors need to find new ways to enhance student learning online and to understand students' interactions with their electronic learning environment.
- Learning Analytics or Web Analytics (WA) is predominately used to obtain key information about users and their behaviour on websites.
- Online learning consists of a Learning Management system (LMS) and Massive Open Online Course (MOOC).

1.2 Objectives

- To gather data and analyze based on the students behavior in online learning platform.
- To provide privacy to student sessions and achieve transparency in data collection.
- To create a flexible analytics tool that is compatible with websites.
- To help the instructor of courses to improvise his content by providing statistical data regarding user interactions with his course material with the help of Analytics tool.
- To provide instructors with relevant data which helps them to make adjustment in the courses.

1.3 Literature Review

Sr. No.	Title	Key Findings	Year
1.	Web Analytics as Extension for a Learning Analytics Dashboard of a Massive Open Online Platform	The Web Analytics was the upgrade version of LA Cockpit and it was used to record student interaction with MOOC based upon mouse events.	2020
2.	Understanding Learner Behavior in Online Courses through Learning Analytics.	The authors present a case study of an online course that used learning analytics to track student behavior and provide feedback to instructors on areas where students struggled or engaged.(Google Analytics)	2021
3.	The Effects of Student Engagement, Student Satisfaction, and Perceived Learning in Online Learning Environments.	The authors argue that cognitive engagement is an important factor in e-learning, as it is related to students' motivation, learning outcomes, and satisfaction.	2016

1.4 Problem Definition

- The third party Analytics tool extracts redundant data which is not part of our requirements.
- The job of instructor becomes hard to communicate with students and get feedback regarding course materials and structure.
- This distant relationship will result in poor course quality and bad user experience.

1.5 Scope

- Can be easily integrated on already existing MOOC websites.
- Can be used where video analytics / audio analytics are required.
- Can be used not only in creative web framework but also for any e-learning platform.
- Can be used for course evaluation to identify areas of strength and weakness in the course and make necessary improvement.
- Can be used to measure student participation and student engagement.

1.6 Technology stack

- Frontend –
  - Html
  - CSS, Bootstrap
  - JavaScript
- Backend –
  - Express,
  - NodeJS
  - MongoDB

1.7 Benefits for environment & Society

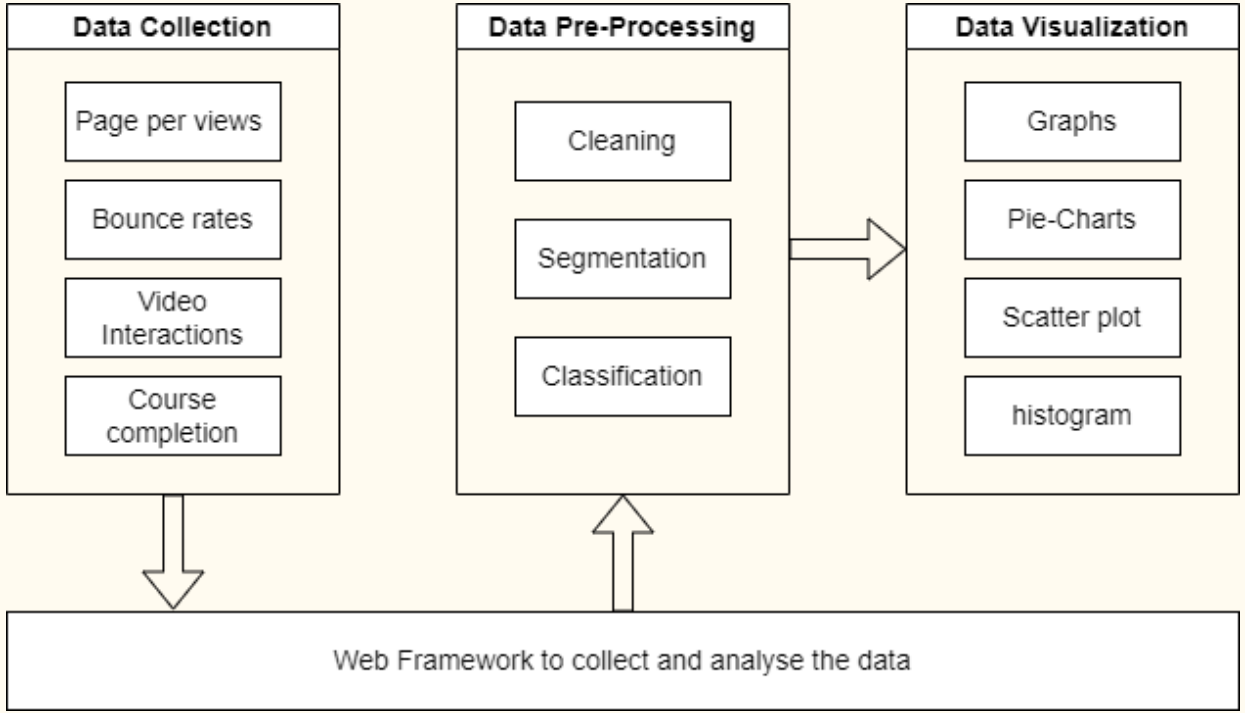
- By providing online courses, there is less need for travel to and from physical classroom locations. This can result in reduced emissions from transportation, lower energy use in buildings, and other environmental benefits.
- Through the use of data analytics, instructors can gain a better understanding of how students are engaging with the course material and the online learning environment. This can help instructors identify areas where students may be struggling and develop strategies to increase student engagement and motivation.
- By providing instructors with data analytics support, they can gain insights into student behavior, and make data-informed decisions to improve their teaching and learning outcomes.

