



OBJECT DETECTION FOR VISUALLY IMPAIRED USING MACHINE LEARNING AND FLUTTER

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Abstract : Machine Learning is being used widely in projects today. It requires knowledge of Machine Learning to create models, for application developers who want to use Machine Learning in the project but don't know how to create a model. Flutter is Google's portable user interface (UI) framework for building modern, native, and reactive applications for iOS and Android. In Flutter[8], certain developments have been done by Google to help developers create the application they want. Although there is a package google_ml_kit[5] however it is only available for android yet. In our project, we use Machine Learning to train and run Deep Learning models on the edge devices such as Smartphones, IoT Devices, and devices without an OS like Microcontroller units (MCU). It's the future of AI inference. In this project, our team will cover two aspects. Firstly, build on-device machine learning models using Tensorflow[4] and Google ML Kit[5], and secondly, construct and run a flutter app that uses this model on Android Devices.

IndexTerms - Machine Learning, Flutter, Deep Learning, Smartphones, Mobile Application, TensorFlow, Google_ML_Kit.

I. INTRODUCTION

Flutter is an open-source framework by Google for building beautiful, natively compiled, multi-platform applications from a single codebase.

Flutter features: Flutter is Fast, Productive and Flexible!

The **TensorFlow[4]** platform helps you implement best practices for data automation, model tracking, performance monitoring, and model retraining. Using production-level tools to automate and track model training over the lifetime of a product, service, or business process is critical to success.

ML Kit[5] is created by Google for developers to build mobile applications that involve machine learning easily. It can be used for text recognition, face and pose detection, barcode scanning, etc. We are going to create an application that detects items in the Image and labels them

Features of the app

- 1.capture the image
- 2.preprocess the image
- 3.identify objects with label
- 4.Decodes barcode
5. recognizes text

Object recognition is a significant issue for those who are visually impaired. We therefore suggest a system to assist those who are visually impaired in classifying various categories of objects using machine learning. The suggested framework makes use of Flutter, Google's TensorFlow Lite object identification API and machine learning. It's a helpful programme that enables blind and visually impaired persons to carry out daily duties much more easily and efficiently

There are numerous technological solutions available to help the blind. This application seeks to utilise the camera to instantly identify objects in front of the user and then use a voice assistant to broadcast these recognised objects to the user. Visually impaired people will be less likely to have an accident since they will be aware of the barriers in front of them in advance. Using this application, the size of the items is decreased, space is conserved, and the programme operates more quickly.

The phrase "visual impairment" is used to describe a wide range of conditions that affect vision clarity and field of vision. For people who are visually impaired, technology is useful as a tool for learning, communication, and visual stimulation. The proposed project's aim is to create an Android-based application for people who are blind or visually impaired. The system's goal is to detect real-time objects along with decoding barcodes, and recognizing texts that are scanned through a mobile camera or chosen from gallery and notify blind people.

II. LITERATURE SURVEY

[1] "Object Detection Using Machine Learning for Visually Impaired People"

Authors: Venkata Naresh Mandhala, Debnath Bhattacharyya, Vamsi B, Thirupathi Rao N.

Description: Eliminating the problem of vision in visually impaired persons, the proposed work can be used effectively in detecting the objects along with their design patterns in an exact manner and to identify them among multiple different objects in a captured input image individually with expert navigation, by implementing the Specific model X-Y plane by calculating their percentages accurately of the detection and also supporting the transformation input images to speech.

Limitations: Accuracy of 80-95 percent but slow

[2] "A Real-Time Object Detection for Visually Impaired People"

Authors: Therese Yamuna Mahesh, Parvathy S S , Shibin Thomas, Shilpa Rachel Thomas and Thomas Sebastian

Description: The main objective of this project is to develop an object detector that is capable of detecting customized classes. This is implemented for five classes of different objects which the user is likely to use daily.

Limitations: YOLO in real time gives less accuracy.

[3] "Deep Learning Based Indian Currency Detection for Visually Challenged using VGG16"

Authors: Nijil Raj N, Anandu S Ram, Aneeta Binoo Joseph, Shabna S

Description: The method proposes a vision-based deep learning technique in this project that can identify and classify Indian currencies. Deep features were extracted from the input image using VGG 16.

