

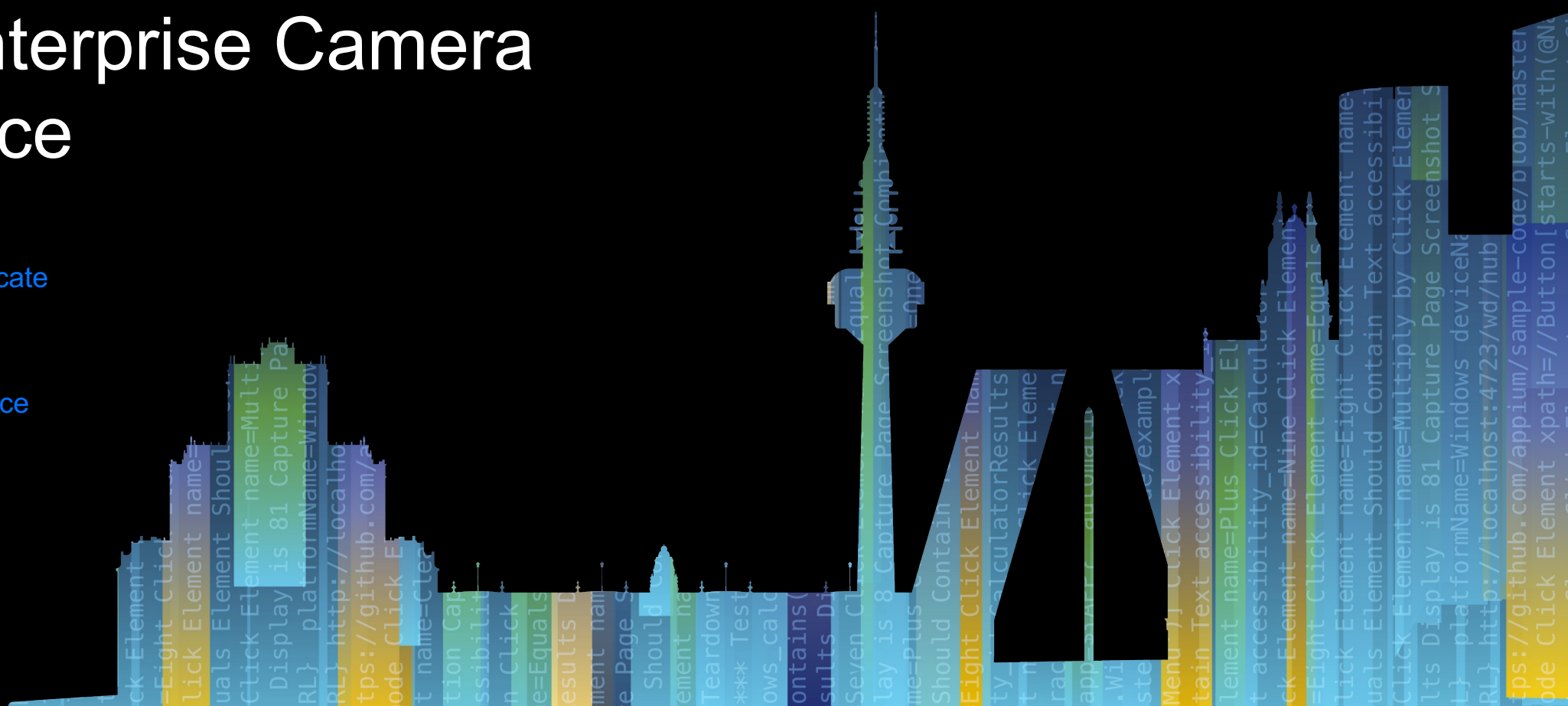
Zebra Enterprise Camera Experience

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EMEA Developer Advocate

Tony Yang

EMC Camera Experience
Software Engineer



Zebra's Enterprise Camera Experience

- **Image Quality**

- Enterprise Camera Tuning
- High Dynamic Range (HDR)
- Low-Light Multi-Frame Noise Reduction (MFNR)
- Premium offers Optical Image Stabilization (OIS)

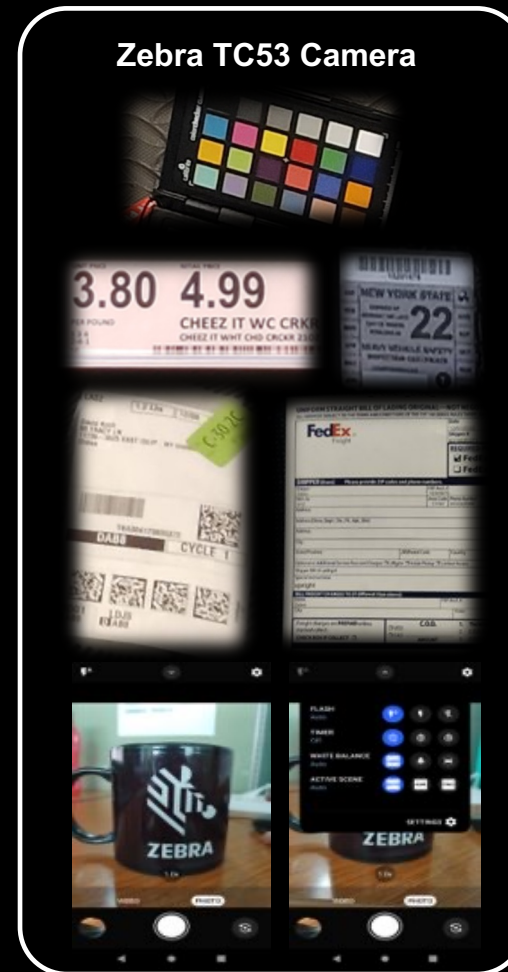
- **Use Case Enablement**

- Parcel Label / Proof of Deliver - Barcode Decode
- ID & Document Capture - Optical Character Recognition
- Field Service – Evidence of inspection certificate