2. Project Design

2.1 Proposed System

1. Data Generation:
    - Analytics tool will provide scripts to embed in the Web Pages.
    - This will help to collect and store user generated data from the web application.
2. Data Processing:
    - According to the requirements appropriate classification and segmentation of data can be done.
3. Data Visualisation:
    - Data visualisation will help instructor to deduce students behaviour and feedback.

2.1 Proposed System



2.2 Design(Flow Of Modules)

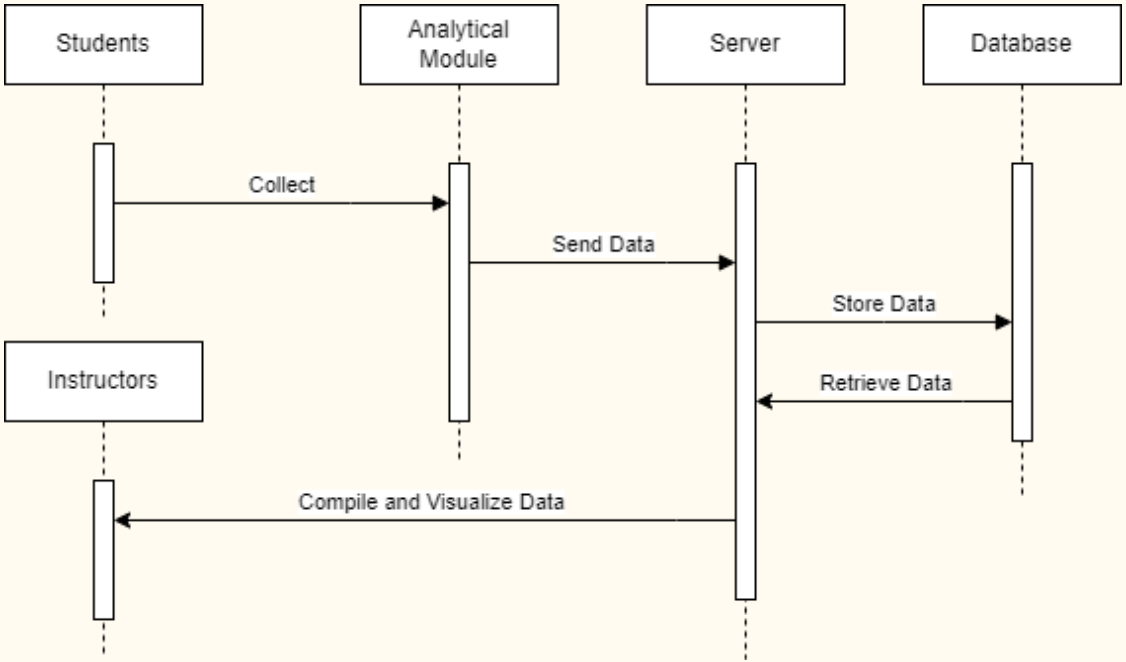


Fig. Sequence Diagram

2.3 Use Case Diagram

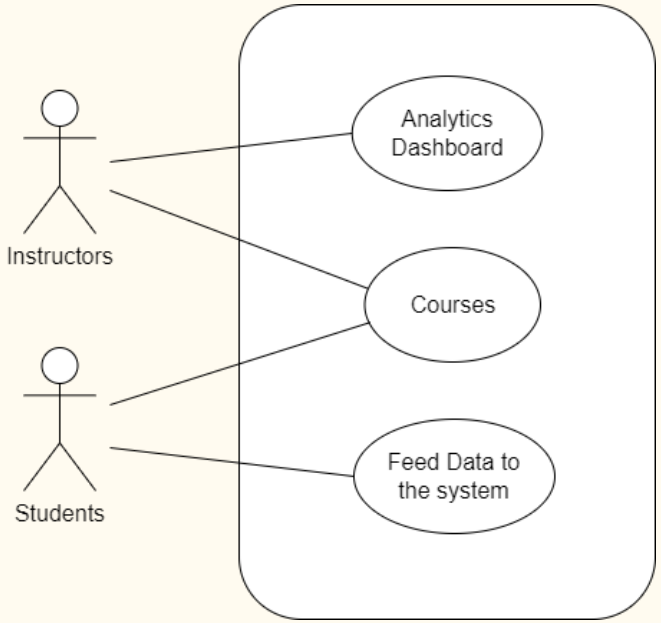


Fig. Use-Case Diagram

2.3 Description Of Use Case

- The use case diagram contains two primary actors: the Instructor and the Students. The students engage with the courses and feeds data to system about the usage of the course material.

- The use case diagram demonstrates the interaction between the actors and the system, highlighting the functions that the system can perform for each user.

- The Instructor can collect data on student behavior, access analytic to gain insights, and view student progress.

- The Students can enroll to courses and complete them.

3. Implementation

```
export class Kratos{
  constructor({...options}) {
    this.data = {
      currentPage: window.location.pathname,
      timestamp: new Date().toISOString().slice(0,10),
      userData: {
