

Buffed-Up Bionmetrics

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Big Nerd Ranch

What are Bionmetrics?

Types of Biometrics¹

- Fingerprint
- Face
- Iris
- DNA
- Gait
- Typing rythm

¹ Examples from <https://en.wikipedia.org/wiki/Biometrics>

Security²



Knowledge



Possession



Biometric

² Image from Better Biometrics in Android P

New Threats

DeepMasterPrints: Generating MasterPrints for Dictionary Attacks via Latent Variable Evolution³

Train Generative Adversarial Network with real fingerprints

³ Research paper available here: <https://arxiv.org/pdf/1705.07386.pdf>

Old News

FingerprintManager

FingerprintManagerCompat

Why introduce something new?

FingerprintManager only works with fingerprint authentication



BiometricPrompt!

Permissions

```
<uses-permission android:name="android.permission.USE_BIOMETRIC" />
```

BiometricPrompt Object

```
private fun showAuthenticationDialog() {  
    val title = getString(R.string.authentication_title)  
    val cancel = getString(R.string.cancel_button)  
    val biometricPrompt = BiometricPrompt.Builder(this)  
        .setTitle(title)  
        .setNegativeButton(cancel, mainExecutor, negativeListener)  
        .build()  
}
```

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        .setTitle(title)  
        .setNegativeButton(cancel, mainExecutor, negativeListener)  
        .build()  
}
```

Cancel Listener

```
private val negativeListener =  
    DialogInterface.OnClickListener { _, _ ->  
        // Biometric auth canceled, authenticate a different way  
    }
```

Trigger Authentication

```
// Regular authentication
biometricPrompt.authenticate(
    cancellationSignal,
    mainExecutor,
    authenticationCallback
)
// Unlock crypto object
biometricPrompt.authenticate(
    cryptoObject
    cancellationSignal,
    mainExecutor,
    authenticationCallback
)
```

Trigger Authentication

```
// Regular authentication
biometricPrompt.authenticate(
    cancellationSignal,
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Trigger Authentication

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)
// Unlock crypto object
biometricPrompt.authenticate(
    cryptoObject
    cancellationSignal,
    mainExecutor,
    authenticationCallback
)
```

Cancellation signal

```
val cancellationSignal = CancellationSignal()  
  
// To cancel later  
cancellationSignal.cancel()
```

CryptoObject

```
val signatureObject = BiometricPrompt.CryptoObject(signature)
```

```
val cipherObject = BiometricPrompt.CryptoObject(cipher)
```

```
val macObject = BiometricPrompt.CryptoObject(mac)
```

Crypto Object

```
KeyGenParameterSpec.Builder(  
    "key1", KeyProperties.PURPOSE_SIGN)  
    // Only permit the private key to be used if the user authenticated  
    .setUserAuthenticationRequired(true)  
    .build()
```

Crypto Object

```
KeyGenParameterSpec.Builder(  
    "key1", KeyProperties.PURPOSE_SIGN)  
    // Only permit the private key to be used if the user authenticated  
    .setUserAuthenticationRequired(true)  
    .build()
```

Callbacks

```
private val authenticationCallback = object: AuthenticationCallback() {  
    override fun onAuthenticationSucceeded(result: AuthenticationResult?) {  
    }  
  
    override fun onAuthenticationError(errorCode: Int,  
                                       errString: CharSequence?) {  
    }  
  
    override fun onAuthenticationFailed() {  
    }  
  
    override fun onAuthenticationHelp(helpCode: Int,  
                                       helpString: CharSequence?) {  
    }  
}
```

Callbacks

```
private val authenticationCallback = object: AuthenticationCallback() {  
    override fun onAuthenticationSucceeded(result: AuthenticationResult?) {  
    }  
  
    override fun onAuthenticationError(errorCode: Int,  
                                       errString: CharSequence?) {  
    }  
  
    override fun onAuthenticationFailed() {  
    }  
  
    override fun onAuthenticationHelp(helpCode: Int,  
                                       helpString: CharSequence?) {  
    }  
}
```

Callbacks

```
private val authenticationCallback = object: AuthenticationCallback() {  
    override fun onAuthenticationSucceeded(result: AuthenticationResult?) {  
    }  
  
    override fun onAuthenticationError(errorCode: Int,  
                                       errString: CharSequence?) {  
    }  
  
