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Picture-in-Picture Video-in-Video

MediaTek Technology White Paper

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Introducing Picture-in-Picture

MediaTek's Picture-In-Picture and Video-In-Video technology is a customer-appealing camera feature. The technology allows the user to simultaneously take photos or record videos with both the front-facing camera and rear camera, and cleverly combines the two images / videos of the subject and the photographer into one piece using an image-in-image effect, as shown below in Figure 1.



Figure 1. The PIP effect

A variety of theme-based photo frames are available and can fit into the content more easily. Photo properties (size, position and rotation angle) can be intuitively adjusted manually, as shown in Figure 2. In addition, the user can switch the top and the bottom image by touching top image or press the switching button.

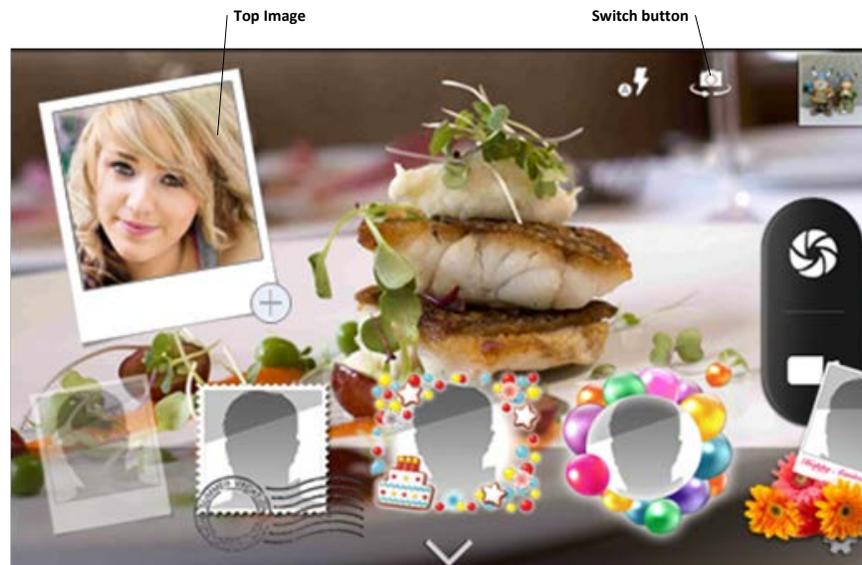


Figure 2. The Customizable Photo Frame UI Interface

With Picture-In-Picture (PIP) technology, users are able to take photos or record videos using both front and rear cameras in a one-button press. For example, a photographer might not even be attending an event but could be included in the group photos.

Mediatek provides a whole solution for Picture-In-Picture, which allows business partners to innovate with this feature using the Mediatek dual ISP ICs. The dual ISP IC consists of a camera interface for front and rear camera sensor input connected to powerful ISP hardware module. This ISP module can process the images from front and rear camera sensors with high frame rates, thereby allowing the front and rear camera sensors to be opened simultaneously. In addition, an embedded Picture-In-Picture effects module is designed to blend the front camera image, rear camera image and the photo frame to one image.

Mediatek Solution and Algorithm

Mediatek based the PIP technology on the IC's dual ISP architecture, which allows the simultaneous opening of rear camera and front camera. When the rear camera and front camera streams are ready, they will be sent to the software synchronization module to make the frames of two camera update at the same time. Then the Effects module handles those frames. In addition, this module has a multi-output function that can provide frames for video recorder, jpeg encoder, and display module in

specified usage.

