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Original Research Paper

Point of Sale System Using Convolutional Neural Network for Image Recognition in Grocery Store

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Abstract: The history of point of sale already has been told from a long time ago. The business nowadays is opting for the point-of-sale transactions because it was easy to sell the item to people face to face. This will build some trust between the cashier and the customer. The popular store that always customer need was the grocery store. However, the grocery store nowadays still not has a good feature for the point-of-sale system. The cashier still needs to scan the item through barcode scanner. This idea was led to make the point-of-sale transactions easier in the grocery store by applying the machine learning to the system. The problem for this research is the customer wait for a long time for their point-of-sale transactions to finish when bought the grocery items. The aim of this research is to detect the grocery items with convolutional neural network model for image recognition through camera within the main user interface. The Agile Development Life Cycle (ADLC) method is used in the development of Point-of-Sale System using Machine Learning for Image Recognition in Grocery Store. Moreover, this research is to evaluate the usability of the system using Post-Study System Usability Questionnaire (PSSUQ) approach. The PSSUQ evaluation is evaluated by the users of the system. The results of PSSUQ stated that the users satisfied with the system. The future research for this research is to make the point-of-sale system with a better model in the future. In conclusion, the system is works well and machine learning image recognition model also can detect the grocery item clearly.

Keywords: Convolutional Neural Network, Image Recognition, Machine Learning.

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1. Introduction

Era of technology, the grocery store also provides a future technology which is no queue and just using machine learning to recognize the item and charged directly to users account such as Amazon Go [1] [2] [3]. By using Artificial Intelligence, Machine Learning and Image Recognition, the system can recognize the item easily and this technology is same kinds as technologies that are been used in self-driving car: deep learning algorithm (DLA), computer vision (CV) [4]. The fact that deep learning methods are gaining more attention, automatic recognition become the new attractive topic in computer vision and machine learning. It can be used in many industries but in the grocery, industries are the way automatic recognition can be more useful than any industries, it is because of the accuracy when recognize certain items or products [5]. To improve the accuracy of the image recognition the feature extraction and selection the one that can be implement in the system [6]. This system can be implemented into our country Malaysia because the system that use image recognition for point-of-sale transactions is rare but also it is very convenient for customer in Malaysia. The techniques in image recognition also can be apply to the system which is YOLO it stands as You Look for Once, R-CNN and SSD it stands as Single Shot Detector. These techniques are crucial for system to works and make the system function working well to recognize the item for point-of-sale transaction. Machine Learning also play the big role in the system to make sure the system knows about the item, and it can recognize the item correctly because the ability of machine learning is so powerful, and it refers to the potential of computers to imitate intelligent human behaviors, with a focus on "cognitive" functions such as problem solving and learning that we identify with the human mind [7] [8]. Thus, the system can recognize the item and it can complete the point-of-sale transactions between customer and cashier. The aim for this research is to detect the grocery items with machine learning model image recognition through camera within the main user interface. The development of the system will help the customer with their point-of-sale transactions.

Machine learning is extremely useful for people. It detects the grocery items by training the grocery item dataset. This feature can be applied in the point-of-sale system. The point-of-sale system that developed based on machine learning can reduce the queuing time for the customer at the cashier checkout. The customer does not need to waste their time to queue just to buy one items in grocery store. In Malaysia, which is all 80% of the grocery store still using the bar code the scan the info about the item and total the items into the system. This is very inconvenience to the customer because they need to queue so long just to buy items in grocery store. Moreover, customer that buy many grocery items need to queue longer than it expected because of the bar code scanning system that been implied many in the grocery store. By using the machine learning and image recognition we can improvised the system and make the customer and employee a pleasant experience and do not queue for a long time.

The system that using technology image recognition can solve this problem which is the time queue when buying many grocery items become shorter and easier for customer and employee to buy their groceries [9]. The initiative for this Artificial Intelligence (AI) system needs to be taken because deep learning is constantly gaining more attention. Many industries and academic groups already work for this technology [10]. The live camera that has image recognition is the way to detect grocery item and it will calculate the accuracy respectively [11]. Therefore, the problem for this research was the customer took a long time to wait for their point-of-sale transactions to finish when bought the grocery items. In conclusion, the research was needed to build with a good efficiency, so that the problem can be solve for this research.