Limitations: This system is only for detecting currency.

Proposed system:

Title: Object Detection Using Machine Learning for Visually Impaired People.

Description: Build on-device machine learning models using Tensorflow & Google ML kit, and secondly, construct and run a flutter app that uses this model on Android Devices.

Advantages: We are making use of the latest TensorFlow model to increase the accuracy.

In addition, developing the app in flutter has the following merits:

- Same UI and Business Logic in All Platforms
- Reduced Code Development Time
- Custom, Animated UI of Any Complexity Available

III. METHODOLOGY AND RELATED WORKS

The Flutter framework[8], which offers a modern, reactive framework developed in the Dart language, is often how developers interact with Flutter. It is made up of a number of layers that work their way up from the bottom and comprises core libraries and a comprehensive range of platform layouts, such as: Fundamental foundational courses, as well as constructing block services like motions that provide regularly used abstractions over the fundamental basis, such as animation, painting, and gestures.

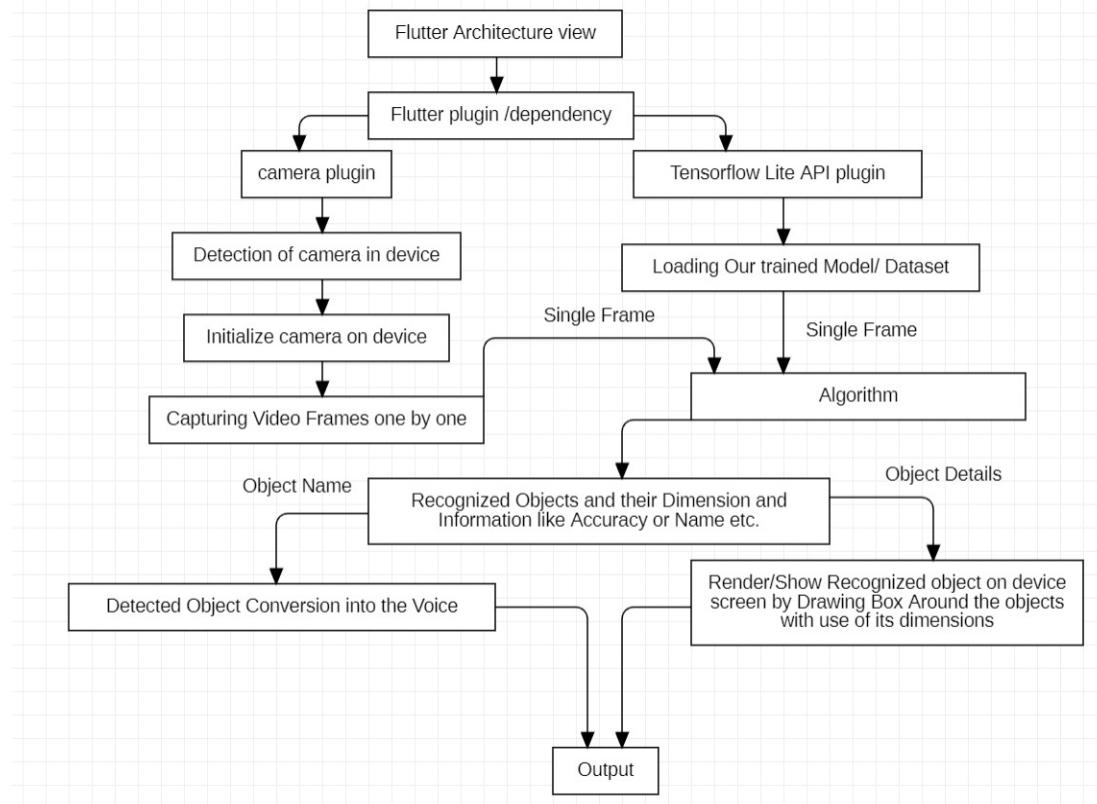
For handling layout, the rendering layer offers an abstraction. You can create a tree of renderable items with this layer. These objects can be dynamically changed, and the tree will update its layout to reflect your modifications.

