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Object Oriented Modeling of Secured Paid Virtual Event Management System

Victor Chakraborty
Assistant Professor, Computer Science & Engineering, Gandhi Engineering College, Bhubaneswar, Orissa

Abstract: ***The COVID-19 pandemic has brought many changes in our personal and professional lives. As organizations were compelled to permit their workforce to go in work from home mode, most scheduled in person events of these organizations was either postponed, canceled or went virtual. Although considered a boon in disguise, virtual conferencing and virtual event applications have almost taken a top spot for vulnerability when it comes to cyber-attacks by hackers. There are many reports of malicious actors creating fake installation files for virtual meeting application platforms such as Zoom, Microsoft Teams, and even Google Classroom. The success of an Event Management system is largely dependent on level of security imposed in the system. Different security services like enabling individual registration link for each attendee, two factor authentication, password manager, using a VPN when possible are sufficient to ensure the security of Event Management system. In this paper we explore a suitable Object Oriented Model to authenticate an attendee into an Event website which is secured though SSL and which uses authentication tools like Password Manager. Proposed model may be used for all kind of Event platforms so that the planners can trust and use such secure systems for conducting their future events.***
Index Terms: Virtual Events, Hybrid Events, Object Oriented Model, Payment Gateway, Two factor Authentication, OAuth2.0

I. INTRODUCTION

During the COVID-19 pandemic, in the Events industry there has been a shift from on premise events to Virtual events. Event planners now prefer to host their events, conferences and seminars in online mode rather than in offline mode. Virtual events have started to become increasingly popular as they offer an economically and environmentally effective way to bring together thousands of attendees to an event from around the globe. Virtual events can offer a number of ways for participants to connect and communicate. Webcasts include live presentations or pre-recorded videos where the presenters are available for questions and answers at the end of the session – a technique called Simulive. Virtual booths, forums and designated meeting places allow participants to connect with event staff or fellow attendees using online chat, video and voice. Participants can leverage their social network within the event to form interest groups or find like-minded individuals. They can also share the findings with their online communities, often leading to viral popularity of an event. As per research conducted by markletic.com on May, 2020, 87% of marketers consider the opportunities generated by virtual events as a success factor.

"Virtual events have been incredibly helpful to organizers during the pandemic and will continue to be an important channel for engaging audiences further down the line," said Alon Alroy, Co-Founder, CMO & CCO of Bizzabo (one of the fastest growing event tech company), in a statement. "However, there are inherent limitations around meeting virtually. While virtual networking experiences will be meaningfully innovated in 2021, we have heard from organizers and attendees alike that in-person is irreplaceable. This is why we believe hybrid events, which combine the best of virtual and in-person events, are how organizers can best future-proof their event programs."

Below is a brief list of some kinds of events that are easily run as virtual events

1) 1: 1 appointments
2) Interviews
3) Meetings
4) Conferences
5) Entertainment (speeches, live music, etc)
6) Educational webinars
7) Community organizing
8) Fundraising events
9) Networking events
10) Workshops & classes

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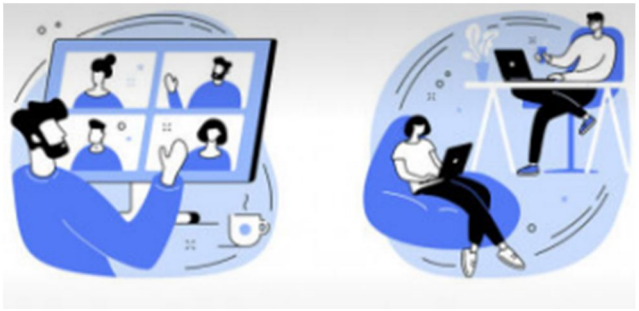

II. OBJECT ORIENTED MODEL (OOM) OF A VIRTUAL EVENT MANAGEMENT SYSTEM

A. Class Hierarchy

End users, Controllers, Developers and Authority are the main entities related to the Event Management system. End users are directly attached with this Event Management system. So, end users are Attendees, Speakers, Exhibitors, Sponsors and Managers. Attendees are the participants who have registered themselves with the event. The registration might be paid or, unpaid (free). For paid registrations, the payment is integrated either with Stripe or, PayPal. The speakers are distinguished delegates who broadcast to the audience. Exhibitors set up booths to display their marketing content, videos and collaterals to the attendees. Sponsors provide the necessary funding of the event. The following OOM shows the details of the class hierarchy and Sequence diagram shows interaction among different level of users of Event Management system.