    override fun onAuthenticationFailed() {  
    }  
  
    override fun onAuthenticationHelp(helpCode: Int,  
                                       helpString: CharSequence?) {  
    }  
}
```

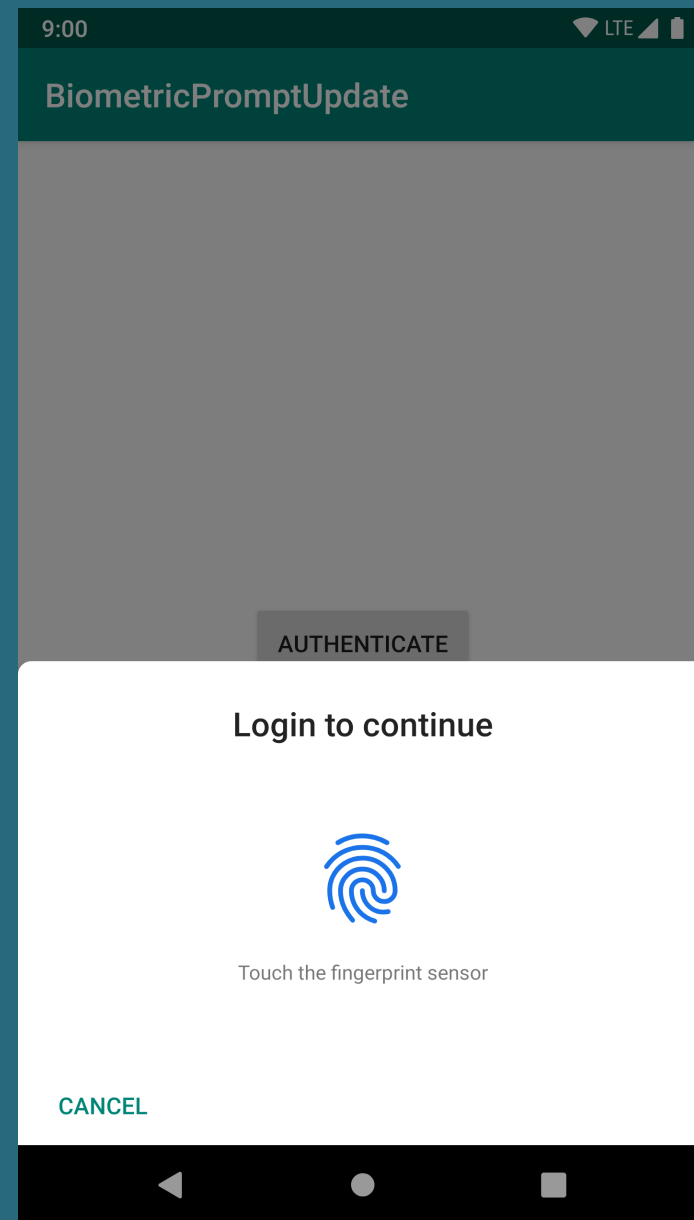

Callbacks

```
private val authenticationCallback = object: AuthenticationCallback() {  
    override fun onAuthenticationSucceeded(result: AuthenticationResult?) {  
    }  
  
    override fun onAuthenticationError(errorCode: Int,  
                                       errString: CharSequence?) {  
    }  
  
    override fun onAuthenticationFailed() {  
    }  
  
    override fun onAuthenticationHelp(helpCode: Int,  
                                       helpString: CharSequence?) {  
    }  
}
```

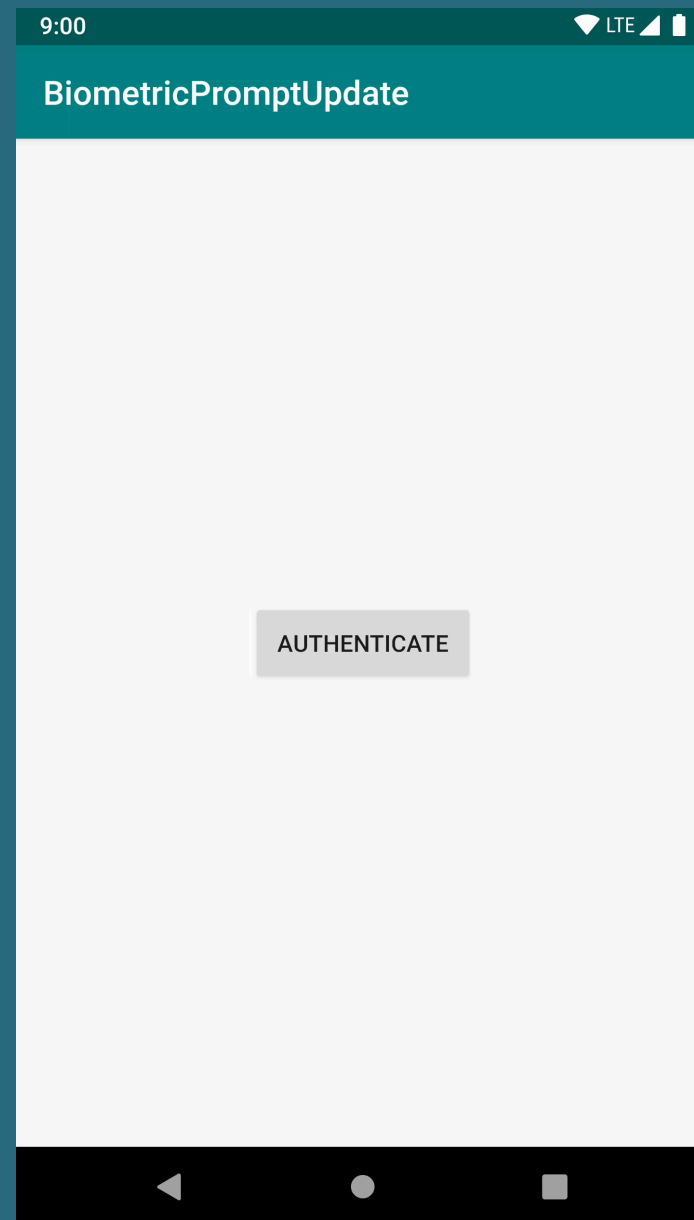
Callbacks