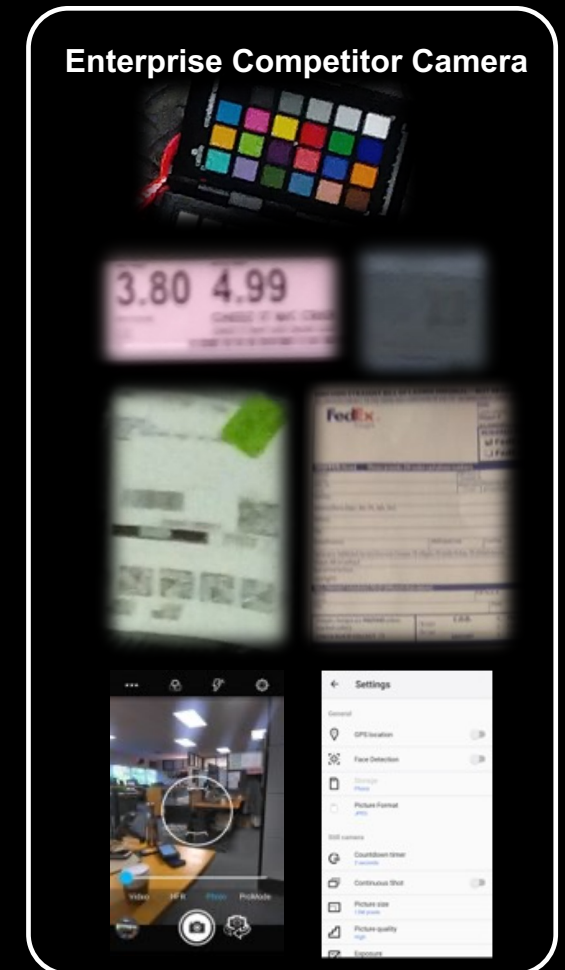
- **User Experience**

- Zebra Camera App – New Sleek UI/UX Design
- Easy access to the settings (Flash / Auto White Balance)
- Automated use of critical features (HDR)
- Built-in Google Lens & Zebra Dirty Lens Detection

Zebra TC53 Camera

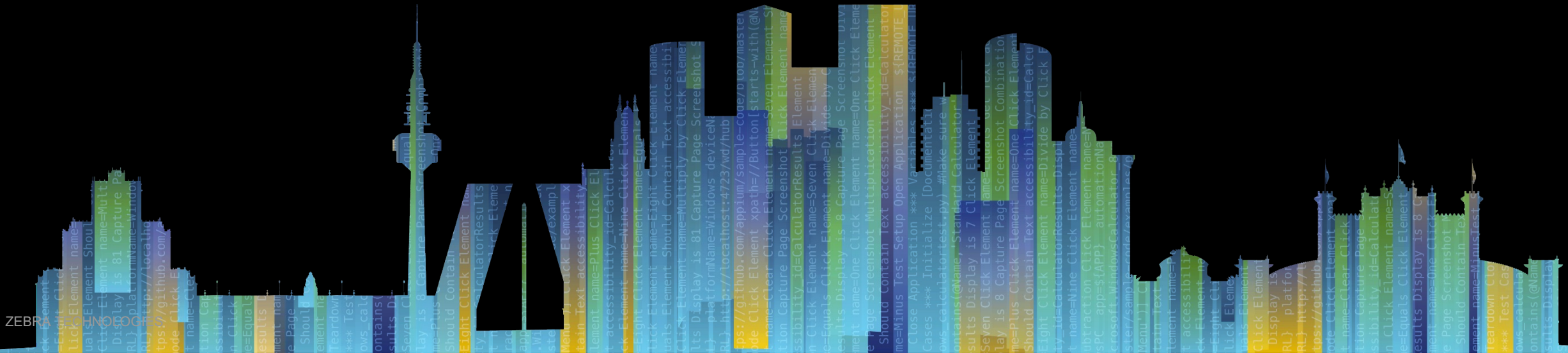


Enterprise Competitor Camera





Enterprise Image Quality



Camera Tuning Improvements

- Zebra Image Quality Goals
 - Offer a reliable image quality for enterprise use cases – OCR, Field Inspection, and Computer Vision/ML
 - Offer a better color accuracy and clarity under different enterprise environments – Retail Store, Warehouse and Outdoor