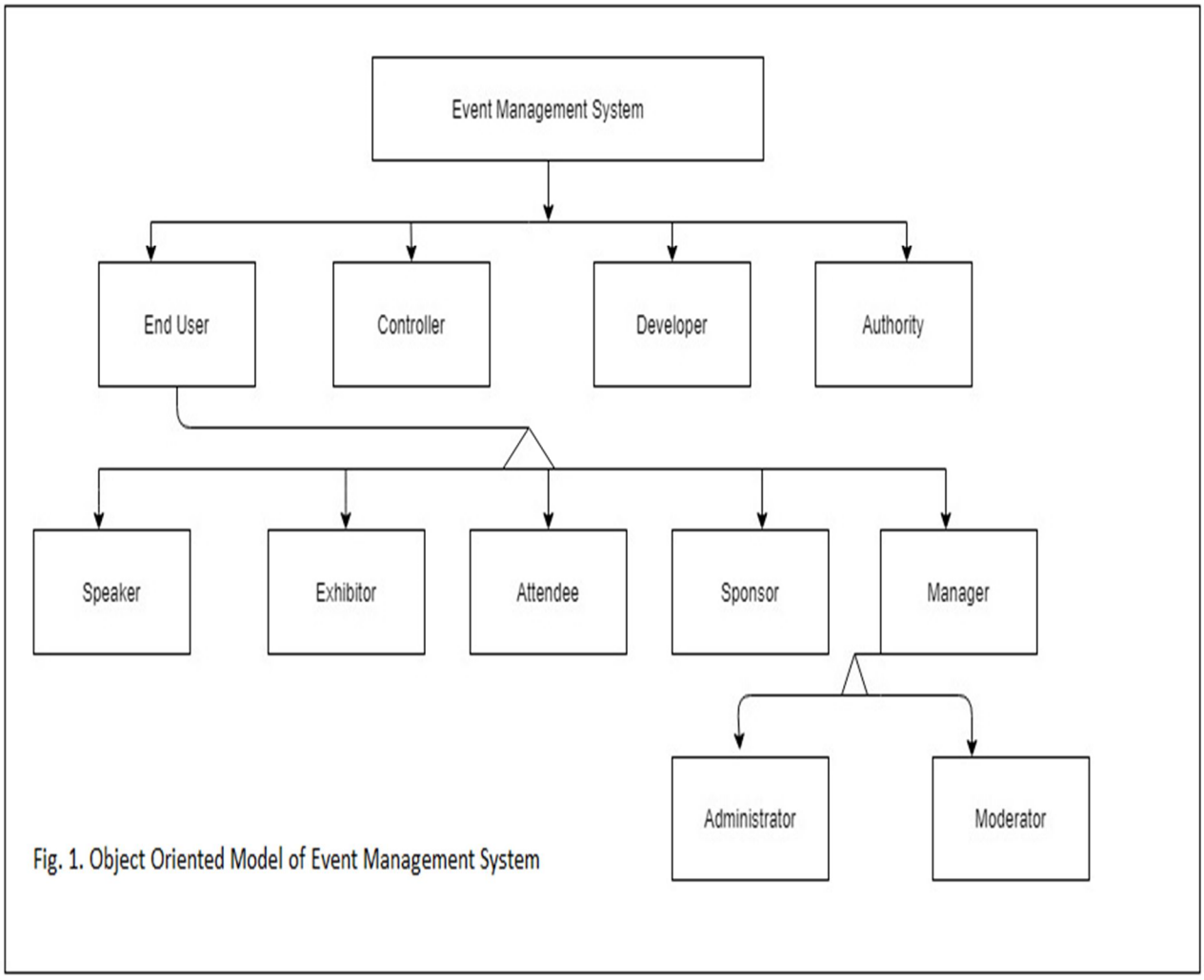

Fig. 1. Object Oriented Model of Event Management System

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A class is a template which defines state (attributes) and well defined behavior (methods) of Objects. In an Object Oriented Model (OOM) overall system is framed by creating objects and establishing relationship amongst objects. This model has been designed keeping in mind that every instruction from the controller has been implemented by the Developer, who are responsible to design the whole system and without Authority no reports can be generated by the system.

B. Stakeholders

Role of various stakeholders associated with Event Management system is outlined below:

C. Attendee

Attendee is one of the main users of the Event Management System. The sessions of a virtual event are displayed as per the time zone of the attendee.

D. Speaker

In an Event Management System, a speaker is a spokesperson nominated to speak in a virtual event. Speaking at a virtual event and speaking on a live event stage do not compare one-for-one as experiences. Even seasoned speakers have had to completely rethink their approach to engaging audiences and delivering a memorable presentation during the last six months as the pandemic has forced all events to get into an online mode.