```
private val authenticationCallback = object: AuthenticationCallback() {  
    override fun onAuthenticationSucceeded(result: AuthenticationResult?) {  
    }  
  
    override fun onAuthenticationError(errorCode: Int,  
                                       errString: CharSequence?) {  
    }  
  
    override fun onAuthenticationFailed() {  
    }  
  
    override fun onAuthenticationHelp(helpCode: Int,  
                                       helpString: CharSequence?) {  
    }  
}
```

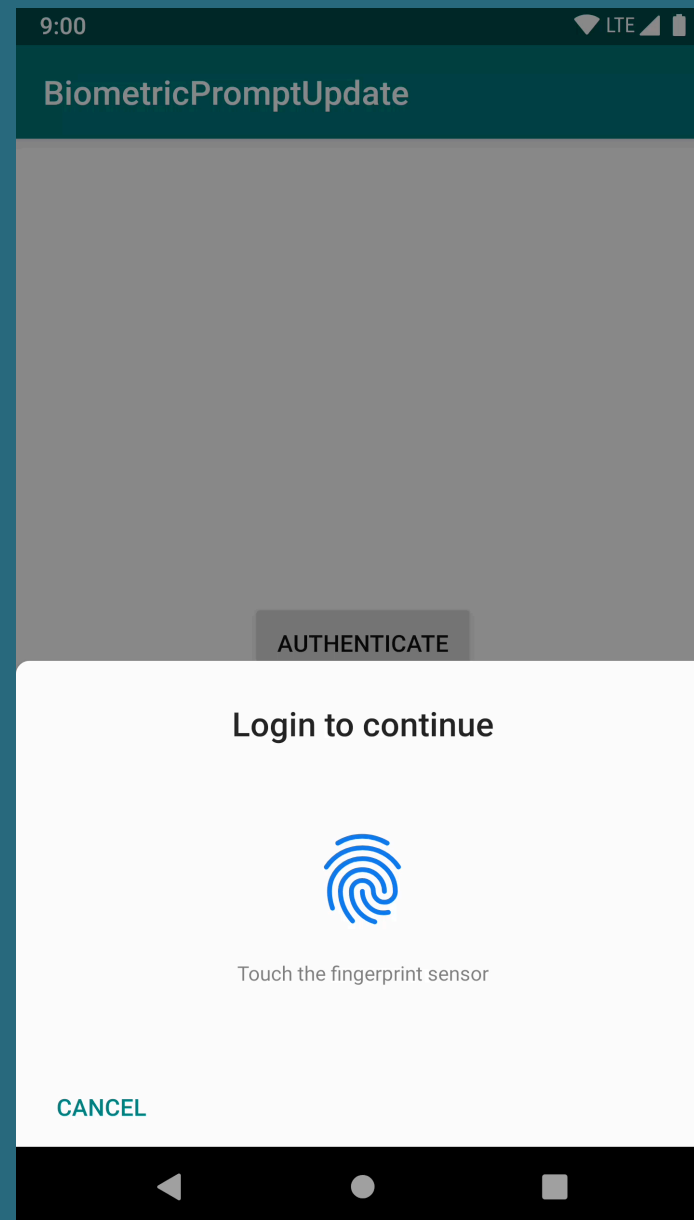
Default Prompt



Sad Prompt



More Sad Prompts



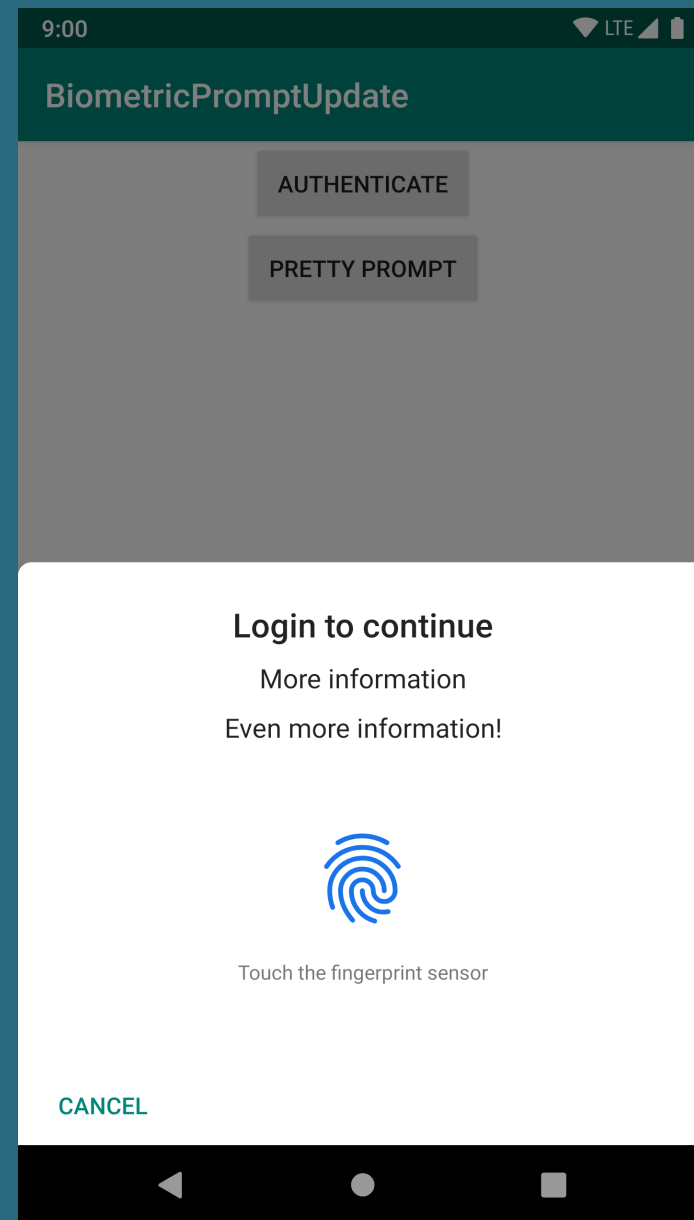
Prompt configuration

