Synchronization of Web Application with Broadcast TV

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***Abstract*—HbbTV (Hybrid broadcast broadband TV) is the standard for the broadcast and broadband services, which also provides customers to interact with their TV. The latest version of HbbTV 2.0, which was released in 2015. This latest release added some new features like HTML5, compatibility of companion screens and multi device synchronization. In our project well be using MPAT as HbbTV development environment. Which is basically a WordPress based applications and provides easy to use development environment for even programing beginners. In this project well be developing an MPAT based plugin, that will allow viewers of "Jede Antwort zhlt!" to play quiz along the TV show. As the theme of quiz show is to present multiple choice questions. TV viewers will be able to select correct answers, and their scores will be shown on screen. Which will make show more interesting for show audience at home. And behind the scenes, there will be another actor (editor), who will interact with this application. An admin panel will be show on the editor side, who will be able to enter the numbers of questions, time stamps and score for each question. This plugin will provide synchronisation in such a way that it will only show components on screen when there will be questions on screen.**

***Index Terms*—component, formatting, style, styling, insert**

I. Introduction

Hybrid broadcast broadband TV (or HbbTV) is a global initiative aimed at harmonizing the broadcast and broadband delivery of entertainment services to consumers through connected TVs, set-top boxes and multiscreen devices. The HbbTV specification is developed by industry leaders to improve the video user experience for consumers by enabling innovative, interactive services over networks. The specification uses elements of existing specifications from other standards including OIPF, CEA, DVB, MPEG-DASH and W3C. With the incorporation of activities from the Open IPTV Forum (OIPF) in 2014 and Smart TV Alliance in 2016, HbbTV is able to address service providers and technology suppliers for IPTV services as well as the combined scope of broadcast and over-the-top services [1]. Jede Antwort zhlt is the famous german game show, theme of the show is to present questions and for each correct answer participants get cash prizes. There are many other games show on same theme and mostly they catch their audience attention with the valuable information they provide in questions. And they make it more interesting by awarding money on each answer. RBB-Quiz Plugins objective is to make Jede Antwort zhlt more interesting for audience watching game show at home. Quiz plugin will allow viewers to interact with this TV, and they well be able to play quiz along with the game show. This interactive experience will catch more engagement of home audience, and show will become more interesting for them as they will feel like they are actually in the show and playing. MPAT takes up the concept of web-page creation tools like WordPress, which allow users to easily build a small to medium web site from pre-defined templates and plug-ins, and adapts it to HbbTV [2]. So, well be using plugin feature of wordpress to interact with wordpress and MPAT powers. Firstly, this plugin will show the video of quiz show on viewers Hbbtv screen, and when then host will ask question on show, our plugin will also trigger an event to show some components on screen. User wills interact with these components by using his remote and he/she will submit answer. If the answer will be right, then user will get score which will be update on the screen after the host will reveal answer in the show. Secondly, before the broadcast of tv show an editor will also interact with the admin panel of quiz plug-in, where he/she will be able to configure questions, answers, time stamps and worth of question. Events on the viewer side will be triggered on screen, by using all these details provided by editor on admin panel by the editor.

II. Related Work

A predecessor of MPAT, named HAT (developed in the FI-CONTENT 2 project) has already been used to provide a child-friendly sub-site for a German public broadcaster. The HbbTV Application Toolkit (HAT) is an easy and cost-efficient way for content creators to produce HbbTV applications. It is based on the WordPress concept of providing tested templates and components so content creators have an easy migration path.

For producing TV content, HAT only requires the same skill set as for web page creation. Due to the separation of layout templates and content, content creators can focus on their content on screen without worrying about styles or maintaining the required corporate design. These are already optimized for TV use and ensure that an application created with HAT will follow established rules for TV application development and usage [3].

III. Setting up Development Environment

For ensuring to work smoothly we had to set up our machines in a proper way. Following are the steps we followed for setting up the environment in the different operating system and different web browser.