E. Manager

A Manager is an entity who runs the entire show in a Virtual Event. Normally Event planners manage the event starting from creating marketing event roadmap, setting up attendee registrations to monitoring the event and moderate live questions raise by attendees.

F. Exhibitor

Exhibitors are salesperson who acts as brand ambassadors of different companies who are interested in setting up Virtual booths to allow attendees to visit their booths and have discussions. In a way a Virtual booth allows for a buyer seller connection via interaction and do brand marketing and promotions.

G. Sponsor

Sponsors are entities who supply the funds required to host an online event. Every virtual Event has a Virtual Lobby which is designed with the logos and images of Sponsors to acquaint the attendees about the fundraisers of the event.

III. USE CASE DIAGRAM : VIRTUAL EVENT MANAGEMENT SYSTEM

For systematic, well-defined and clear understanding of actual implementation we need to use UML(Unified Modeling Language) design[8],[11].Most virtual events these days are paid ones. The paid Virtual Event Management system involves collecting and managing payments for tickets.

To make the registration process seamless, the event planners use an Event Management Platform with integrated payment gateway functionality. This means that the registrants can fill out their details, pay online and confirm their registration all in one easily.

Other tricky paid event tasks such as invoicing and receipts (sending them, and managing them) can be completely automated when using an Event Management Software.

Even without an Event Management solution, third party applications can be used to manage registrations and invoicing online. You might even look into third party payment apps such as PayPal and Stripe.

A. How Do you Ensure Only Paid Registrants attend your Virtual Event?

To block unpaid registrants from attending your virtual event you need to give your ‘join meeting’ link in the confirmation email you send to paid registrants. For an extra layer of security you might want to consider applying a password to your virtual event.

Many video conferencing applications also allow for ‘waiting rooms’ where hosts have the ability to admit or boot a newcomer depending on who they’re identified as.

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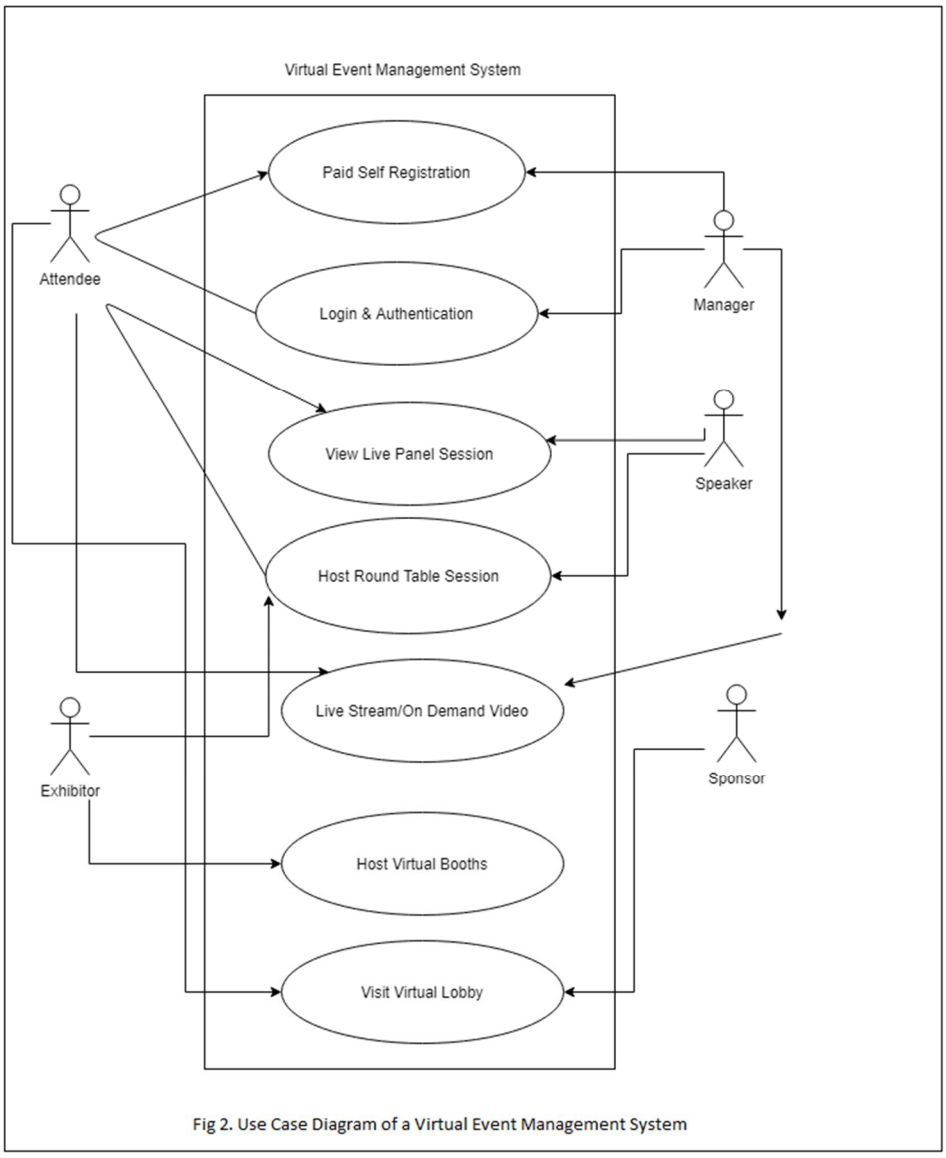

