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AI Driven Billing System

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ABSTRACT:The project AI driven billing system aims to revolutionize the retail industry by using machine learning and computer vision technologies for object detection. Shopping is an essential part of daily life, and retail stores are an important source of goods and services for consumers. Barcode scanning is a commonly used method for product identification and billing in retail stores. However, it can be time-consuming and labour-intensive. The AI driven system offers a contactless and faster shopping experience for customers, minimizing human interaction and reducing wait times. The system incorporates MobileNet TensorFlow, an efficient and lightweight convolutional neural network model, to improve computational efficiency and scalability. The system can accurately detect products and prices, making the billing process faster and more efficient. Overall, the AI billing system offers a new and exciting approach to retail billing, providing a faster and more efficient shopping experience for customers.

KEYWORDS:Neural Network, Object Detection, MobileNet

I. INTRODUCTION

AI-Driven Billing System is an AI-powered autonomous checkout system for retail stores that utilizes computer vision and machine learning to offer a faster and more efficient shopping experience. The system is designed to minimize human interaction in the store to keep shoppers and employees safe during the pandemic. The system works by using computer vision algorithms and machine learning models to visually detect and identify items placed on the counter-top. The system is equipped with cameras that capture high resolution images of the products, and a deep learning model processes these images in real-time to recognize the products accurately. Once the products are recognized, the system automatically adds them to the virtual cart and generates an itemized bill. In addition to visual recognition, AI-Driven Billing System also utilizes a weight sensor to measure the weight of the items placed on the counter-top. The system uses this information to ensure the accuracy of the billing process and prevent any discrepancies. One of the most significant advantages of AI Driven Billing System is its ability to generate an instant bill. AI-Driven Billing System is not only a convenient solution for shoppers but also a cost-effective solution for retailers. The system eliminates counters, reducing labour costs and increasing operational efficiency. AI-Driven Billing System is a game-changing technology that has the potential to revolutionize the retail industry. The system's advanced computer vision and machine learning capabilities provide a fast, efficient, and safe checkout experience for shoppers, while also offering retailers a cost-effective and data-driven solution to manage their inventory and operations. es the need for cashiers and checkout.

II. RELATED WORK

Several papers have explored the use of deep learning and computer vision techniques for automated billing and checkout processes in supermarkets. "Object Detection with Deep Learning: A Review" [1] discusses various deep learning architectures for object detection, including Faster R-CNN, YOLO, and SSD, and their advantages and disadvantages. "Automated billing in a supermarket using Hybrid PCA-SIFT FREAK Algorithm" [2] proposes an algorithm that combines PCA, SIFT, and FREAK for automated billing in supermarkets. "MobileNets: Efficient convolutional neural networks for mobile vision applications" [5] presents an efficient deep neural network architecture specifically designed for mobile and embedded vision applications. "Machine learning: trends, perspective, prospects" [3] provides an overview of current and future trends in machine learning (ML) and its potential applications in various fields, including healthcare, finance, and education. This paper can be useful for identifying potential areas



of improvement and new applications of ML in the context of an AI-driven billing system. "A Region-Based Deep Learning Approach to Automated Retail Checkout" [6] proposes a novel, region-based deep learning approach to automate product counting using a customized YOLOv5 object detection pipeline and the Deep SORT algorithm. This approach can be useful for automating the product checkout process at conventional retail stores. "Automated super shop using image processing" [4] proposes a system that uses image processing techniques to automate various tasks in a supermarket, such as product identification, inventory management, and customer tracking. However, the system does not employ a mechanism to weigh the products. These papers provide valuable insights into the use of deep learning, computer vision, and machine learning techniques for automating the billing and checkout process in supermarkets. By integrating these techniques, an AI-driven billing system can significantly speed up the billing process, reduce errors, and enhance the overall user experience.