Zebra TC53 Camera



Enterprise Competitor Camera



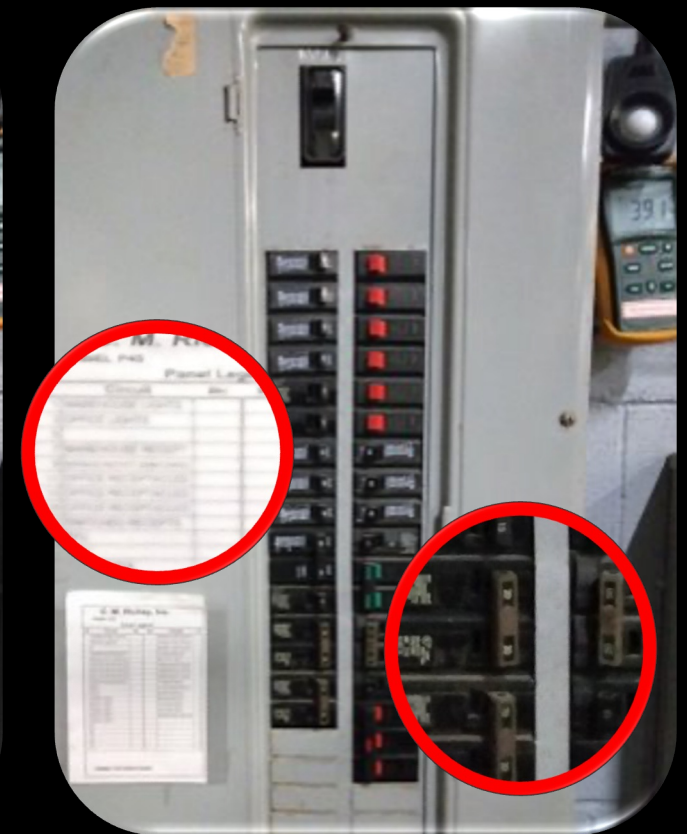
Low Light Environments

- Multiple-Frame Noise Reduction and optimized tuning improves sharpness and details under super low light warehouse environment (~50Lux)

Zebra TC53 Camera



Enterprise Competitor Camera



High Dynamic Range Environment

- High Dynamic Range mode help provide more details in the picture of the shadow region in the scene is under direct bright sunlight
- HDR is not enabled by default

Zebra TC53 Camera



Enterprise Competitor Camera



Optical Image Stabilization (OIS)

- OIS camera reduces the picture motion blur caused by hand tremors, further improving image details in low light and when snapping a picture with digital zoom in view.
- Available on Zebra premium devices