2. Literature Review

This chapter will tell you about domain and techniques that need to be use in the final year research. This chapter will elaborate more about domain which is economy for this research also there are many techniques that can be used for this research. For example, the techniques for image recognition are object detection, face detection, object tracking and finally is optical character recognition. All these techniques will be elaborate more in this chapter. Moreover, this chapter will talk about application that already exist which is have the same concept for this research. It will compare the application that already exist with this research and compare the techniques that need to be use for this research. After that, this chapter will justify what is the techniques and domain that will be suitable for this research. Figure 1. shows the conceptual map for the research.

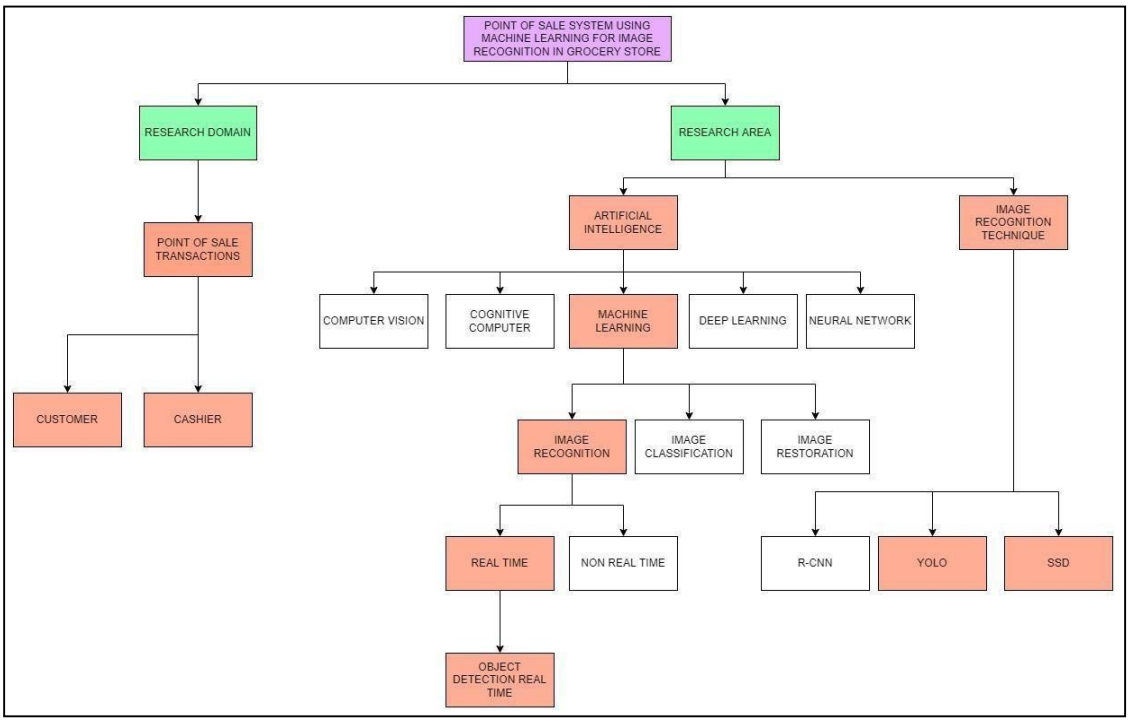

Figure 1. Conceptual Map for Point-of-Sale System Using Machine Learning for Image Recognition in Grocery Store

2.1. Overview of Point-of-Sale Transactions

Firstly, we need to focus more on point-of-sale system and knew more details about point of sales system and how it works for every grocery store in the world. Point of Sales that been referred to the Cambridge Dictionary is a place that sold something to the public and someone pay for it. At this point we knew seller will put the barcode on the item that will be sale to the customer also calculate the amount of money that customer gives to the seller. All the action that has been explain, we knew that is a cashier that play a big part in how point of sale works. The cashier offers the payment option to the customer and accept the payment from the customer directly. Lastly, the invoice or receipt will be given to the customer that state that they already own the item and all the transactions that works between cashier and customer. The receipt function is benefit for both which is cashier and customer to record the transactions clearly. Before we go to the point-of-sale system we also need to know about point-of-sale data. Point of sale data is that the data about how much product that customer bought from grocery store or from local dealers [12] [13]. The data is important to record, and it has many benefits for the grocery store itself. The grocery store will know what their customer wants when point of sale data has been research thoroughly. The point of sales data will be collected from the point-of-sale system which is in this research we need to improve this system to another level and help both customers and grocery store or cashier itself.