        guestId : localStorage.getItem('guestId'),
        browser : window.navigator.userAgentData.brands[2].brand,
        browserVersion : window.navigator.userAgentData.brands[2].version,
        platform : window.navigator.userAgentData.platform
      },
      scrollDetails: null,
    }

    this.interval = setInterval(() => {
      this.sendData();
    }, options.dataFrequency);
    this.currentTime = Date.now()
    this.previousScrollDepth = 0;
    this.currentScrollDepth = 0;
    this.scrollThresholds = [25, 50, 75, 100];

    this.url = options.url;
    this.updates = false;
```

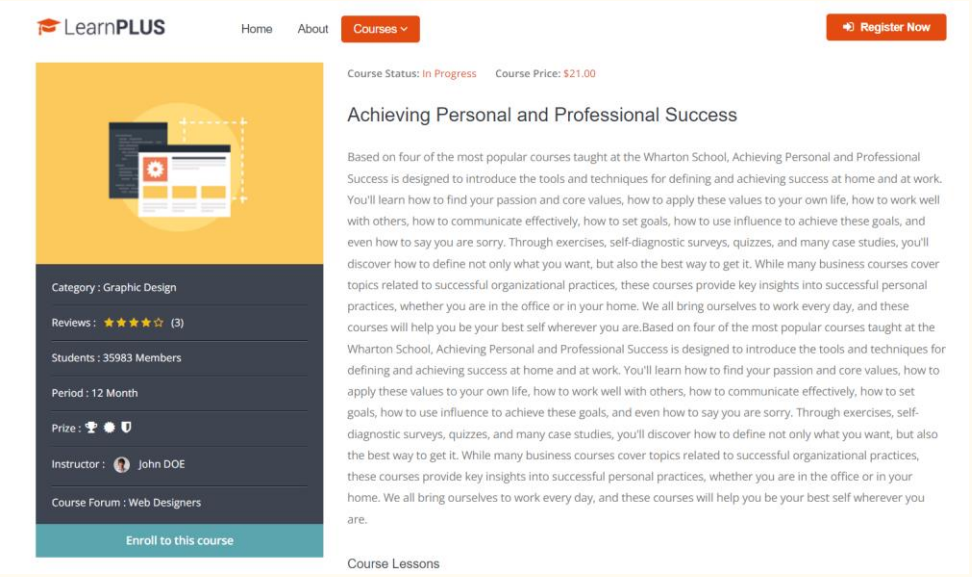
```
sendData(){
  if(this.updates){
    var xhr = new XMLHttpRequest();
    xhr.open('POST', this.url, true);
    xhr.setRequestHeader('Content-Type', 'application/json; charset=UTF-8');
    xhr.send(JSON.stringify(this.data));
    this.updates = false;
    this.print();
    console.log('sending data...');
  }
}

sendDataAsync(){
  return new Promise((resolve,reject) => {
    if(this.updates){
      try {
        var xhr = new XMLHttpRequest();
        xhr.open('POST', this.url, true);
        xhr.setRequestHeader('Content-Type', 'application/json; charset=UTF-8');
        const res = xhr.send(JSON.stringify(this.data));
        this.updates = false;
        this.print();
        resolve(res);
      } catch (error) {
        reject(error)
      }
    }
  })
}
```