A. Installation Process for Windows OS

1) Download XAMPP for Windows Operating system.
2) Download MPAT-Core from GitHub link (https://github.com/MPAT-eu).
3) Install XAMPP by running the .exe file.
4) Extract MPAT-Core to xampp/htdocs/.
5) Run XAMPP and start Apache and MySQL.
6) Start XAMPP Shell.
7) Navigate to MPAT-core-master directory.
8) Run ”php composer.phar install” command.
9) Open localhost/phpmyadmin/ in web browser and create wordpress database.
10) Change .env.example to .env file in MPAT-core-master directory then change its content accordingly and Generate key from https://roots.io/salts.html and add them in .env file.
11) Open localhost/MPAT-core-master/web/ (if this links open then everything is good).
12) Now open sub-directory wp/wp-admin inside ’web’ directory (localhost/MPAT-core-master/web/wp/wp-admin/). It will ask you to install wordpress.
13) After that login to Wordpress
14) Then goto Plugins and activate all plugins and update them if needed.
15) For accessing the timeline feature of MPAT, activate multisite on WordPress.

B. Installation Process for Ubuntu

1) Download installation package for Ubuntu Operating system.
2) Download MPAT-Core from GitHub link (https://github.com/MPAT-eu)
3) Make sure the installation package is executable.
4) Navigate to the downloaded package and change the mode,e.g.
   chmod 755 xampp-linux-x64-7.2.10-0-installer.run
5) Confirm the execute permission by
   ls -l xampp-linux-x64-7.2.10-0-installer.run
6) Launch the Setup Wizard by
   sudo ./[package name] and finish the installation
7) Extract MPAT-Core to xampp/htdocs/
8) Start LAMPP by
   sudo /opt/lampp/lampp start
9) Navigate to MPAT-core-master directory
10) Run ”php composer.phar install” command
11) Open localhost/phpmyadmin/ in web browser and create wordpress database.
12) Change .env.example to .env file in MPAT-core-master directory then change its content accordingly and Generate key from https://roots.io/salts.html and add them in .env file
13) Open localhost/MPAT-core-master/web/ (if this links open then everything is good)
14) Now open sub-directory wp/wp-admin inside ’web’ directory (localhost/MPAT-core-master/web/wp/wp-admin/). It will ask you to install wordpress.
15) After that login to Wordpress
16) Then go to Plugins and activate all plugins and update them if needed.
17) For accessing the timeline feature of MPAT, activate multisite on WordPress.

C. Browser Setting

MPAT can be used on almost all the browsers, where WordPress is supported. Any standards Internet browser like Google Chrome, Mozilla Firefox or MS Internet Explorer is required to use the MPAT editor tool and to start creating HbbTV applications.

In order to preview the HbbTV applications , Mozilla Firefox v51.0.1 as well as the Firefox Add-on FireHbbTV v1.3.20 are needed. This Add-on must be switched on in order to preview the HbbTV application and must be switched off in order to edit the application with MPAT.

To achieve a better workflow and efficient development environment, we configured FireHbbTV only on FireFox. Google Chrome will only be used for the development and it will not be having FireHbbTV addon. In case if the FireHbbTV addon will be active on the browser, where well be working. Then well always need to stop FireHbbTV addon, because it changes the standard display of browser [2].

IV. Our Approach

Based on the demand of the project we decided to use Plug-in feature of WordPress since there were so many other options like using the timeline feature of MPAT or developing an application by using Multi-sites and a separate database. etc. WordPress plugin is a piece of software written in PHP that contains different functions and features to extend the functionality of the WordPress environment, and it does not change anything in the core functionality of WordPress. Plug-ins functionality can be very elastic, and it can be simple like just printing Hello World, or complex as plugins like Yoast SEO for WP plugin .

A. Technologies we used

We used the following technologies for developing out plug-in in order to complete the project.

1) : PHP

In the plugin development, the first skill you need is PHP skills. There are some basic protocols one has to follow in the plug-in like, the name of the plugin, plugin URI, Description of the plugin, version of the plugin, Authors URI, name of the authors and last the license. PHP functions and some hooks for the attachment of functions, to maintain the functionality of plugin or to attach different function together.

2) : Javascript

A scripting language which is commonly used in client side. It is used to provide for a more user-friendly experience such as dynamically updating web pages.