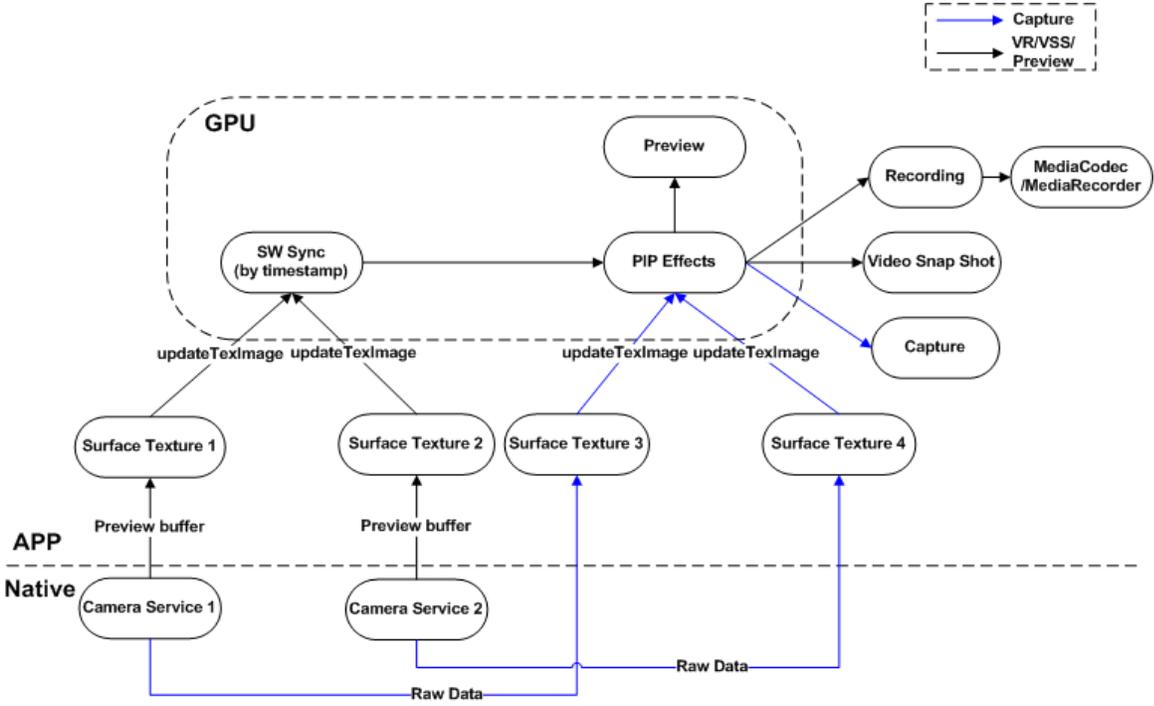


Figure 3. The Picture-In-Picture Architecture

Dual Camera

We provide in our Picture-In-Picture solution a simple interface controlling multiple cameras at once, thereby allowing our customers to enhance or customize the feature, as shown in Figure 4

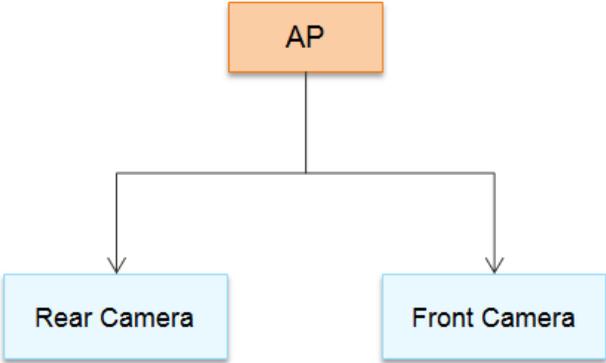


Figure 4. The Dual Camera Architecture

Sensor Synchronization

The Picture-In-Picture technology requires the two sensors imaging simultaneously. To solve the fundamental problem of the two non-identical sensors having unequal frame rates our design includes a software module to synchronize the two sensors.

Sensor Characteristics

The Picture-In-Picture technology supports the switch camera function, but the two different cameras have different features, such as size, lens module etc, which show in the camera settings. We have designed a settings synchronization mechanism to fix this problem.

Picture-In-Picture Effects

In our PIP solution, the Effects are designed to blend the top stream, photo frames and the frame to the bottom stream, which is based on OpenGL. The photo frames template will define the top stream region and frame image with different color, the effects will crop the top stream as template defined, the use GPU to blend frame on it, and then the effects will put them on the bottom stream. We provide many photo frames for this feature, and it is very easy to make new one for our customer.

