

Creating sensors-aware physics simulation apps using EjsS

Francisco Esquembre

Facultad de Matemáticas, Universidad de Murcia, 30100, Murcia, Spain

Félix J. García-Clemente

Facultad de Informática, Universidad de Murcia, 30100, Murcia, Spain

Loo Kang Wee

Education Technology Division, Ministry of Education, Singapore

Abstract. Easy Java/JavaScript Simulations, EjsS, is a modelling and authoring tool that allows teachers to create, adapt and share instructional simulations in Java or JavaScript. EjsS transforms a high-level specification of a physics simulation into code that uses the latest technological advances. This presentation focuses on the EjsS functionality to generate physics simulation apps, which can use mobile device sensors, for iOS and Android.

1 Introduction

Educational technologies change rapidly, and these changes offer new opportunities for innovative teaching. Isolated educators can find it difficult to keep up, but collaborative development and teaching communities that use standard open source tools can benefit from these technical advances.

Easy JavaScript Simulations (EjsS) [1] provides instructors with a click and drag programmer interface on an authoring tool that includes facilities for the creation of JavaScript simulations, generate the computer codes automatically, thus simplifying the purely programming aspects. The instructor defines the physics model and links model definitions to the components of the view. EjsS includes the automatic generation of code that integrates the simulation definition into the EjsS JavaScript framework [2]. The generated simulation can then be used in any web browser with HTML5 and WebGL support (currently, most of them) in any kind of device, such as smartphones or tablets.

This oral presentation focuses on new EjsS functionality, that is capable of generating educational physics simulation apps for Android and iOS. This generation process is based on the integration of the Ionic/Cordova [3] and AngularJS technologies into EjsS. Moreover, EjsS-generated apps can run on all devices and even access mobile device sensors. The Open Source Physics collection at the AAPT-ComPADRE digital library hosts hundreds of these EjsS-based simulations created by and for physics teachers.

2 Deployment of physics simulations apps

There are two alternatives to develop simulation apps: native and hybrid apps. Native apps are designed and coded for a specific kind of device, however hybrid apps are built using cross-platform web technologies, such as HTML5, CSS and Javascript. In our case, we want to create apps for Android and iOS, and still maintain the EjsS Model-View-Controller pattern and the simulation flow, as well as the EjsS Library. Therefore, we opted to generate hybrid apps based on a simple template that can be easily modified using any HTML editor.

In the hybrid apps development world, there are several different appropriate technologies, among them, Cordova, PhoneGap and Ionic. Ionic is built on top of AngularJS and Apache Cordova, and provides tools and services for developing hybrid mobile apps using web technologies like CSS and HTML5. In our opinion, Ionic presents the best features, therefore the EjsS generation of simulation apps uses Ionic platform, for which the EjsS modeling tool generates the Ionic template for serving the simulation on the app.

The generation process consists of a few steps that end with the further building of the app in the platforms Android and iOS. We can test and build the app using Ionic tools. In addition, we may want to edit the Ionic files of the project in order to change the name, description and author entries, or change the icon and splash images.

We will describe how the EjsS toolkit enables the generation process of an app ZIP file that can be used to deploy on Android and iOS as mobile apps, which we argue is so much more accessible to educators who now require no prior knowledge about mobile apps programming/development.

In addition, our simulation can access mobile device sensor when it is running as an app. EjsS allows authors to include code to access accelerometer, gyroscope, and others. The following figure shows the simulation *Block On An Incline Plane* that illustrates the forces and dynamics of a block sliding on a surface. This simulation uses the accelerometer on mobile devices to read the direction of the gravitation field g .

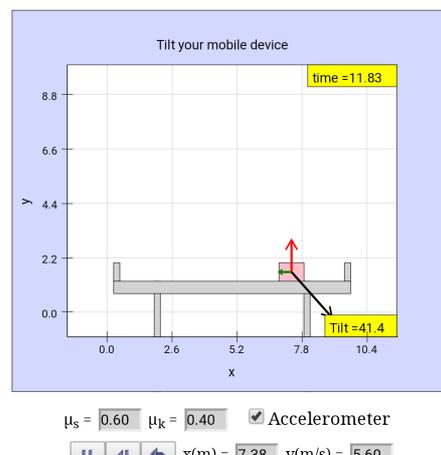


Figure 1 Block On An Incline Plane.

3 Conclusion

This talk shows how ready-to-use, tech-savvy products can be created from any EjsS simulation, and - as a result - how EjsS-generated apps can run on all devices and even access mobile device sensors.

References

- [1] University of Murcia, *Easy Java/JavaScript Simulation*. Available at: <http://www.um.es/fem/EjsWiki/>.
- [2] F. J. Garcia Clemente and F. Esquembre, *Ejss: A javascript library and authoring tool which makes computational-physics education simpler*, XXVI IUPAP Conference on Computational Physics (CCP), Boston, USA, 2014.
- [3] Ionic, *Ionic Framework*, Available at: <https://ionicframework.com/>.