In the context of our project, we used javascript for different purposes such as, triggering different events like, buttons, When to appear in the screen and which time of the video, adding the score of the user, updating the score.

3) : CSS

CSS is the language that defines the design of HTML documents. In our project, we used it for designing all the components on video those will appear on the user side like timing, score, and options to select answers. The color of the buttons when they appear in the screen and the color will change once the user selects the answer. On the admin panel, the design of the input form.

4) : HTML

A standard markup language, HTML (Hypertext Markup Language), is used for developing the web pages and web applications. In HTML we use different other languages like CSS, Javascript for different purposes like the design, style of the text, color and so many other features.

Currently HbbTv 2.0 is the latest version which supports HTML5, and older versions HbbTV 1.0 and 1.5 supports HTML 4. So, while the development of MPAT plugin, we used HTML5.

B. Plugin Installation and Activation

MPAT plugin Installation is the same as other simple WordPress plugins. The only difference will be we need to copy the plugin file in different folders. MPAT RBB-Quiz plugin resides on the following paths.

1) Linux: /opt/lampp/htdocs/MPAT-core-master/web/app/plugins/mpat-plugins

2) Windows OS : C:/Xamp/htdocs/MPAT-core-master/web/app/plugins/mpat-plugins

When plugin files are placed in the respective directories, then they will show in plugin names (RBB-Quiz) in the plugin list of WordPress. Then Well just need to click the activate button to start its functionality. Following use case diagram shows how administrator and TV viewer will interact with the plugin.

When RBB-Quiz plugin is activated, in WordPress it creates a page named as RBB-Quiz-Page, Which will be linked with the layout created by admin manually, and administrator will also be responsible for adding video source link in components settings.

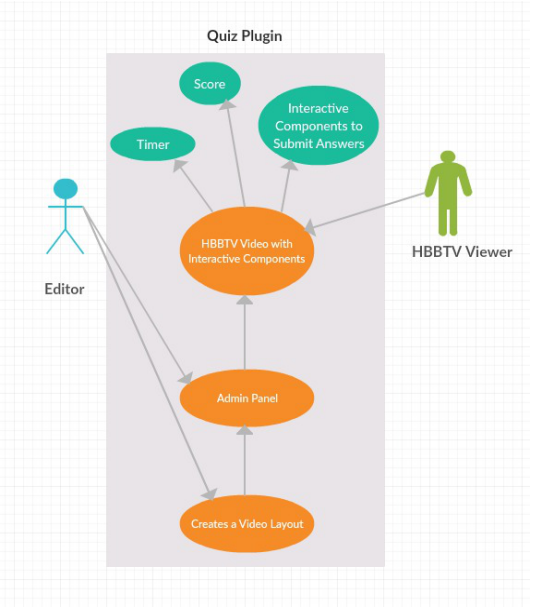

Fig. 1. Use case Diagram.

After that administrator's responsibility will be to login to admin panel and fill the details about questions. In the admin panel, first of all, the admin will enter the question number, which is just a sequence number of question in the database. It has no effect on triggering events on screen. Secondly, the admin will enter the start time of the question according to the video, the end time of the question. These timestamps will be responsible for triggering events on the screen such as showing buttons to submit answers and these buttons will disappear when question time expires. In the last section of this form, the admin will enter the score for and correct answer for that question. This information will verify the correct answer to the question and updates the score accordingly.

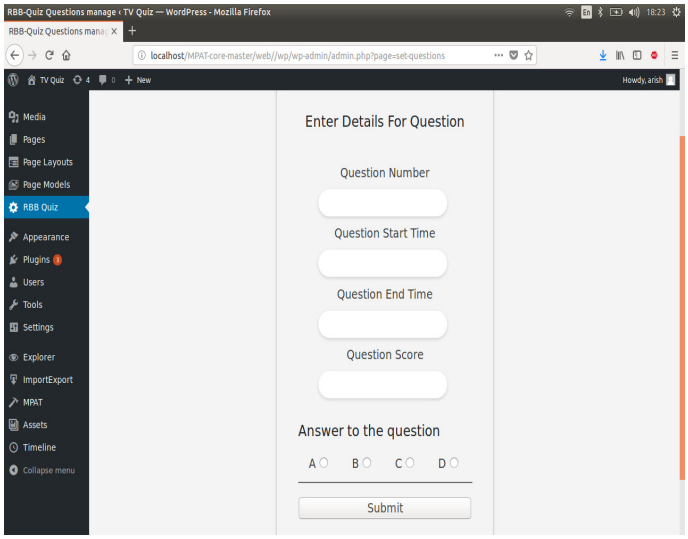

Fig. 2. Admin Panel.