Flutter/Dart Framework

The flexible, layered system known as Flutter. It exists as a collection of separate libraries, each of which is dependent on the base layer. Every component of the framework level is intended to be optional and changeable, and no layer has special access to a layer below it.

Flutter Plugin/Dependency

One of the fundamental ideas behind the pub package manager is dependencies. Another package that your package depends on in order to function is known as a dependency. The pubspec you created specifies dependencies. You only list the applications that your package directly depends on. Transitive dependencies are taken care of by Pub. You indicate the name of the package you depend on and the range of its versions that you accept for each dependence. Also, you can indicate the source, which instructs Pub where to look for the package, as well as any other information the source requires to locate the item.

**Figure 1:** Architecture View

Tensorflow lite Plugin

For accessing the TensorFlow Lite[4] interpreter and carrying out inference, the TensorFlow Lite Flutter plugin offers a flexible and quick solution. The Java and Swift APIs for tflite are comparable to the API. It is effective since it directly attaches to the TF tflite Lite C API (low-latency). In addition to similar functionality to the TensorFlow Lite Android Support Library, the TfLite Flutter Helper library intends to provide an interface for using high-level objects involved in Picture, Text, and Audio processing with TfLite Flutter plugin and related utility functions.

Camera Plugin

A Flutter Camera plugin for getting Access to camera and controlling the camera on Android and iOS, Plugin provided by official flutter authors.

Features:

- 1.Supports previewing the camera feed
- 2.capturing images
- 3.capturing video
- 4.and streaming image buffers/frames

Google ML Kit

As a robust and user-friendly package, ML Kit[5] makes Google's machine learning capabilities available to mobile developers. With device-optimized solutions, you can turn your iOS & Android applications more engaging, personalised, and useful.

Algorithm

Since Convolution Neural Network (CNN) with a fully connected layer is not able to deal with the frequency of occurrence and multi objects. While considering these factors we have a lot of region proposals and if we apply deep learning (CNN) on all those regions that would computationally very expensive.

Ross Girshick et al.in 2013 proposed an architecture called R-CNN (Region-based CNN)[10] to deal with this challenge of object detection. This R-CNN architecture uses the selective search algorithm that generates approximately 2000 region proposals. These 2000 region proposals are then provided to CNN architecture that computes CNN feature

IV. MODULES USED

Object Detection

The object detection and tracking model is optimized for mobile devices and intended for use in real-time applications, even on lower-end devices.

Barcode Detection

Barcodes make it simple to transfer data from the outside world to your app. You can encode structured data, such as contact information or WiFi network credentials, especially when using 2D formats like QR codes. Your app can react intelligently when a user scans a barcode since ML Kit can automatically identify and analyse this data

Text Recognition

The text recognition module can recognize text in any Latin-based character set. It can also be used to automate data-entry tasks such as processing credit cards, receipts, and business cards.

V. RESULTS AND DISCUSSION



VI. CONCLUSION

The main goal of the project is to create a Flutter-based mobile application with object detection features. In our app, we intent to identify object through the camera as well as importing images from the gallery. The Flutter UI provided an optimal environment for computer vision features in the developed mobile application. The Flutter architecture presented also a stable near maximum frame rate for both a Tiny-Yolo-based and SSD Mobilenet-based object detection. Furthermore, Flutter also triumphed in frame rate over its most significant competitors with a twofold frame rate.

VII. FUTURE ENHANCEMENT

Here are some possible future enhancements that we can consider for our project on object detection using Flutter technology: Instead of just detecting objects, you could enhance the app to recognize specific objects and classify them based on their attributes. You could allow users to train the app to detect custom objects and create their own object detection models. You could enhance the

app to track objects as they move in real-time, which could be useful in surveillance systems or for monitoring the movement of people or vehicles. You could integrate your app with other technologies, such as augmented reality or virtual reality, to enhance the user experience. Instead of performing object detection on the device, you could use cloud-based object detection, which could reduce the processing load on the device and improve the app's performance. You could integrate the app with social media platforms, such as Instagram or Snapchat, to allow users to share their object detection results with their friends.

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