IMAGE PROCESSING BASED BILLING STRUCTURE USING EDGE COMPUTING AND REACTJS

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Abstract - *The idea of this project is to promote image processing-based billing structure that leverages edge computing. Basically, in many remote places, in the shops, the billing is done manually, since all the shops are not technologically forward to use devices like OCR's. Also, the mix-up of prices of different products also remains a problem in manual billing. To counter such issues the authors, propose the idea of an image-based billing system, which produces fast and accurate results and works with simple camera devices like a mobile phone which uses IBM cloud's service called visual recognition tool. The specialty of this model is that it will differentiate the objects accurately but based on its size meaning that if there are ten versions of the same products, one of the sizes (of price x) and the other of larger size (of price 2x) then it will successfully recognize them and add the price to the billing system accordingly. The precision of the model for the object detection is 90%. It has been developed in the form of a web application. Thus, this paper proper a fully developed software for billing in the local C-Shops*

Keywords--Edge Computing, IBM Cloud, Image detection, billing system

1. INTRODUCTION

The idea of this paper is to propose an Object/Image Detection based billing structure which employs edge computing. The idea for the study of this product comes taking note of the C- shops, where billing of grocery products and others is generally done manually. All the retailers aren't technologically advanced or financially well to do, to use devices like OCR. The confusion of cost of different products. remains a road block in manual billing. To tackle such issue, we present the idea of image-based billing structure which produces quick and fault- less results and works with simple devices like a front camera of laptop or a mobile phone. The feature of this model is that it will differentiate the objects accurately but based on its size i.e., that if there are two versions of the same product, one of small size (of price a) and the other of larger size (of price 2a) then it will successfully recognize them and add the price to the billing system accordingly. The precision of the model for object detection is90%. It has been developed and implemented in the form of a responsive ReactJs web application. Thus, this paper proposes a completely developed.

2. OBJECTIVE

The project deals with the billing of different products in a C-Shop. We need to develop solution using an ML model that could easily detect different products of a C-shop and could add the products into a bill with other proper details. Unlike older method of billing products in a C-shop or any shopping mart which uses a bar code scanner or traditional manual method for each and every product to get billed, this is a ML based solution which provides better billing system by identifying the products by its image. The solution has to be robust enough to identify the products of the same brands but of different sizes as different products. For example, the same brand, same color, and similar toothpaste of different sizes should be identified differently as the small, medium, or large sizes, and accordingly, these sizes will be listed the bill separately. At the same time, the solution has to be developed, keeping in mind that the edge computer is not compute-intensive. Keeping the problem statement in mind, we have to develop a web application that does the job.

3. LITERATURE SURVEY

Camille Ballas [1] proposed "Performance of video processing at the edge for crowd monitoring applications" in 2019.In this paper, they mentioned, Smart city applications covering a wide area such as traffic monitoring and pothole detection are gradually adopting more image machine learning algorithms

utilizing ubiquitous camera sensors. To support such applications, an edge computing paradigm focuses on processing large amount of multimedia data at the edge to offload processing cost and reduce long-distance traffic and latency. However, existing edge computing approaches rely on pre-trained static models and are limited in supporting diverse classes of edge devices as well as learning models to support them. This research proposes a novel crowd-based learning framework which allows edge devices with diverse resource capabilities to perform machine learning towards the realization of image-based smart city applications. The intelligent retraining algorithm allows sharing key visual features to achieve a higher accuracy based on the temporal and geospatial uniqueness. Our evaluation shows the trade-off between accuracy and the resource constraints of the edge devices, while the model re-sizing option enables.

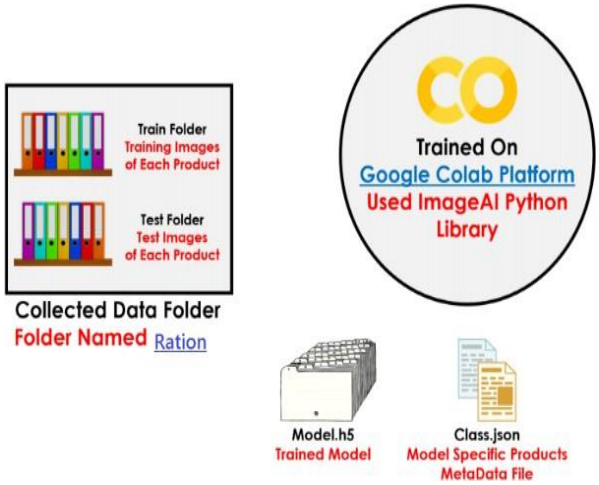
Shravan G V [2] proposed "Comprehensive Analysis of React-Redux Development Framework" in 2018. In this paper, they mentioned, as developers while creating apps compatible on cross platforms is a tedious task and poses huge challenges before the developers, to be acquainted with cognizance specific to two or more native platforms. Besides, certain hybrid application frameworks existing in market were not able to cater similar experience to same user on all native platforms. Comprehending a solution to the underlying problem, the research work presented in this paper utilizes the advantages of React-Redux framework to create a hybrid application capable of provisioning solutions. The generated framework can be used for windows and iOS machines and the produced results are satisfactory for the users in both the platforms. The proposed methodology has been implemented using JavaScript ES6.