Fig. Analytical module

```
listenerforVideo(trigger, element, cb){
  this.data.video = {
    play: [],
    paused: [],
    seeking: false,
    seeked:[],
    rateChange: [],
    ended: false
  };
  element.addEventListener(trigger, (e) =>{
    switch (trigger) {
      case 'play':
        this.data.video.play.push(Math.round(e.target.currentTime));
        if(this.data.video.seeking){
          this.data.video.paused.pop();
          this.data.video.play.pop();
          this.data.video.seeking = false;
          this.data.video.seeked.push(Math.round(e.target.currentTime))
        }
        break;
      case 'pause':
        this.data.video.paused.push(Math.round(e.target.currentTime));
        break;
      case 'seeked':
        this.data.video.seeking = true;
        break;
      case 'ratechange':
        this.data.video.rateChange.push(e.target.playbackRate)
        break;
      case 'ended':
        this.data.video.ended = true;
        console.log('ended');
      break;
      default:
        cb();
        break;
    }
    this.updates = true;
  })
}
```

```
listenerAndFindOnce(trigger, element, arr) {
  if(!element && !trigger && !arr.length) {return false}
  const listener = (event) => {
    const id = event.target.id;
    arr.forEach((query) => {
      if(query == id){
        this.data[id] = true;
        console.log(this.data);
        this.updates = true;    // for update status
      }
    })
  }
  element.addEventListener(trigger, listener)
}
```