Zebra TC53 Camera

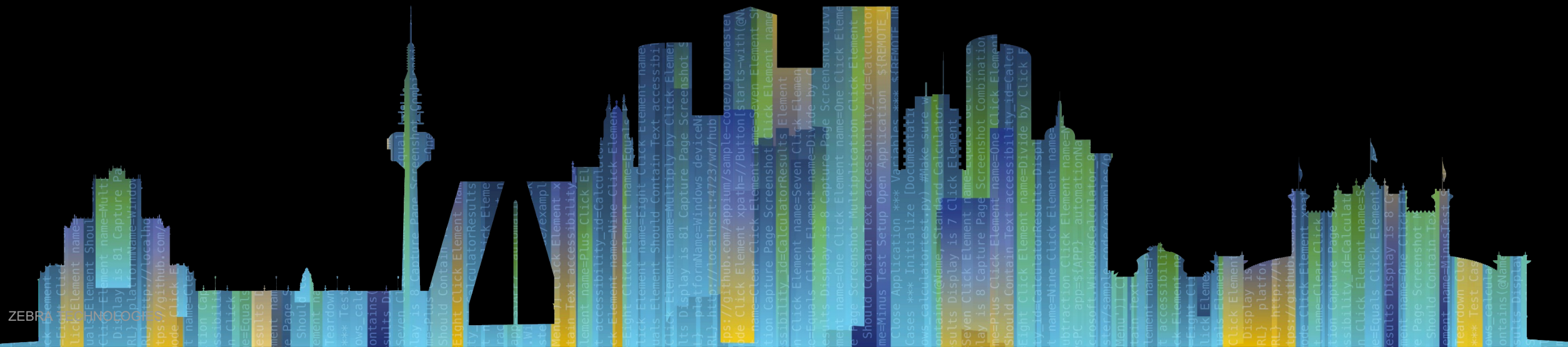


Enterprise Competitor Camera





Zebra Enterprise Camera Application



Enhancements



Sleek New UI Design Sleek



Enhanced Gesture Support



Dirty Lens Detection

**Experimental Feature*



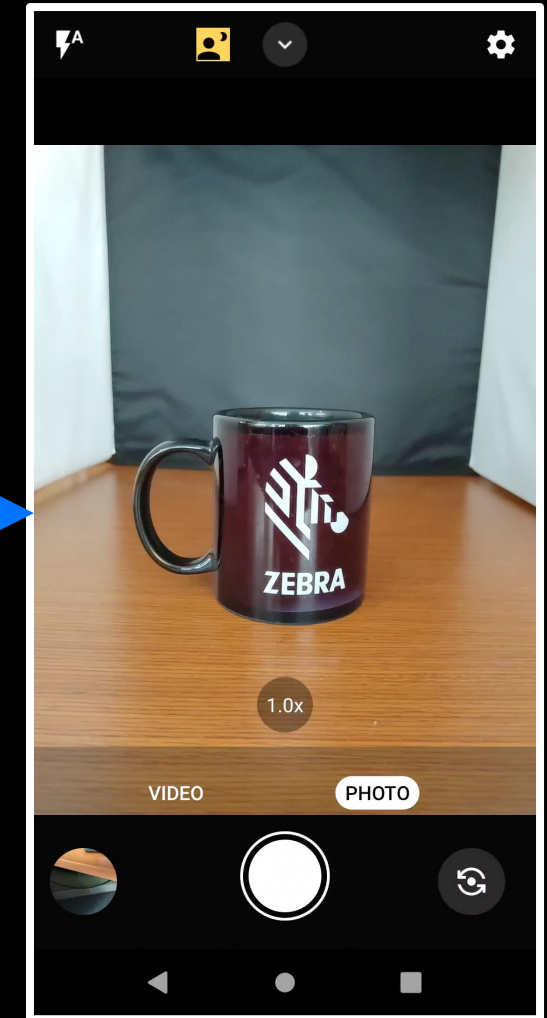
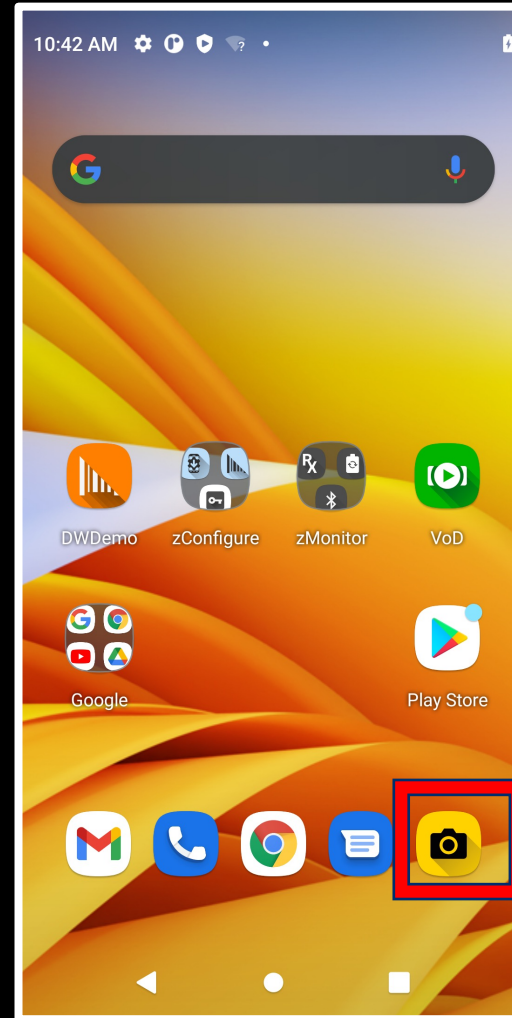
QR Code Scanning

**URL & ESIM supported*

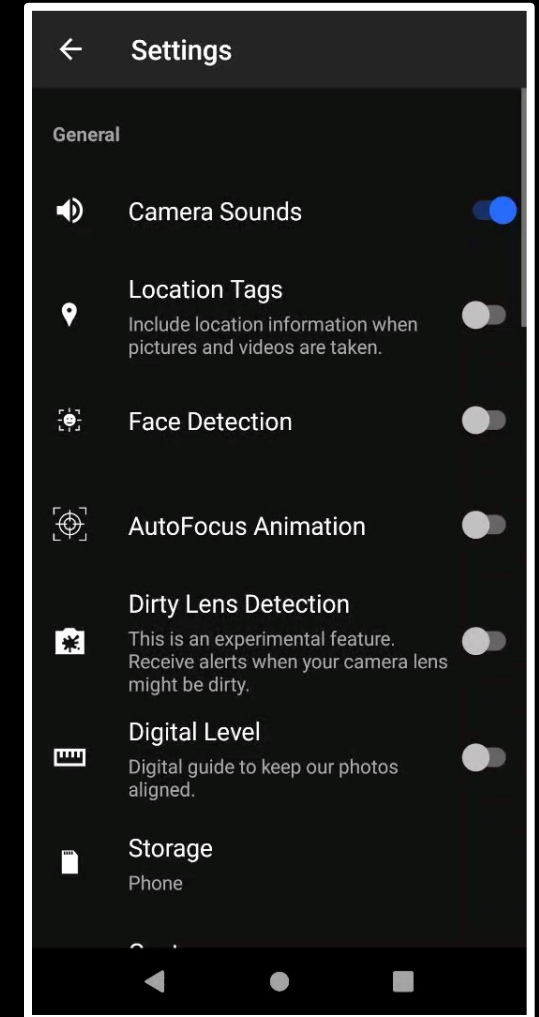
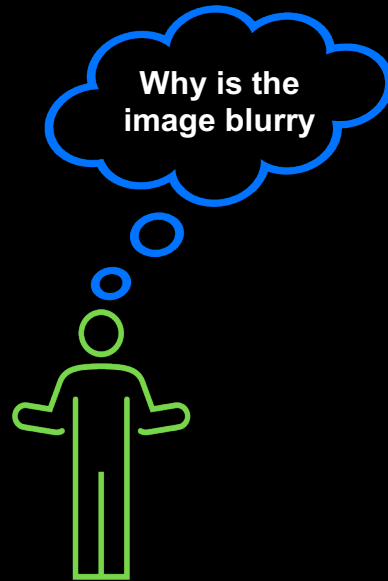
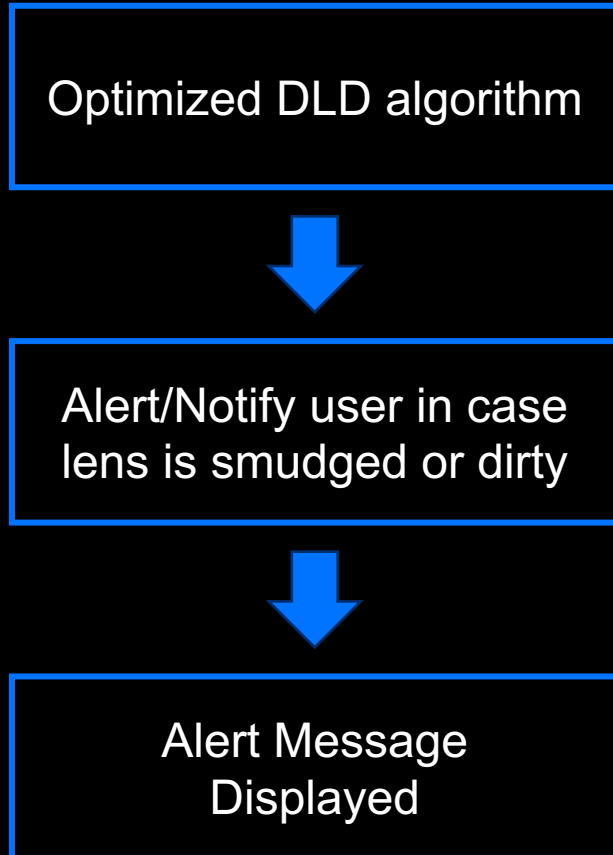