Fig 2. Use Case Diagram of a Virtual Event Management System

IV. THE REGISTRATION PAYMENT GATEWAY (STRIPE/PAYPAL)

To register for a virtual event, the event management software provides a form built using HTML/JavaScript. The attendees will have to fill the required details such as name, age, address, phone number etc. and submit the form. One of the main requirements is to make the form GDPR compliant in order to tackle the issue of consent. Users must provide clear consent and if checkboxes are used, they must be manually checked by users. Consent forms should be clear and explain the data that is collected and how it is used in easy-to-understand language.

Once the user enters all the required information and click on the "Payment" button, he/she is redirected to the Payment Gateway if the payment provider chosen is either Stripe/PayPal. The user can also opt for Credit card transfer or, Pay via Net banking.

There are plenty of other payment gateways out there such as Authorize.Net, 2Checkout, Braintree (owned by PayPal), but Stripe and PayPal are by far two of the easiest ones to use.

A. The Payment Integration Mechanism

1) Stripe

Stripe uses web hooks to notify your application when an event happens in your account.

Web hooks refers to a combination of elements that collectively create a notification and reaction system within a larger integration.

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The web hook endpoint has an associated URL (e.g., https://example.com/webhooks). The Stripe notifications are Event objects. This Event object contains all the relevant information about what just happened, including the type of event and the data associated with that event. The web hook endpoint uses the event details to take any required actions, such as indicating that an order should be fulfilled.

Stripe integration can be done in just three steps:

a) Create a web hook endpoint on your server.
b) Use the Stripe Command Line Interface (CLI) to test that your endpoint works.
c) Register the endpoint with Stripe to go live.

2) PayPal

The steps of integration with PayPal are:

a) *Step 1:* Create Sandbox Accounts-PayPal has a sandbox environment to test functionalities before developer makes them live. This way the software developer can find out any issues before a business starts accepting payments from any customer. A developer can easily get access to this sandbox by signing up for a PayPal sandbox account.
b) *Step 2:* Create Database Tables– Two tables are required to be created in the database to store the product and payment information.
c) *Step 3:* PayPal Settings and Data Configuration- The consent variables of the PayPal gateway needs to be defined in the configuration file.
d) *Step 4:* Connecting the Database - All the products are pulled from the database and listed on the webpage
e) *Step 5:* Configure the Payment Submit button- The Pay Now button action needs to be configured. Once the payment is successful the buyer sees a "Transaction is Successful" message on the screen. If the payment is not successful, the message, "Transaction has failed" is displayed.
f) *Step 6:* Setup PayPal Auto-Return and Payment Transfer- This is required to get the transaction details back from PayPal.
g) *Step 7:* Setup Instant Payment Notification (IPN) listener- This setup is required to make the payment secure. As soon as your IPN is enabled, PayPal will send you instant transaction notifications.