```
val title = getString(R.string.authentication_title)
val cancel = getString(R.string.cancel_button)
val subtitle = getString(R.string.authentication_subtitle)
val description = getString(R.string.authentication_description)
val biometricPrompt = BiometricPrompt.Builder(this)
    .setTitle(title)
    .setNegativeButton(cancel, mainExecutor, negativeListener)
    .setSubtitle(subtitle)
    .setDescription(description)
    .build()
```

Prompt configuration

```
val title = getString(R.string.authentication_title)
val cancel = getString(R.string.cancel_button)
val subtitle = getString(R.string.authentication_subtitle)
val description = getString(R.string.authentication_description)
val biometricPrompt = BiometricPrompt.Builder(this)
    .setTitle(title)
    .setNegativeButton(cancel, mainExecutor, negativeListener)
    .setSubtitle(subtitle)
    .setDescription(description)
    .build()
```

Pretty Prompt



Problem

BiometricPrompt API is available on API 28+

AndroidX Compatibility 🎉

androidx.biometric:biometric:1.0.0-alpha02

BiometricPrompt

```
val biometricPrompt = BiometricPrompt(  
    this,  
    executor,  
    authenticationCallback)
```

Executor

```
val executor = if (Build.VERSION.SDK_INT >= 28) {  
    mainExecutor  
} else {  
    Executor {  
        fun execute(runnable: Runnable) {  
            runnable.run()  
        }  
    }  
}
```

Executor

```
val executor = if (Build.VERSION.SDK_INT >= 28) {  
    mainExecutor  
} else {  
    Executor {  
        fun execute(runnable: Runnable) {  
            runnable.run()  
        }  
    }  
}
```

Executor

```
val executor = if (Build.VERSION.SDK_INT >= 28) {  
    mainExecutor  
} else {  
    Executor {  
        fun execute(runnable: Runnable) {  
            runnable.run()  
        }  
    }  
}
```

AuthenticationCallback

```
private val authenticationCallback = object : BiometricPrompt.AuthenticationCallback() {  
    override fun onAuthenticationSucceeded(result: BiometricPrompt.AuthenticationResult) {  
        Log.d(TAG, "onAuthenticationSucceeded")  
    }  
  
    override fun onAuthenticationError(errorCode: Int, errString: CharSequence) {  
        Log.d(TAG, "onAuthenticationError $errString")  
    }  
  
    override fun onAuthenticationFailed() {  
        Log.d(TAG, "onAuthenticationFailed")  
    }  
}
```

AuthenticationCallback

```
private val authenticationCallback = object : BiometricPrompt.AuthenticationCallback() {  
    override fun onAuthenticationSucceeded(result: BiometricPrompt.AuthenticationResult) {  
        Log.d(TAG, "onAuthenticationSucceeded")  
    }  
  
    override fun onAuthenticationError(errorCode: Int, errString: CharSequence) {  
        Log.d(TAG, "onAuthenticationError $errString")  
    }  
  
    override fun onAuthenticationFailed() {  
        Log.d(TAG, "onAuthenticationFailed")  
    }  
}
```


AuthenticationCallback

```
private val authenticationCallback = object : BiometricPrompt.AuthenticationCallback() {  
    override fun onAuthenticationSucceeded(result: BiometricPrompt.AuthenticationResult) {  
        Log.d(TAG, "onAuthenticationSucceeded")  
    }  
  
    override fun onAuthenticationError(errorCode: Int, errString: CharSequence) {  
        Log.d(TAG, "onAuthenticationError $errString")  
    }  
  
    override fun onAuthenticationFailed() {  
        Log.d(TAG, "onAuthenticationFailed")  
    }  
}
```

AuthenticationCallback

```
private val authenticationCallback = object : BiometricPrompt.AuthenticationCallback() {  
    override fun onAuthenticationSucceeded(result: BiometricPrompt.AuthenticationResult) {  
        Log.d(TAG, "onAuthenticationSucceeded")  
    }  
  
    override fun onAuthenticationError(errorCode: Int, errString: CharSequence) {  
        Log.d(TAG, "onAuthenticationError $errString")  
    }  
  
    override fun onAuthenticationFailed() {  
        Log.d(TAG, "onAuthenticationFailed")  
    }  
}
```

Prompt Configuration

```
val title = getString(R.string.authentication_title)
val cancel = getString(R.string.cancel_button)
// Configure data for the prompt
val promptInfo = BiometricPrompt.PromptInfo.Builder()
    .setTitle(title)
    .setNegativeButtonText(cancel)
    .build()
```

Prompt Configuration