2.2. Overview of Image Recognition and Machine Learning

There is also general image recognition stage sequence. In the stages of pre-processing and segmentation, the groupings of methods of sample comparison and statistical methods use classical algorithms. Such an approach is not really the best way to solve a problem. Artificial intelligence methods produce a better result due to their learning ability, but the lack of image pre- processing and the inefficiency of segmentation algorithms do not always deliver satisfactory results, even though the neural network is well trained. As a result, effective pre-processing and segmentation algorithms should be invented for each new image recognition task [14].

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2.3. Image Recognition Techniques

2.3.1. You Only Look Once

The YOLO that known familiarly as 'You Only Look Once'. It is an algorithm that detects the object recognize it in an image which is real-time. Object detection that has been done in YOLO as a regression problem and it provides many probabilities of the detected images. CNN which is known as convolutional neural networks has been employs in the YOLO algorithm [15]. Moreover, the YOLO is algorithm that need a single forward propagation which is it need a neural network to detect the objects. It means that all image recognition is done by single algorithm and CNN has been used to predict many probabilities that lies in the image and bounding boxes simultaneously. The most common ones that YOLO algorithm known is tiny YOLO and YOLOv3. There are reasons for this study we consider the YOLO technique to be use because the YOLO algorithm has a speed of the object detection. It means that YOLO algorithm can detect object very fast and it in a real-time. Secondly, the YOLO got a high accuracy predictive technique which is it will provide an accurate result with such a minimal backgrounds error. For this algorithm, learning capabilities also need to be consider because YOLO algorithm got the excellent learning capabilities. It enables to learn the object, and this will apply in the object detection.

We go to the YOLO model which is YOLO V3. YOLO V3 will predict boxes with different scales using the concept of FPN. It utilizes a certain number of convolutional layers and residual layer to complete the detection process (Chen et al., 2019). The feature that been used in the YOLO V3 is that the entire image will be predict for each bounding box and it predicts all the classes in the bounding boxes at the same time. The detection model based on YOLO V3 is that network structure is important to be optimize, and the state has accurately been recognized. Each grid will be divided and predict s bounding boxes with categories probability. Next, the network structure of the YOLO V3 which is the main structure is Darknet-53 structure. The structure is the combination of YOLO V2, Darknet-19, and lastly is ResNet. There are seven parts about how the detection steps are working in the YOLO V3 which is consist of bounding boxes and many predictions of grid cells or layers. Network training of YOLO V3 is also divide into three steps which is the original image will be adjusted to speed up the training process (Chen et al., 2019). The second step is exterior frame of insulators or shockproof hammers present in each image is marked using the VOC2007 dataset format. The last step is the YOLO V3 is initialize the network parameters, and then train the model to acquire a training parameter for detection. The training parameter is affected by three main things which is batch size, weight decay and the size of IOU.

2.3.2. R-CNN

There is also a technique that suitable for this research which is R-CNN. R-CNN already was described in 2014. R-CNN may have been the large and good application of convolutional neural networks for the research of object detection [16]. They are purposed for R-CNN and it comprised to the three modules which is region proposal, feature extractor and lastly is classifier. An overview about this module for region proposal is to produce category and independent region proposal such as candidate bounding boxes and then extract them. Next module is featuring extractor that works to extract the feature from candidate region by using deep convolutional neural network. Lastly is module classifier which is worked to classify features to known class such as linear SVM classifier model. The more explanation about feature extractor has been used by the model that name AlexNet deep CNN which is already won image classification competition. Feature extractor that used CNN which CNN generated a 4,096-element vector that characterizes the image's contents and is input into a linear SVM for classification, with one SVM trained for each known class. It is such simple and straightforward application of the CNN that solve the problem of object localization and recognition. The disadvantage of this application is that used this technique is slow. The application needs CNN-based feature extraction to develop each of the candidate region.

It because of this disadvantage of R-CNN that the Fast R-CNN is been developed because the speed issues of R-CNN that inconvenient when work to recognize the image. Fast R-CNN has been describing that improve limitation of the R-CNN which three main things. Firstly, it is training the application using this technique is a multi-stage pipeline. To training the data it needs to involve with three different separate models and operation. Secondly, the training that used this technique is so expensive in space and time. What it means by that is training a deep CNN on every image is so slow which time is important and expensive, we cannot reverse time and training space is too limited.