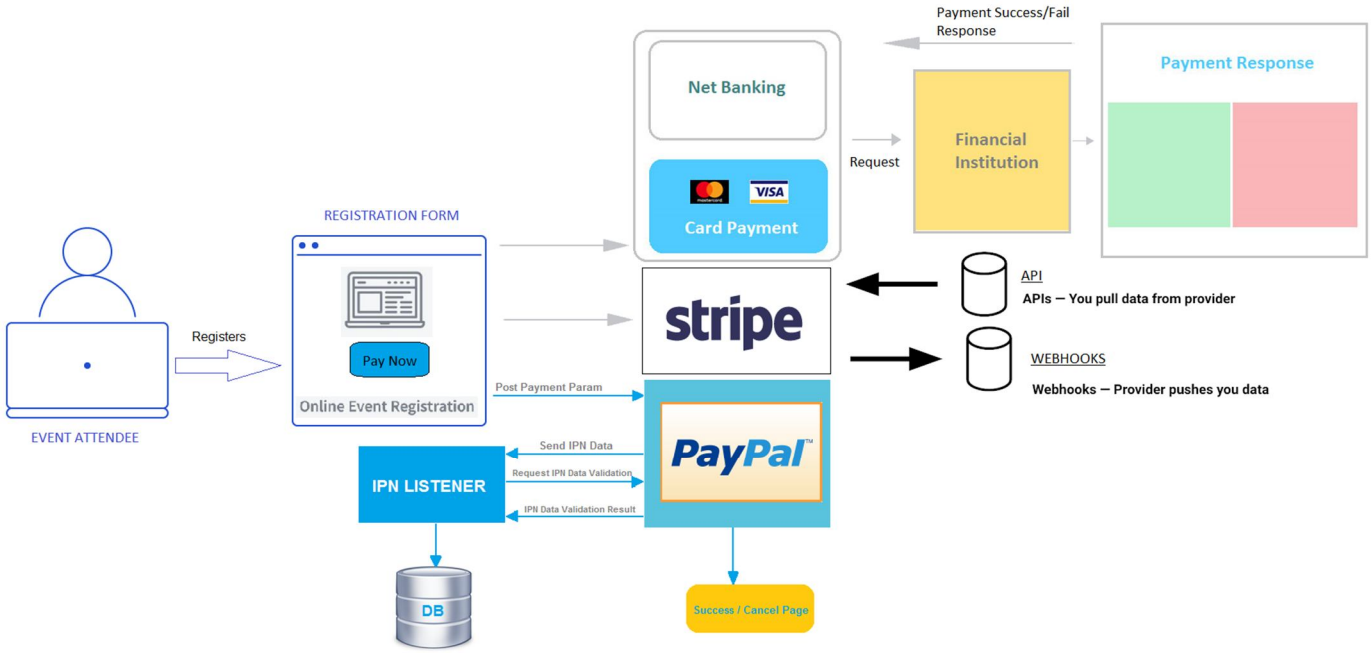

Fig.3 Virtual Event Payment Integration

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V. THE EVENT REGISTRATION FORM DESIGN: GIVING IT THE CONVINCING LOOK

The design and aesthetics play a crucial role in creating a Virtual Event Registration form. Here are some of the guidelines for design a well informative form.

1) *Ask Only What you Need:* Avoid long list of questions. Try to keep it simple.
2) *Keep it Concise and Clear:* Avoid adding complex questions which might confuse the registrant.
3) *Leverage Gestalt Principle:* Gestalt Principle states that when things are organized or grouped in a certain manner, our brains tends to assume that they are interrelated. Hence, place specific and related questions (like name, username, password, company, country, etc) in their own specific group to make it easier to see and interpret.
4) *Save energy with Defaults:* Save time by using default fields like e.g., default date and time of the event.
5) *Provide Progressive Disclosure:* Use progressive disclosure to reveal specific part of form upon certain actions or conditions. For example, if you want a text reply when an attendee selects the 'other' option, then don't make it visible unless he/she chooses that option.
6) *Take time to Test:* Check the usability. Testing the form will acknowledge what sorts of errors are likely to occur and hence amend them. This will result in increasing the likelihood of your attendees actually completing the registration form.

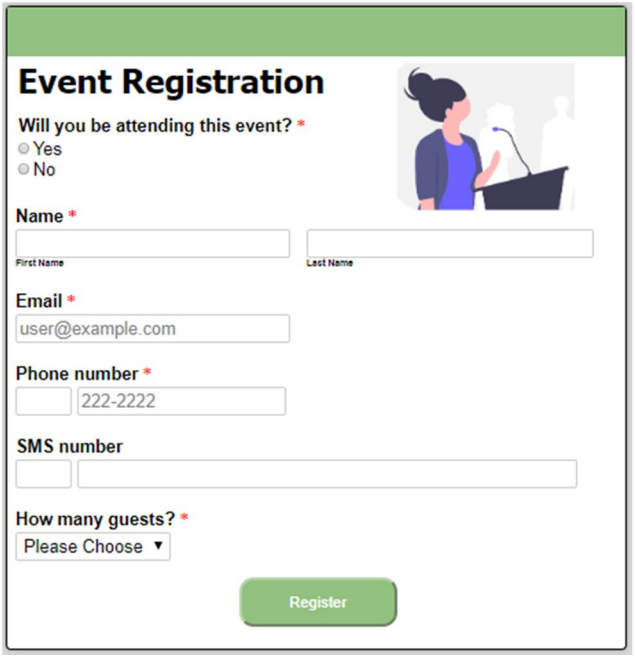

Fig.4 A sample Event Registration Form

VI. VIRTUAL EVENT SECURITY

The Event planners are given strictly confidential and valuable information of attendees which needs to be safeguarded and ensured it does not fall into wrong hands. To ensure a safe and secure online event below are the measures to be followed.