Google Lens

**GMS Required*



Dirty Lens Detection



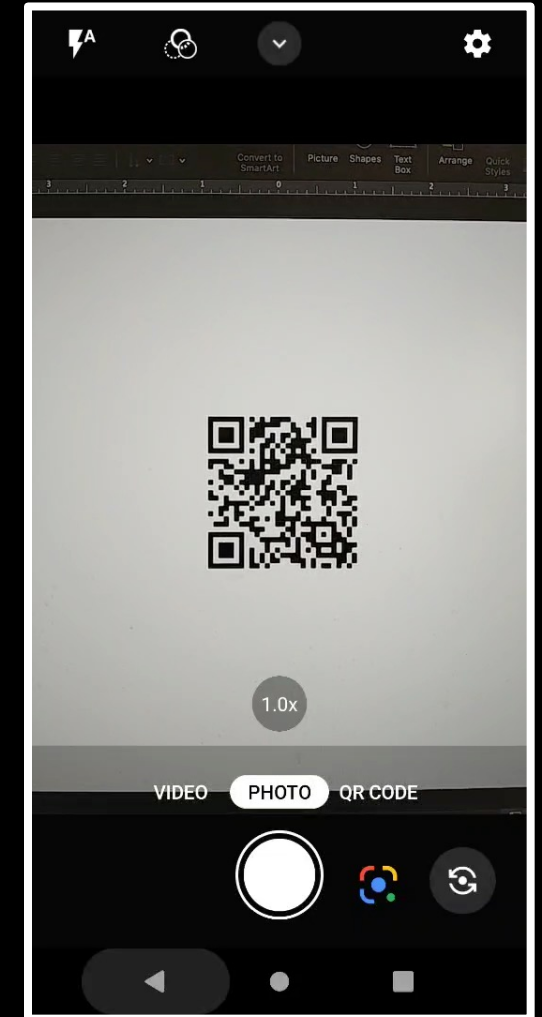
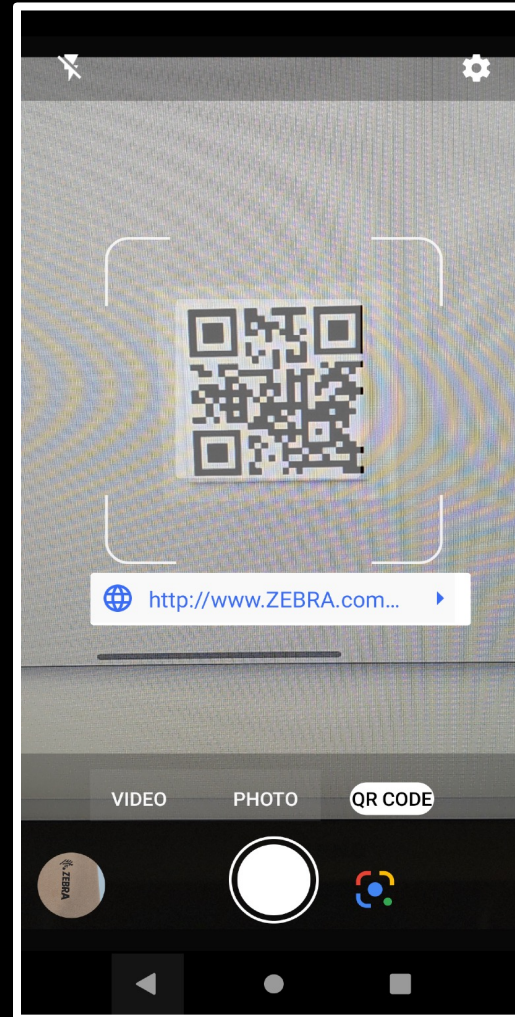
URL QR Code and ESIM Registration