III. PROPOSED WORK

The system we propose uses computer vision and machine learning to visually detect and instantly identify the items placed on the weight sensor. Weight sensor measure the weights of the things placed on the countertop. Once the items are identified, things are automatically added to the cart and the amount is generated Our approach for object classification involves the use of deep neural networks such as MobileNet. MobileNet is a lightweight convolutional neural network architecture designed to enable efficient computation on mobile and embedded devices with limited computing power and memory. It was introduced in 2017 by Google researchers as a way to enable efficient and accurate deep learning on mobile devices with limited computational resources. MobileNet achieves its efficiency by using a specific type of convolutional layer called depth wise separable convolution. Depth wise separable convolution separates the spatial and channel wise convolutions in a traditional convolutional layer in two separate operations, reducing the number of computations required. This architecture is trained on a large dataset of images and consists of multiple layers of convolutional neural networks that learn to extract features from the input image. To classify an object, the input image is pre-processed and passed through the network. The network performs a series of mathematical operations such as convolution, pooling, and activation to extract relevant features from the image. Finally, the network produces a probability distribution over the different classes of objects that it has been trained to recognize, and assigns the predicted label for the input image based on the class with the highest probability. Overall, this approach allows for accurate object classification by leveraging deep neural networks and efficient mathematical operations. In addition to the computer vision and machine learning aspects of our proposed system, we have also created a user-friendly interface using Qt Designer. The interface displays the contents of the cart in real-time and constantly interacts with the back-end to update any changes in the cart. This allows users to easily keep track of the items they have added to the cart and ensures that the system accurately reflects the current contents of the cart. Moreover, our system is designed to be modular and scalable, allowing for the addition of new features and modules in the future.

IV. METHODOLOGY

The AI Driven Billing System project aimed to automate the billing process in supermarkets using artificial intelligence. To achieve this, we utilized a Raspberry Pi 4 and the latest version of the Raspberry Pi OS. The setup process involved installing Python, TensorFlow, and other necessary dependencies for the project. Additionally, we connected a weight sensor to the Raspberry Pi and configured it to communicate with the back-end code. We utilized TensorFlow and MobileNet for object classification, and to configure TensorFlow on the Raspberry Pi, we first installed Python and pip, and used pip to install TensorFlow and any necessary dependencies. We tested the installation by running a script that loaded a pre-trained MobileNet model to classify an image. We connected a load cell to the Raspberry Pi's GPIO pins using a HX711 module and wrote a Python script to read data from the load cell. The user interface for the auto billing system was designed using Qt Designer and integrated into our Python code using the PyQt5 library. The implementation of the system involved integrating various hardware and software components. The system's ability to accurately detect and classify objects using machine learning techniques could significantly speed up the billing process, enhancing user experience and increasing efficiency in supermarkets.

Given is an illustration of logical flow of AI-Driven Billing System. The Raspberry Pi serves as the central processing unit and oversees all the major functions. Its high processing power and advanced algorithms make it the ideal device for this application. Along with the Raspberry Pi, the system also includes several modules such as the load cell and

camera. The load cell plays a crucial role in measuring the weight of the items placed on the counter-top, while the camera captures images of the products. The system uses computer vision and machine learning algorithms to identify and classify each item. The front-end of the system is responsible for displaying the user interface and providing the user with real-time updates. The front-end continuously checks for changes happening in the back-end API and displays them to the user in real-time. For example, when an item is added to the API, the front-end updates the cart.