A. *Measures*

1) *Lock Registrations:* While setting up Event registrations, it needs to be ensured that individual links for all attendees be enabled so that the activity and data related to each link can be tracked. It's also important to be very clear about the nature of the links in the event communications so that attendees realize that they're personalized and are aware they shouldn't be sharing their links with anyone else.
2) *Code of Conduct:* Include the code of conduct along with terms and conditions during registration so that everyone understands what is expected as well as the consequences of noncompliance.
3) *Password Manager:* One of the best ways to improve security in a Virtual Event is to use Password Manager tool which will generate and keep track of randomized passwords so as to ensure that the same, easy-to-guess password are not reused across multiple event platforms and services.

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4) *Integration With other Tools:* Although sometimes integration of the Virtual Event platform with other tools gets inevitable it is a good idea to limit the number of such integrations. Also, these integrations needs to be monitored regularly so as to ensure removal of any integration and associated resources once it is not required anymore.
5) *Use VPN:* It is recommended to use a company VPN will allows to access and use the office's server from home, which will be much more secure than a home or public Wi-Fi network when sending and sharing sensitive information over the Internet. Also, consumer grade VPNs such as ExpressVPN can be a good choice.
6) *Two factor Authentication (TFA):* Authentication can be improved through a system that aims to verify someone's identity by requesting two pieces of evidence as opposed to just one (which is generally a password).Typically email is considered as the secondary authentication method.

B. *Sequence Diagram*

Sequence Diagram clearly explains the object to object communication of a Virtual Event Management system[16]. This diagram below explains the operations carried out by the various stakeholders of the system. The Admin manages the entire system. The event and user profiles are on boarded by the Event Manager who also tracks user login and generates reports. The Exhibitors are on boarded into the system through contracts by the Admin. Upon request they share their profile, images, collaterals and videos with the Event Manager who sets up the Virtual Booths. The attendees who are registered in the system can access various features of the event like participate in live sessions, watch on demand videos, visit Exhibitor booths and join Roundtable discussions at ease.

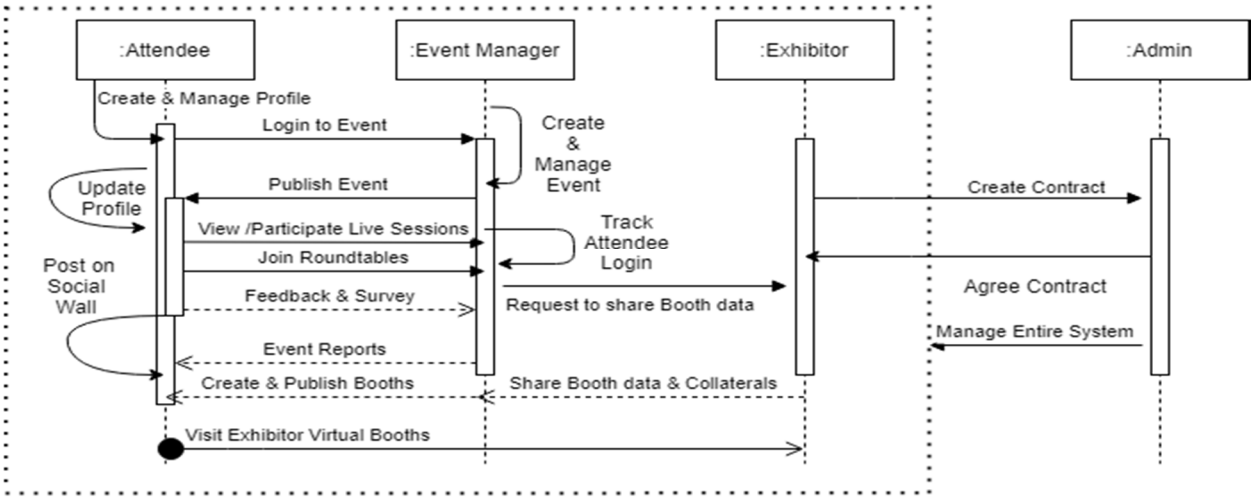

Fig.5 Sequence diagram of the Object Oriented Model of a Virtual Event Management System

C. *Event Attendee Login Authentication Protocol (OAuth 2.0 : Open ID Connect)*

To enter into the Event website user has to register himself first. After registration the system provides facility to login into the site. The open standard, Open ID Connect built upon web authentication protocol OAuth 2.0 performs user authentication. The user needs to enter his/her registered email address and password and hit the Login button to enter the Event platform. The figure below depicts the sequence diagram of the user authentication process through Open ID Connect. In this architecture, a frontend server (an authorization server and an OpenID provider) utilizes a backend service which provides APIs to help the frontend server implement OAuth 2.0 and OpenID Connect. The processes of authentication and authorization (in the context of OAuth), can be described as shown below.