Fig. Analytical module



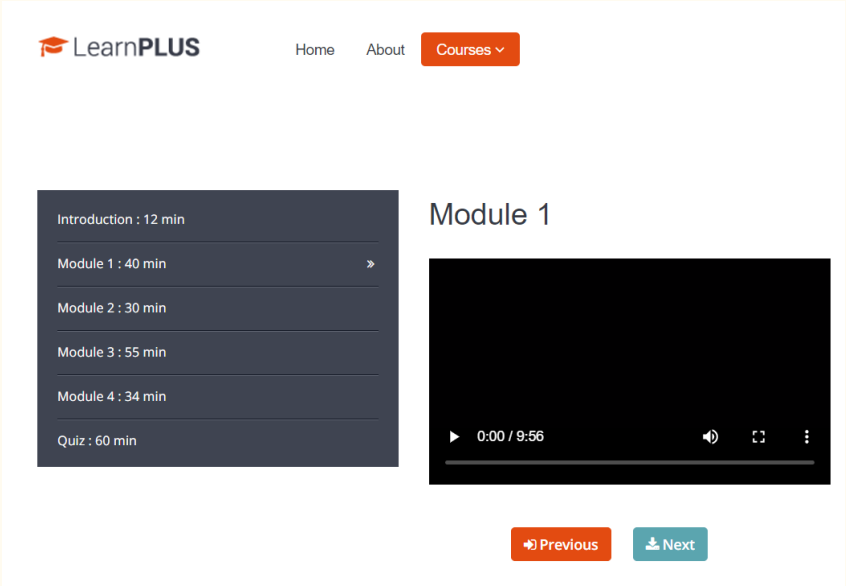


Fig. Client side Pages

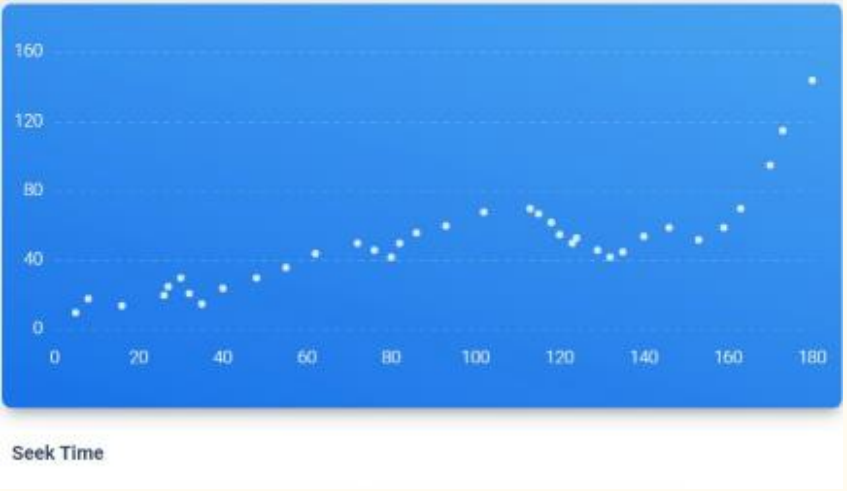
4. Testing

Test condition	Test Step	Test Data	Expected Result	Actual Result	Pass/Fail
Element listener	Pass Node element and listener	Check if the element exists in DOM	Event Listener added to the element	Event listener Working	Pass
Media listener	Pass media element and listener	Classify listeners	Video data capturing	Data stored in Array	Pass
Push User Data	Pass data from the Front-end	Check if the user exists in database	User data gets added	User gets created/ updated	Pass
Aggregating Data	Pass raw data	Check for timestamps and already stored documents	Data gets added cumulatively	Documents are updated	Pass

5. Result

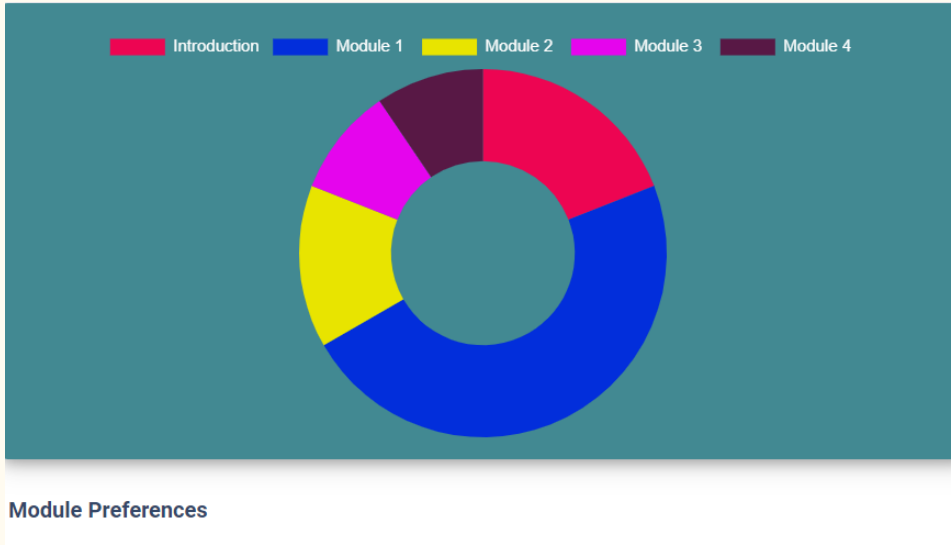
This figure represents the bounce rate for a particular course, where X-axis represents dates and Y-axis represent total counts of bounce rate for a day. The percentage change of bounce rate helps determine the trend in recent days.

The line denotes the number of students enrolled to the course against the number of page visits represented in pink bar chart. This metric can help instructors understand whether the first impression of course is good enough.



The X-axis represents the time in seconds concerning the video and Y-axis represents the number of times the video was skipped. This helps to determine whether the students are skimming through the course for the sake of completion.

The chart represents the distribution of modules that are completed in the course. This can help instructors better understand student requirements from the course. For instance, in this example “Module 1” is the most popular section of the course.



6. Conclusion and Future Scope

6.1 Conclusion

In conclusion, building an analytical tool to capture student interactions with online learning platforms is a critical step in improving the overall learning experience for students. By providing instructors with valuable insights into how student interact with their courses, this tool can help them make data-driven decisions on improving the course content. The development of learning analytics to increase student engagement and performance has the potential to revolutionize the way we approach online learning.

6.2 Future Scope

The future scope of this project is vast as the use of online learning platforms is constantly increasing. Some of them are discussed further. Firstly, the data collected can grow exponentially in this kind of application based on the popularity of the course. So decision making for instructors could become difficult. We can implement predictive analysis and reduce the overhead on the end user, showing them filtered and only necessary results. Secondly, we can provide personalized learning experiences for students by tracking their progress and making recommendations for courses that match their learning style.

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Paper Publication

Paper entitled **“Developing Data Analytics Support for Creative Learning Web Framework”** is awaiting decision at **“International Conference on Sustainable Computing and Smart Systems (IEEE - ICSCSS 2023)”** by **“Neel Dudheliya, Anand Morye, Ayush Jain, Prof. Jayshree Jha and Dr. Kiran Deshpande”.**

Thank You