Creating web application often tends to be a difficult job for a developer as the developer has to make one application for Android platform and one for iOS platform which requires knowledge of two different domains i.e. for Android application, the knowledge of different browser interpret react and its libraries (programming language: Kotlin or JavaScript) and for iOS mobile application (programming language: swift or JavaScript and IDE: XCode) is required. Besides, some popular hybrid web application framework made by developers were not much successful for creating the exact same experience on multiple native platforms. Comprehending a solution to the problem, this paper utilizes the advantages of React-Redux which is a framework capable of generating hybrid web applications for cross platforms with high data fetching without caching. React developed by Facebook developers in 2015, tends to have a single place to write code in JavaScript ES6 as the programming language and build mobile application for both iOS and Android at the same time with single code written for both the native platforms. To implement complex applications, it uses another dependency with name Redux capable of managing the state in react native. Moreover, this Research paper describes the dependencies developed by other react native developers that has been utilized.

Tomas Eglinskas [3] proposed "The most important lessons I've learned after a year of working with React" in the year 2017 in which he said Starting out with a new technology can be quite troublesome. You usually find yourself in a sea of tutorials and articles, followed by millions of personal opinions. And every single one states that they found the "right and perfect way." This leaves us debating whether our chosen tutorial will be a waste of time or not. Before diving into the ocean, we must understand the underlying concepts of a technology. Then we need to develop a technology-based mindset. If we are starting to learn React, we first have to think in React. Only later on we can start mixing various mindsets into one. Don't stick to the basics — become advanced. You might think sometimes that you don't understand something enough to move on to the advanced stuff. But often times you shouldn't worry about it too much — take up the challenge and prove yourself wrong. By taking up the advanced topics and pushing yourself, you can understand more of the basics and how they are used for bigger things.

4. PROPOSED METHODOLOGY

We propose "**Image Processing Based Billing Structure with Edge Computing**", in which we have developed a responsive web application that continuously captures live video stream sent by a camera of smartphone connected to the edge computer (Laptop in this case) via IP-webcam mobile application. Whenever a product is placed in front of the camera, the web application can be used to capture the image and then it immediately processes the image through the Machine Learning model and accordingly add the identified product to the bill. The basic setup is illustrated in the following diagram.



We have first captured around 16 to 40 images of each product from different angles in a folder, one folder for each product and all those folders have been placed in a train folder which is further present in the main folder named 'Ration'. Likewise, we also have a similar test folder, which contains the folders for each product, which further contains other similar images of the products for testing. We have used the Google Collab platform, which is completely free to use, to train our ML Model. We have used a python Library named as ImageAI to train our data. With the benefit of 12 GB of RAM and GPU that we get along with Google Collab, we were able to train our ML model easily for 12 products within 45 minutes. As the Edge computer is not compute intensive, training the data on a cloud platform is a good idea. Once, the product is identified by the camera, it is added to the bill

Advantages of Proposed System:

There's no cost to train the model for the Edge Computer as we are training on the Free Google Collab platform, which is simply fast and free.

And we can turn our existing billing computers to adopt this solution by installing just a few software. Therefore, the transition cost from the traditional C-shop billing structure to this new Machine Learning model-based approach is almost null and therefore we can achieve huge cost savings.

CONCLUSION

After studying the current existing billing systems and developing our own software-based systems image detection it can be concluded that this image based billing model not only detects object with high level of accuracy but can also differentiate based on its size.

FUTURE ENHANCEMENT

Edge computing is still in its infancy and not quite ready for primetime yet. For "the edge" to become as ubiquitous as "the cloud" in the tech industry, a myriad of technical challenges will need to be tackled. These include the development of compact devices with outsized processing power, the creation of software that enables companies to remotely monitor and update a limitless number of edge devices from across the world and new security technology and protocols to keep everything safe. 5G is one of the drivers for edge computing, as it allows for increased numbers of data sources or processing points that can be interconnected, implying an exponential increase in the volume of data to be processed. This can quickly become too much for existing "sites to cloud" connections and requires data processing much closer to the source. 5G also allows for much lower latencies, a key component to some new applications and another factor in making processing power available closer to where it is consumed or generated. The scalable nature of edge computing makes it an ideal solution for C-shops.

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