1) *Authentication:* Who one is.
2) *Authorization:* Who grants what permissions to whom.

Authentication is a simple concept. In other words, it is confirmation of identity. The most prevailing way to identify a person at a website is to request the person to present a pair of ID and password, but there are other ways such as biometric authentication using fingerprint or iris, one-time password, random number table and so on. In any case, whatever way is used, authentication is a process to identify who one is. On the other hand, authorization is complicated because three elements, namely, *"who"*, *"what permissions"* and *"to whom"*, are involved. In addition, what makes it confusing is that among the three elements, the process to identify *"who"* is authentication. Because authorization process includes authentication process as a part, being authorized means being authenticated.

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D. Access Token

The OpenID Connect ID Token is a signed JSON Web Token (JWT) that is given to the client application alongside the regular OAuth access token. JSON Web Token (JWT) is a compact means of representing claims to be transferred between two parties. It is URL-safe. The claims in a JWT are encoded as a JavaScript Object Notation (JSON) object which is used as the payload of a JSON Web Signature (JWS) structure or as the plaintext of a JSON Web Encryption (JWE) structure, enabling the claims to be digitally signed or encrypted.

The ID Token contains a set of claims about the authentication session, including an identifier for the user (sub), the identifier for the identity provider who issued the token (iss), and the identifier of the client for which this token was created (aud). Additionally, the ID Token contains information about the token's valid (and usually short) lifetime as well as any information about the authentication context to be conveyed to the client, such as how long ago the user was presented with a primary authentication mechanism.

E. Features of the ID Token

1) Asserts the identity of the user, called subject in OpenID (sub).
2) Specifies the issuing authority (iss).
3) Is generated for a particular audience, i.e. client (aud).
4) May contain a nonce (nonce).
5) May specify when (auth_time) and how, in terms of strength (acr), the user was authenticated.
6) Has an issue (iat) and expiration time (exp).
7) May include additional requested details about the subject, such as name and email address.
8) Is digitally signed, so it can be verified by the intended recipients.
9) May optionally be encrypted for confidentiality.

Authentication must take place at the identity provider, where the user's session or credentials will be checked. For that a trusted agent is required, and this role is usually performed by the web browser.