Auto detect/decode QR Code

Decode QR Code – URL's
On-Screen shortcuts to launch web
browser

Decode ESIM QR and automatically
launch ESIM registration.
*Depends on WWAN support

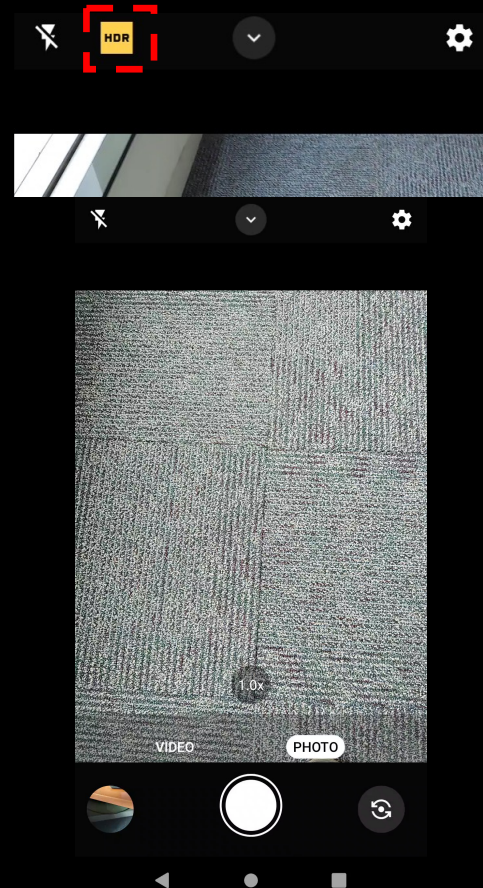
OOB Feature is not enabled



Auto HDR

Auto HDR Scene Indicator

- Disabled by default OOB
- Auto triggers when High Dynamic Range Scene is detected
- Merges multiple exposure frames to improve IQ
- HDR Image Capture Indication to user



HDR OFF



HDR ON

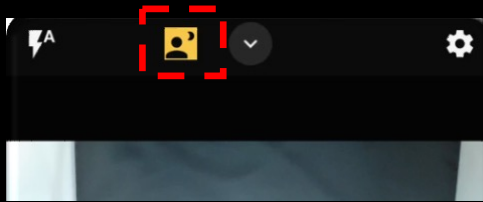


Auto Low Light (MFNR)

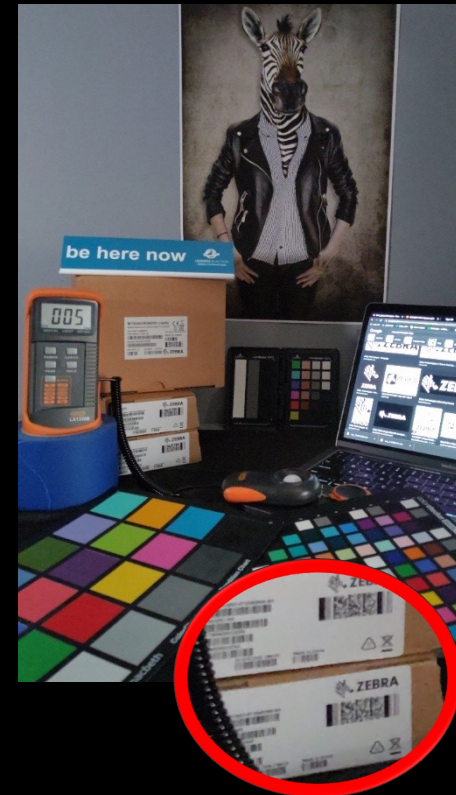


- Enabled by default
- Auto Triggers when low light scene detected
- Improves low light image quality by reducing noise.
- Merges multiple frames to improve SNR
- Low Light Image Capture Indication to User