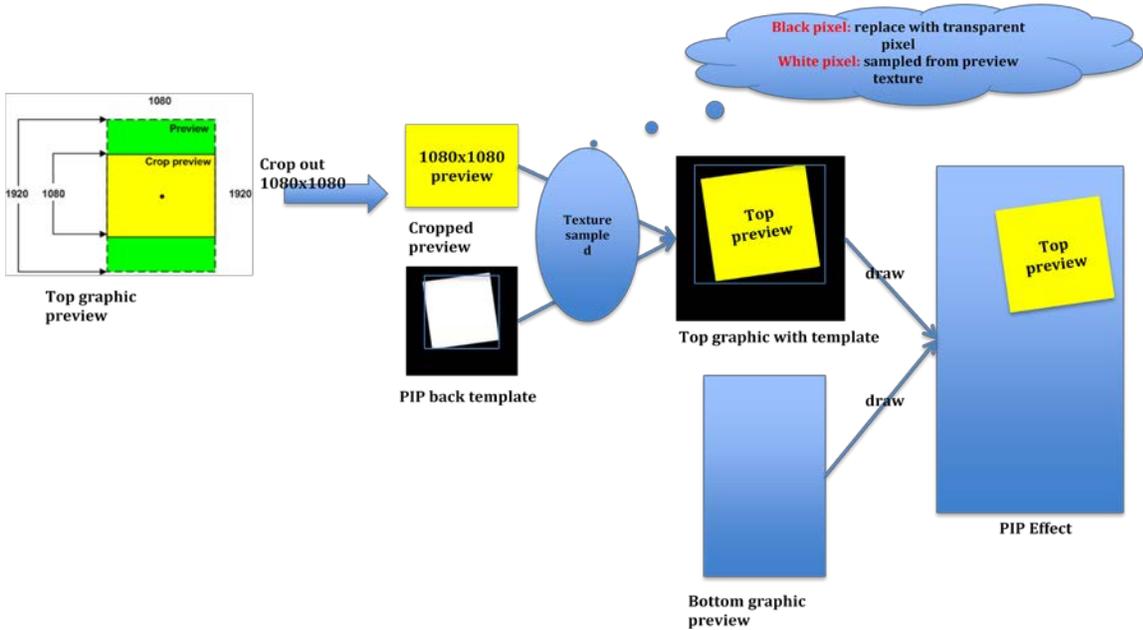


Figure 5. Picture-In-Picture effects

For the Top stream, we support many effects, including rotation, scaling, and translation, all of which can be defined in frame templates or user operation.

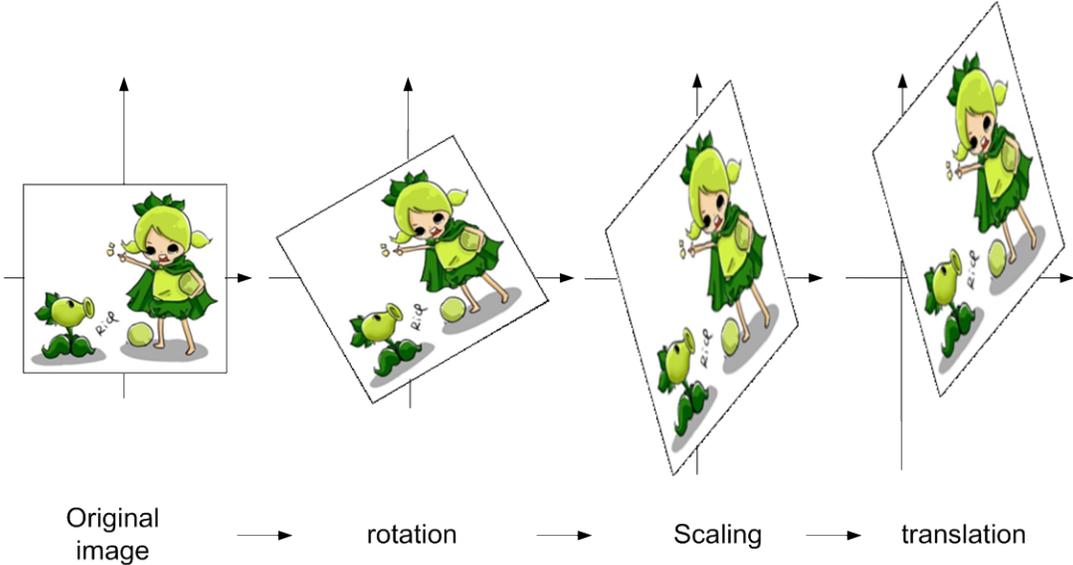


Figure 6.The Effects on the Top Stream