```
val title = getString(R.string.authentication_title)
val cancel = getString(R.string.cancel_button)
// Configure data for the prompt
val promptInfo = BiometricPrompt.PromptInfo.Builder()
    .setTitle(title)
    .setNegativeButtonText(cancel)
    .build()
```

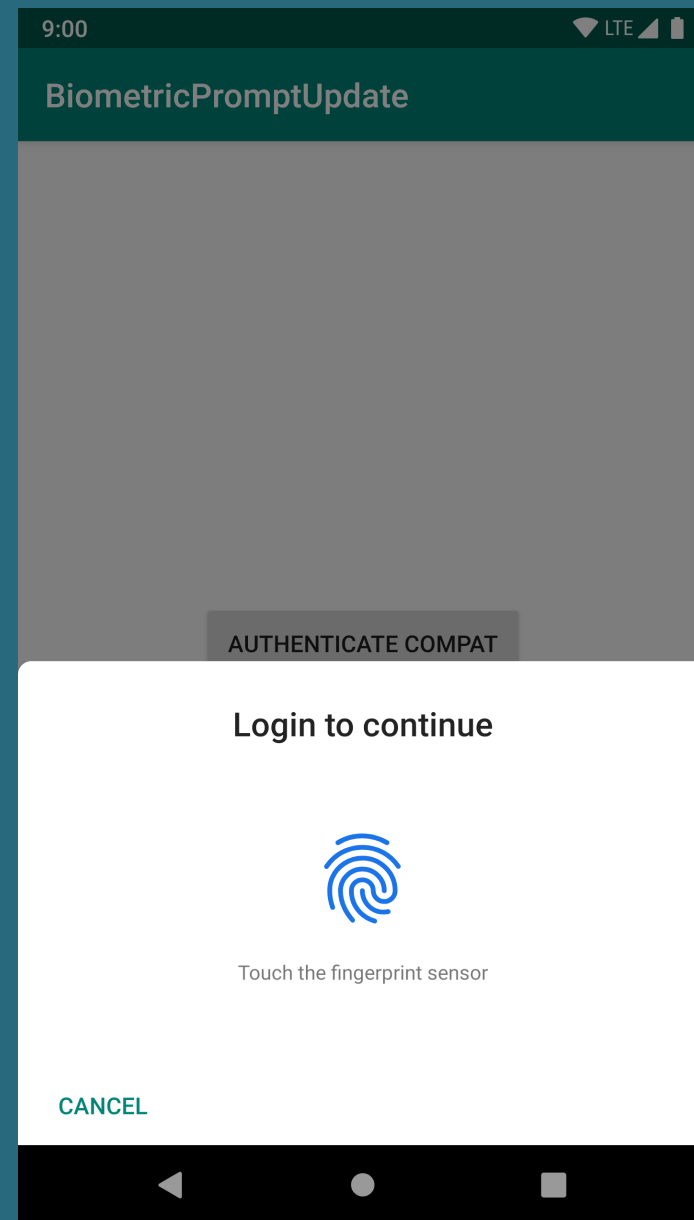
Trigger Authentication

```
biometricPrompt.authenticate(promptInfo)
```

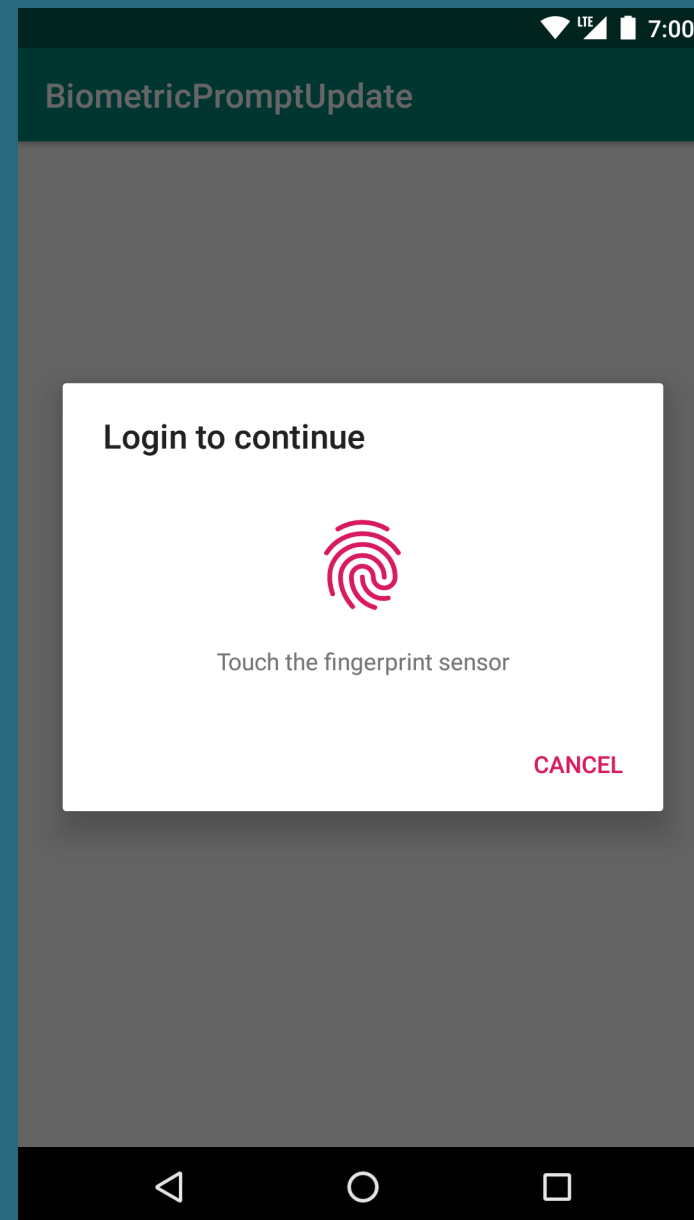
```
// or
```