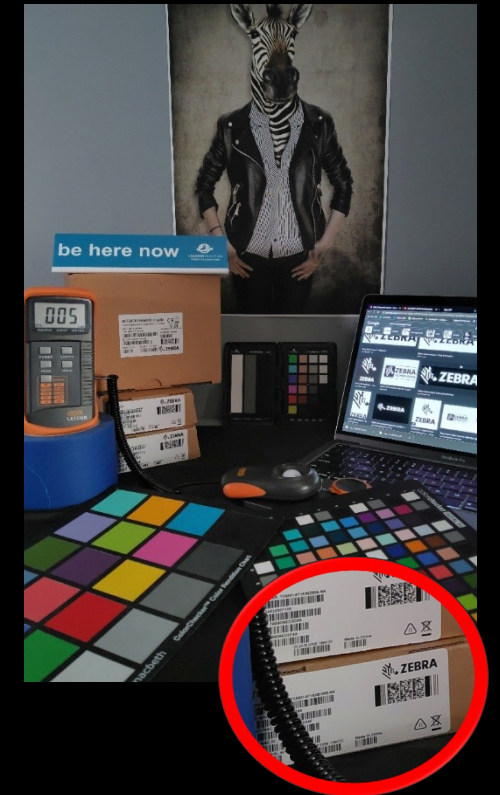
Auto Low Light
Scene Indicator



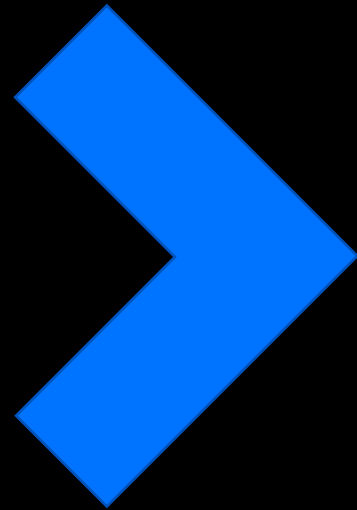
MFNR OFF



MFNR ON



Roadmap



- Admin Control For ZCA
- Localization Support
- Continued UI/UX Improvement
- Custom Scene Modes/Scene Optimizer:
 - Package – Optimize Camera picture taking for packages/parcels
 - Document – Optimize Camera Picture taking to enhance OCR accuracy and efficiency
 - Wound (Healthcare) – Optimize Camera to accurately capture images of Wound

Using Camera2 API to Control Auto HDR

Declare a HDR Capture Result Vendor Tag
"com.zebra.camera.hdr.detected"



Query the HDR Vendor Tag from Capture Result
to Check for HDR Scene Status
"com.zebra.camera.hdr.detected"



Apply "CONTROL_SCENE_MODE_HDR"
Scene Mode in Capture Request

```
public static CaptureResult.Key<Byte> isHdrScene = new  
CaptureResult.Key<>("com.zebra.camera.hdr.detected", Byte.class);
```

```
private void detectHDRMode(CaptureResult result, int id) {  
    Byte isHdrScene = getCustomVendorTags(result, CaptureModule.isHdrScene);  
    if (isHdrScene == null) return;  
    mActivity.runOnUiThread(new Runnable() {  
        @Override  
        public void run() {  
            if(isHdrScene == 1) {  
                mUI.showAutoHDRStatus(true);  
                mIsHDRScene = true;  
            } else {  
                mUI.showAutoHDRStatus(false);  
                mIsHDRScene = false;  
            }  
        }  
    });  
}
```

```
private void applySceneMode(CaptureRequest.Builder request) {  
    if (mIsHDR) {  
        request.set(CaptureRequest.CONTROL_SCENE_MODE, CaptureRequest.CONTROL_SCENE_MODE_HDR);  
        request.set(CaptureRequest.CONTROL_MODE, CaptureRequest.CONTROL_MODE_USE_SCENE_MODE);  
    }  
}
```


Using Camera2 API to Control Low Light MFNR

1. Declare a MFNRReq Capture Request Vendor Tag
"com.zebra.camera.hw.mfnr"
2. Declare a Low Light Scene Capture Result Vendor Tag
"com.zebra.camera.mfnr.detected"



- Query the Low Light Scene Vendor Tag from Capture Result to Check for Low Light Scene Status
"com.zebra.camera.mfnr.detected"



1. Apply Noise Reduction Mode in Capture Request
"NOISE_REDUCTION_MODE_HIGH_QUALITY"
2. Apply MFNRReq Vendor Tag in Capture Request
"com.zebra.camera.hw.mfnr"

```
private static final CaptureRequest.Key<Byte> ZebraMFNRReq =  
    new CaptureRequest.Key<>("com.zebra.camera.hw.mfnr", byte.class);  
  
private static CaptureResult.Key<Byte> isLowLightScene =  
    new CaptureResult.Key<>("com.zebra.camera.mfnr.detected", Byte.class);
```

```
private void detectLowLightMode(CaptureResult result) {  
    Byte isLowLightScene = getCustomVendorTags(result, CaptureModule.isLowLightScene);  
  
    if(isLowLightScene == null) return;  
  
    mActivity.runOnUiThread(new Runnable() {  
        @Override  
        public void run() {  
            if (isLowLightScene == 1) {  
                mIsLowLight = true;  
                mUI.showLLStatus(true);  
            } else {  
                mIsLowLight = false;  
                mUI.showLLStatus(false);  
            }  
        }  
    });  
  
    return;  
}
```

```
private static final int NOISE_REDUCTION_MODE_HIGH_QUALITY = 2;  
  
private void applyCaptureMFNR(CaptureRequest.Builder builder) {  
    if(mIsLowLight) {  
        builder.set(CaptureRequest.NOISE_REDUCTION_MODE, NOISE_REDUCTION_MODE_HIGH_QUALITY);  
        builder.set(ZebraMFNRReq, (byte) 0x01);  
    }  
}
```

Using Camera2 API to Control Optical Stabilization

Check for Optical Stabilization Support from
CameraCharacteristics
"LENS_INFO_AVAILABLE_OPTICAL_STABILIZATION"