C. TV User Interface

When the video starts streaming, the HbbTV plugin will populate the TV screen with different components. Following are the components with their details:

- Timer Component
- Score Component
- Buttons to Submit Answer

Fig. 3. User Interface

1) : Timer Component

Timer component will show the current time on the video, timer value will also be used to show answer components on the score. When the time on time counter will be the same as the time mentioned as the start time of question. Then exactly on that time new components will appear on screen, where the user can make the decision and selects the answer by the given time for the question by the administrator of the show. For each question, there is a start time and end time. In between that time user has to make the decision and select any of the possible answers.

2) : Score Component

Score component will always be there on the screen, but it will update scores only when the video reaches at the end time of each question. Total scores will be updated after every question. The total core is dependent on the weights that the administrator provides for each answer. The scoring algorithm simply counts the weight of submitted answer and then adds it to the current score value. If the user does not select any answer the score will be zero. Once the user selects the answer it will be locked and the right answer will appear after the expiry of question time.

3) : Buttons to Submit Answer

When TV host will announce the question in the Jede Antwort zhlt, on the users screen three clickable buttons will appear and these buttons will stay on screen until the question time expires. User will only be able to select the answer only once, and it will be locked until the right answer will be revealed in the show. When the answer will be revealed the player's score will be updated in the core component.

Once the user selects the answer the color of the selected answer will be changed and its locked. User will not be able to change the answer once it is selected.

V. Future Work

The RBB Quiz plugin was designed to meet basic requirements of a given use case. Its functionality and design can be improved to great extent.

- Designers Functionality
- Admin panel improvements
- Improvement of Score Algorithm
- Right Answer Detection with Colors

In the future updates, we can introduce a new feature of designing components. Which will be done by a new editor called Designer. The designer will have its own designer panel where he will be able to submit design files. So, in the new version size, location, color, and other styling attributes wont be static and the designer will be able to customize them easily.

There are a couple of things to improve in the admin panel. Fist of all, being flexible to the number of answers. Right now we have static with three possible number of answers as in Jede Antwort zhlt but, It can be improved to the dynamic number of answer possibility for other quiz shows of similar genres.

Some HbbTV providers the ability to fast forward programs, currently, in our application, we are assuming as the viewer cant forward broadcasted Video. So, if the user will have the power to forward streamed video then it might show wrong score.

We can optimize the algorithm so that a user can submit the answer once for each question and there wont be double additions in score in any case.

In the current version, we are validating answers by using information provided by the administrator. A more complex and efficient approach can be introduced so that the application can detect colors in real-time and validate answers for each question. It will surely be a bit complex task to implement, but by using color detection we can reduce the workload of administrator.

VI. Conclusion

While developing RBB-Quiz plugin, we have explored MPAT and found it as very easy to use platform for HbbTV applications. MPAT allows programmers to design interactive applications while not manipulating with WordPress core, which is the underlying environment of MPAT. MPAT also provides a very convenient environment for testing applications. Applications built with MPAT can either be viewed on a Smart TV that supports the HbbTV standard versions named above or, alternatively, MPAT can be previewed on the Internet browser with Firefox [4].

Overall RBB-Quiz plugin development process was a great learning experience for developing HbbTV applications. Some

of its features provide great power programmers like Content Components, Navigation models and its integration with WordPress.

MPAT installation and setting up the working environment was a bit difficult and tricky, but when we were done with the Installation process, Then MPAT power makes it easy to plan and design applications.RBB-Quiz plugin idea was a bit difficult to absorb at the start, but MPAT made it very easy and we did successful final demonstrations by fulfilling all the use case requirements.

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