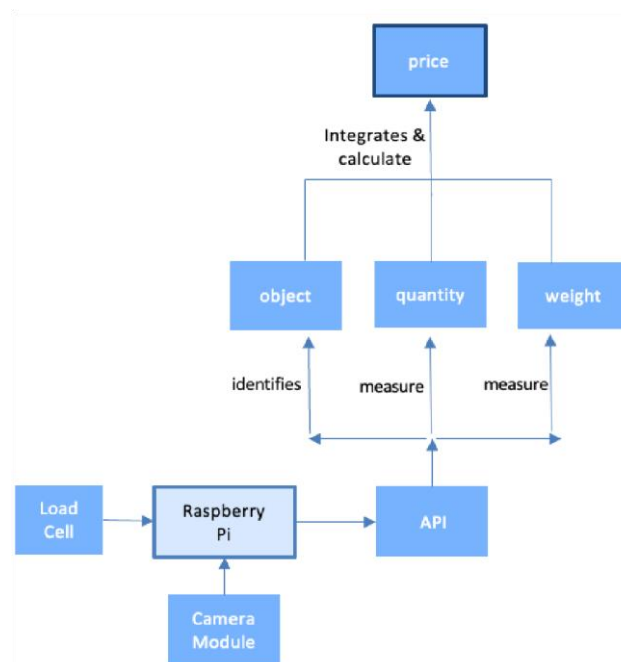


Fig -1: Flow Chart

V. RESULTS

The AI-driven billing system utilizes a weight sensor, and a web camera which is attached to a cabinetry to detect products and generate bills automatically. The system was tested by placing an apple as a subject, and the system was able to accurately detect the product and determine its weight. The weight sensor was attached to the bottom of the cabinetry, and the web camera was affixed on top of the cabinetry to capture the product image.



Fig -2: Apple placed on the counter top

The system was designed to automatically start the video feed upon clicking the "start" button, and the system was able to detect the product. The weight was determined simultaneously and the bill was generated. The system was also able to record the quantity of the product, making it easier for customers to keep track of their purchases.



Fig -3: Billing Interface

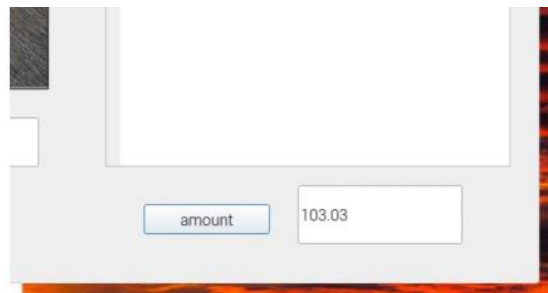


Fig -4: Final Amount Generation

By clicking on the amount button, customers will be able to generate their final bill of purchase. At the end, A QR code will also be generated for payment.

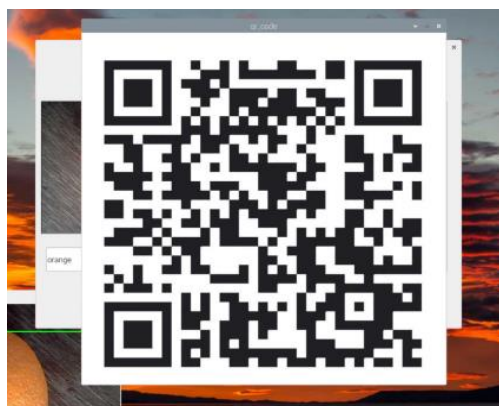


Fig -4: QR Code for Payment

Overall, the results indicate that the AI-driven billing system using a combination of weight sensors, web cameras, and real-time detection algorithms can provide an accurate and efficient billing solution for supermarkets and other retail stores. The system can help reduce waiting times for customers, improve the accuracy of bills, and increase the overall

efficiency of the billing process. Future research can focus on improving the system's ability to detect different types of products and enhancing the user interface to make it more user-friendly.

VI. CONCLUSION

In conclusion, the use of artificial intelligence (AI) and computer vision in the retail industry has the potential to significantly improve the billing process, leading to increased efficiency, accuracy, and customer satisfaction. By leveraging deep learning architectures for object detection and image processing, we can automate the identification of products and generate bills in real-time. Additionally, by using machine learning algorithms, we can optimize pricing strategies, reduce inventory costs, and personalize promotions based on customer behaviour and preferences. Incorporating AI technologies in a billing system requires a thorough understanding of the different types of AI and their respective applications in the retail industry. By using lightweight and efficient models such as MobileNet TensorFlow, we can reduce computational costs and improve the scalability of the system. Overall, AI has the potential to revolutionize the retail industry, and it is important to continue exploring new approaches and techniques to fully leverage the benefits of these technologies. There are several areas for potential future development, such as improving the interface for adding items to the cart and streamlining the billing process, existing system can be integrated with a payment gateway and amount can be paid through QR code, SMS functionality can be implemented where registered users can get bills through SMS and billing system could be integrated with other retail systems, such as inventory management, customer relationship management (CRM), and point of sale (POS) systems. This could provide more comprehensive data and improve the accuracy of the billing process.

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