```
biometricPrompt.authenticate(promptInfo, cryptoObject)
```

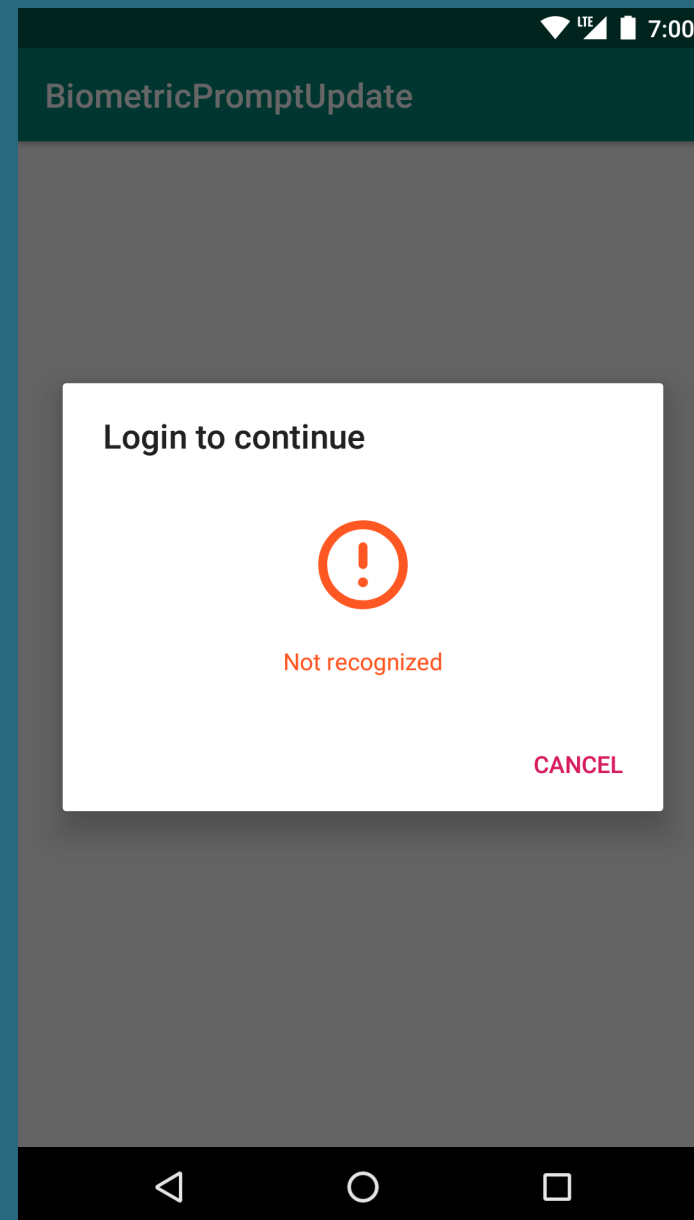
Compat Prompt (API 28)



(Old) Compat Prompt



(Old) Compat Error



What about the CancellationSignal?

