

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 another 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):

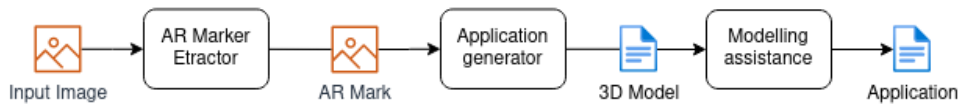


Figure 1 – Blueprint SDK’s chain of responsibility

This way, modules operate as one whole program while being absolutely separate, enabling them to be used by their own. Changes in one of the modules do not affect other modules, unless file format is changed.

This pattern allows SOLID principles to be used during development process. Every module has a designated role, which implies Single-Responsibility Principle. Functionality of components can be extended by adding new modules into the chain, or wrapping modules into other modules – Open-Closed Principle. Every module has certain formats for input and output files, and can be replaced other module that obeys to same rules – Liskov Substitution Principle. In general, specific formats of the files passed between the modules provides level of abstraction required for SOLID principles.

Each component of the SDK is tested separately by checking format and contents of each module – Unit testing. After that, the workflow is running as a whole (without intervention between the layers) – integration testing.

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CREATION OF SOFTWARE FOR THE AGGREGATION OF WORKING TIME AT AN ENTERPRISE

The decision to create a program for aggregating working hours arose due to the inconvenience of keeping track of time in several company resources. The company has 3 systems: a system for tracking weekends, a system for recording working hours (within the company and on the customer's side). This application provides aggregated and generalized data that can be used to make payroll calculations more efficiently and to make it easier for ordinary users to track time.

When developing the application, we chose to create a separate micro-service to collect data from all systems and then save it to the database. Java was chosen as the programming language, and Spring Boot as the web