Apply Optical Stabilization Mode in Capture Request
"LENS_OPTICAL_STABILIZATION_MODE_ON"
Note: OIS available on Premium SKU and default is ON

```
public boolean isOISSupported(int id) {  
    int[] os = mCharacteristics.get(id).get(CameraCharacteristics.LENS_INFO_AVAILABLE_OPTICAL_STABILIZATION);  
    for(int i = 0; i < os.length; i++) {  
        if (os[i] == LENS_OPTICAL_STABILIZATION_MODE_ON)  
            return true;  
    }  
    return false;  
}
```

```
private void applyOIS(CaptureRequest.Builder request) {  
    int rear_camera_id = 0;  
    if(isOISSupported(rear_camera_id)) {  
        request.set(CaptureRequest.LENS_OPTICAL_STABILIZATION_MODE,  
            CaptureRequest.LENS_OPTICAL_STABILIZATION_MODE_ON);  
    } else {  
        request.set(CaptureRequest.LENS_OPTICAL_STABILIZATION_MODE,  
            CaptureRequest.LENS_OPTICAL_STABILIZATION_MODE_OFF);  
    }  
}
```

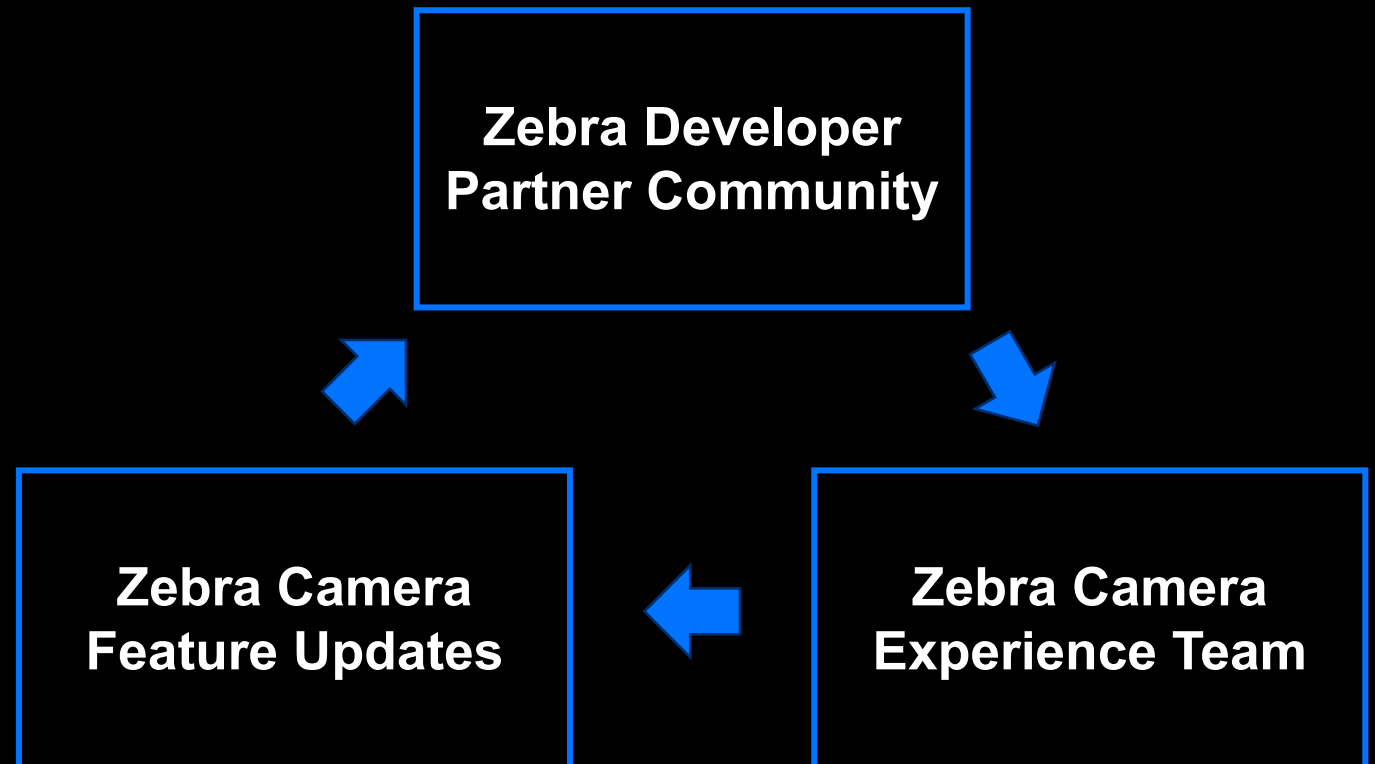
Continuous Improvement

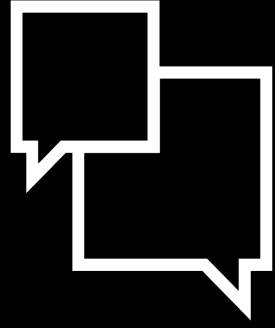
- Stay tuned for more Camera Updates on Zebra Developer Blog

<https://developer.zebra.com/community/home/blog-central>

- Stay tuned for Camera Sample Project on Zebra GitHub

<Pending for Zebra Public GitHub Project URL>





Questions



Thank You

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