```
biometricPrompt.cancelAuthentication()
```

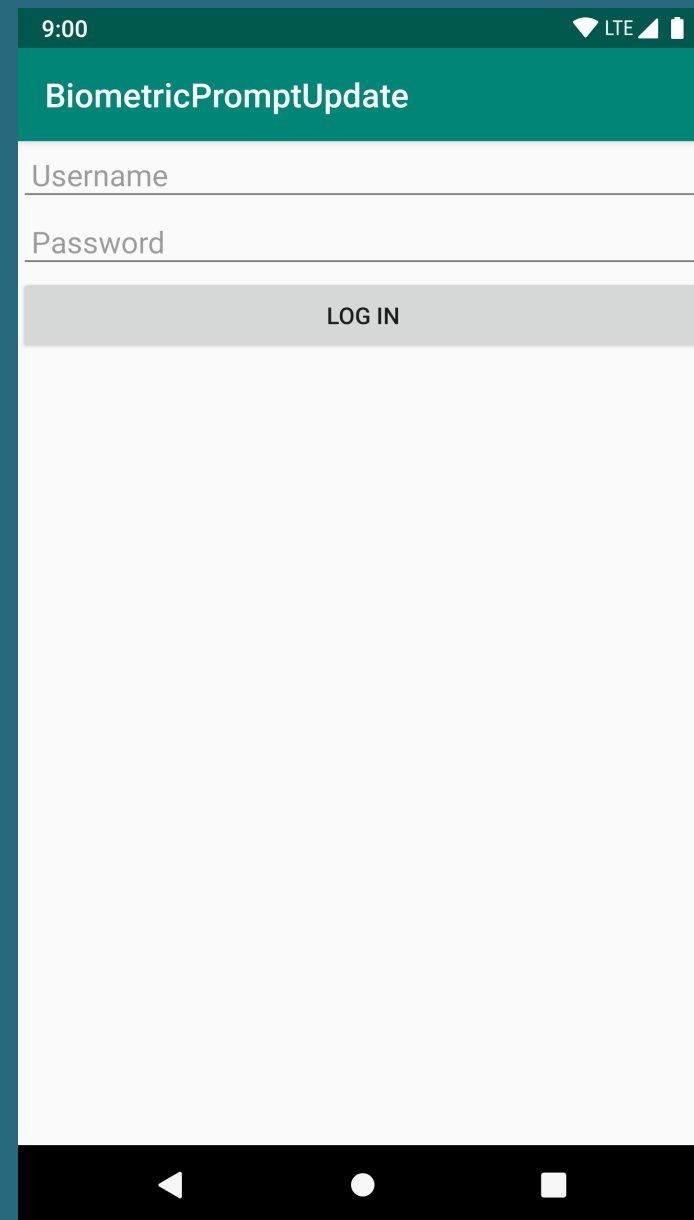
Authentication Flow

Is user already using biometrics?

If no -> First-time flow

If yes -> Main flow

First-time flow

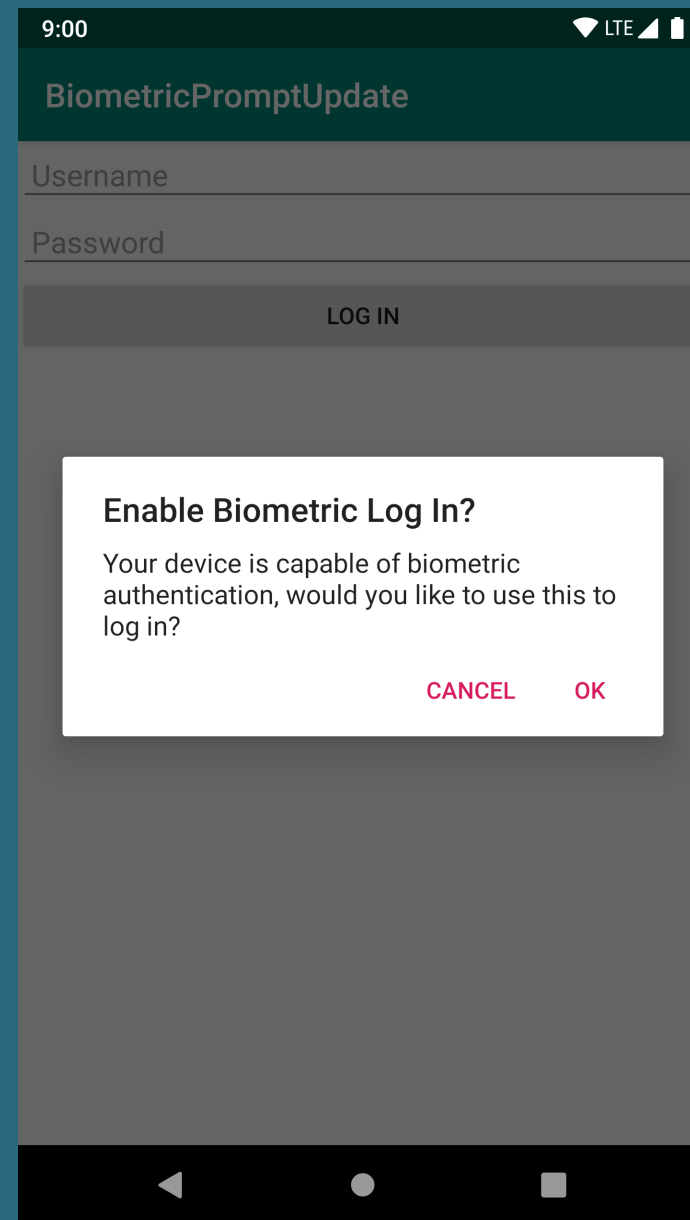


A mobile application login screen mockup. At the top is a dark green status bar with the time '9:00' and LTE signal indicators. Below this is a teal header bar with the text 'BiometricPromptUpdate'. The main content area is white and contains two text input fields: 'Username' and 'Password'. Below the password field is a grey button with the text 'LOG IN'. At the bottom is a black navigation bar with three white icons: a back arrow, a home circle, and a recent apps square.

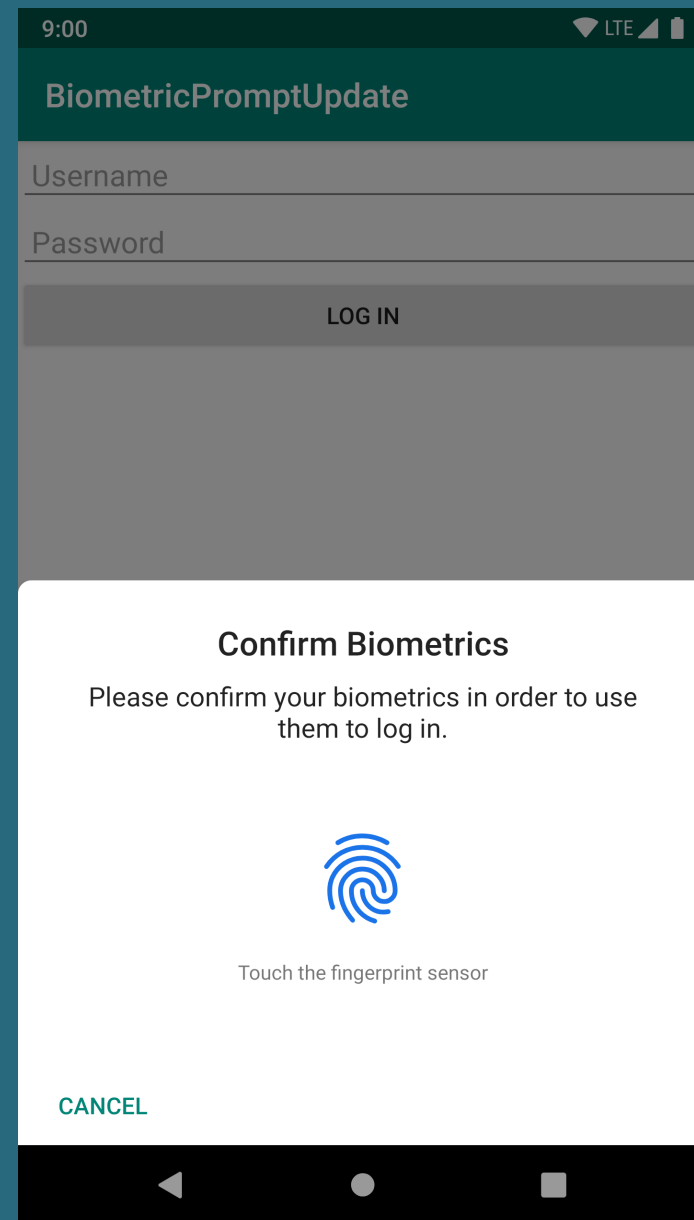
Check device capability