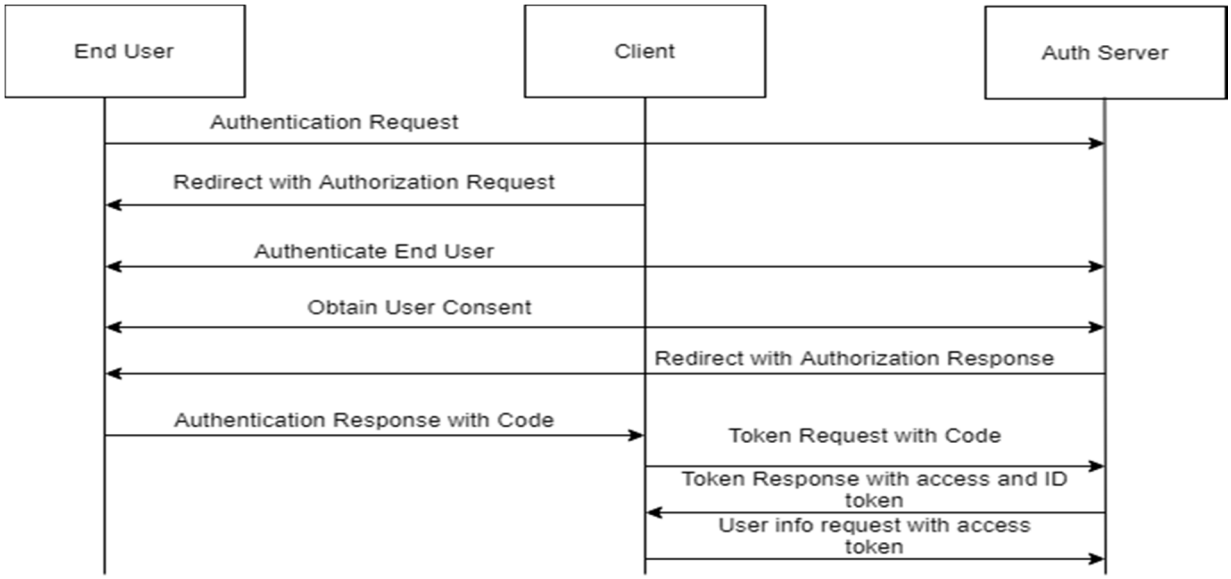

Fig. 6 Event User Authentication with OpenID Connect

VII. CONCLUSION

In this paper the emphasis is given in building the Object Oriented Model of a Virtual Event Management system to ensure the trust of all participants and other stakeholders of the system like Speakers, Exhibitors, Sponsors and Event planners. Controllers are supervising the access of information right for different level of users through developers of the system. Relevant data and procedures has been binded together efficiently through objects such as Speaker, Attendee, Manager etc. We have outlined the behavior of different participants of Virtual Event system with the help of Use Case Diagram and Sequence Diagram which are true significant tools of Object Oriented software engineering and also needed for the development of improved quality software. Sequence diagram has been used to show event user authentication with OpenID Connect ID Token.

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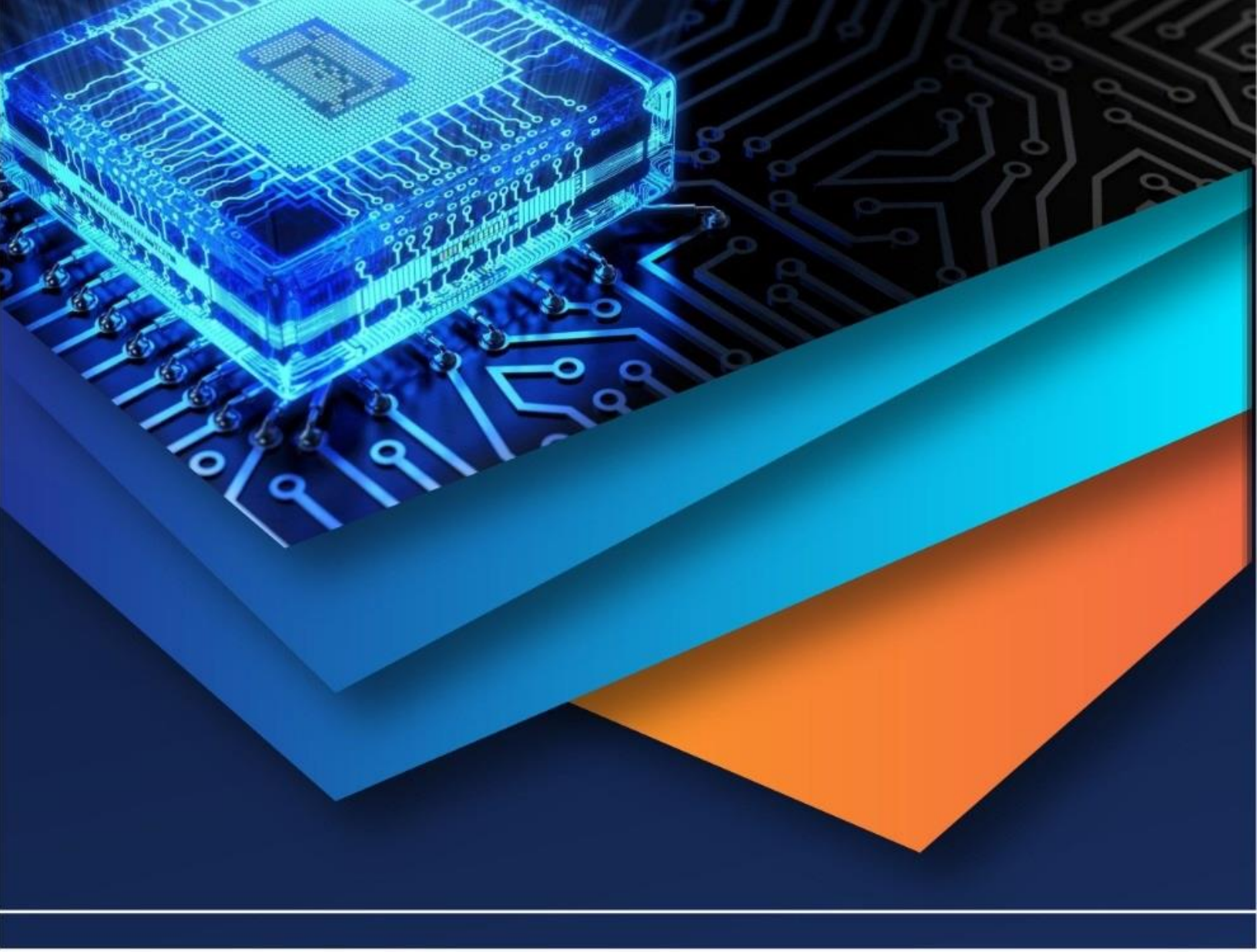

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