

The first section to be described is Initialization. After creating a Flask instance, it is needed to set configuration options and connect database to the current instance. Since Flask is instance based, it is needed to create an instance and configure the settings for that instance. This allows us to have multiple processes, each with a different configuration.

The second section to be described is Routing. Flask requires to define URL routes for web application so it knows which pages to display/render when users access specific URLs. Each route is associated with a controller – more specifically, a certain function within a controller, known as a controller action. So, when you enter a URL, the application attempts to find a matching route, and, if it's successful, it calls that route's associated controller action.

The last one section to be described is Execution. To run our Flask application, we can add the following code to our app.py module to ensure it executes when it is run as a script.

The application was tested successfully, no errors and bugs were found.

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APPLICATIONS OF BLUEPRINT SDK FOR DATA VISUALIZATION PURPOSES

Media technologies are widely used to display complex data in intuitive graphical forms. However, three dimensional visualizations can be problematic to perceive because of the complicated controls. Augmented reality is an intuitive approach in displaying models. Instead of controlling position and rotation of virtual camera with primitive controls, users are enabled to look at the model by inspecting them through cameras of their devices. However, augmented reality is recent and young technology, and creating such applications from scratch may have pointless costs.

Blueprint SDK designed to help create applications that allow to inspect models of buildings in augmented reality. Models of the buildings appear on top of the building plans, which helps users to intuitively understand and remember building structure. Control buttons allow users to switch between building levels dynamically. This SDK provides instruments to process plans of buildings, create models of this buildings based on these plans, and create an augmented reality application.

Image processing utilizes OpenCV library and allows users to adjust building plans so they can be recognized in augmented reality. These images are also imported into the addon for Blender 3D, that generates schematic 3D model of the building based on the images of processed building plans. This addon also assists user for further enhancing the model of a building. This model is imported into Vuforia project and associated with the plan it was built on top of. This final step produces executable application that can be installed by staff or customers.

OpenCV is a computer vision library, developed by community. It utilizes hardware acceleration and provides a wide range of image processing and recognition.

Blender 3D is an open-source software for creating 3D models. It provides application programming interface that allows to programmatically interact with its environment.

Vuforia is a framework that provides addons for augmented reality application development. It is responsible for processing markers, synchronizing real and virtual environments and augment video with desired models.

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BLUEPRINT SDK ARCHITECTURE AND DESIGN

Blueprint SDK was implemented according to «Chain of Responsibility» pattern. Library's components are separated into modules, each of them plays their separate role in generating the final data. Modules are software units that require files of certain format as an input and produce files of other format as an output. Data produced by a previous step should be used as an input for the next step. Chaining these modules one after other results in the chain of responsibility.

Specifically for Blueprint SDK, it consists of three modules. First module is a program that takes image file as an input, processes it, and returns file of an image that suits for computer vision to be detected. Second module is responsible for creating 3D model by taking AR mark that was generated by the previous module. Third module produces application file that is based on 3D models produced by the previous module (figure 1):