```
private fun hasBiometrics(): Boolean {  
    return if (Build.VERSION.SDK_INT >= 23) {  
        packageManager.hasSystemFeature(  
            PackageManager.FEATURE_FINGERPRINT  
        )  
    } else {  
        false  
    }  
}
```

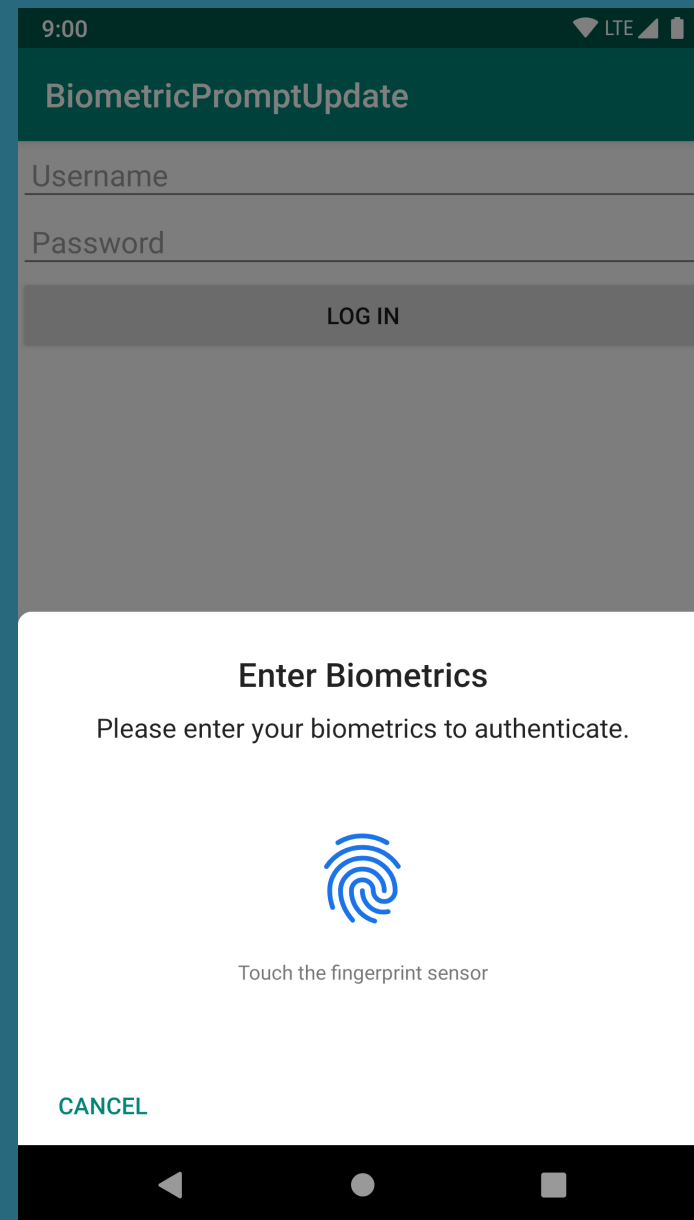
First-time flow



First-time flow



Main flow



Main flow

9:00 LTE

BiometricPromptUpdate

Username

Password

LOG IN

Unrecognized biometrics, please log in with username and password

Future plans

Resources

Biometrics

Better Biometrics in Android P

Measuring Biometric Unlock Security

About Me

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Big Nerd Ranch

Sample project & slides:
bit.ly/dcsf-bio-prompt