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Lastly, the object detection about R-CNN is too slow. The prediction that has been made using deep CNN on many region proposals is very slow. This Fast R-CNN was proposed just to improve the R-CNN that has been many disadvantages and as a single model instead of a pipeline for training and directly generating regions and classifications the architecture has been change that takes the photograph as a set of region proposals and it will be passed to the deep convolutional neural networks. There is a pre-trained such as a VGG-16 that used as feature extraction. By the end of the custom layer of CNN we called it a Region of Interest Pooling Layer, Rol Pooling. It will extract the features specific that has been given their input candidate region. By using the Fast-RCNN the output of the CNN is fully connected to the layer and the model can generate two output which is one for the class predictions through soft max layer and another on is a linear output for bounding box. The technique will be done for each region of interest in each image many times.

For object detection, the entire system is a single, unified network. The RPN module directs the Fast R-CNN module where to look, using the lately trendy language of neural networks with 'attention' processes. For region proposal, we introduce the network's designs and properties. We create algorithms to train both modules with shared features (Ren et al.,2017). We go deeper about how region proposal networks work which is takes an image that has any size as input and the output will be set as rectangular of the object proposal. This technique will process will fully convolution neural network and the most important goal for this is to share computation with Fast R- CNN object detection. We slide a little network over the convolutional feature map output by the last shared convolutional layer to generate region proposals. (Ren et al., 2017) The small network will take input from convolutional feature map.

2.3.3. Single Shot Detector

Single shot detector (SSD)has two main components which is a backbone model and SSD head. This backbone model is a model that usually train early with image and produce pretrained image classification network as a feature extractor [17]. This is typically the same network just like ResNet that has been trained in ImageNet. Next, the SSD head is just one or more convolutional layers that has been added to the backbone. The output that has been produced will be interpret as the bounding boxes of the object's classes in the spatial location. The spatial location is located at final layers activations. We can see below the figure that is shown the first few layers which is white boxes known as backbone while the last few layers which is blue boxes represent the SSD head.

The SSD architecture's basic concept is receptive field, which allows us to identify objects at different scales and output a narrower bounding box. This strategy can work to some extent, and it is exactly same as YOLO stands for (You Only Look Once). SSD goes one step further by applying more convolutional layers to the backbone feature map and having each of these convolution layers produce object detection results. Predictions from previous layers can help in dealing with smaller sized items because earlier layers with smaller receptive fields can represent smaller sized objects. As a result, SSD enables us to create a hierarchy of grid cells at various layers. A 4x4 grid, for example, might be used to detect tiny things, a 2x2 grid for medium-sized objects, and a 1x1 grid for objects that cover the entire image. There is also a multi-scale feature map for detection in the SSD. Convolutional feature layers that have been added to the end of the base network. These layers gradually shrink in size, allowing detections to be predicted at numerous sizes. Each feature layer has a different convolutional model for predicting detections. We go for convolutional predictors for detection [18]. Each layer can generate a consistent set of detection prediction using convolutional filters. The output values of the bounding box offset are measured in relation to a default box at each of the m n sites where the kernel is applied. position in relation to the location of each thing on the map [19]. Aspect ratios and default boxes for numerous feature maps at the top of the network, we associate a set of default bounding boxes with each feature map cell. The default boxes tile the feature map in a convolutional pattern, with each box fixed in relation to its corresponding cell.

2.3.4. Comparison of Technique

From the explanation above, there are three technique which is YOLO (You Only Look Once), R-CNN and SSD (Single Shot Detector). This section will briefly help to find the best technique that could be applied in the research and help to compare the technique.

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Table 1. Techniques Comparison

Techniques	You Only Look Once (YOLO)	R-CNN	Single Shot Detector (SSD)
Description	Technique that recognizes the imageand videos instantly	The technique that using Inception ResNet which run at1 second per image.	The method that runsa convolutional network on input image only one time and computes a feature map
Support Real-Time	Yes	Yes	Yes
Type of Data	Image	Image	Image
Application	Autonomous Driving	Security System	Google Maps
Advantage	It can detect the object in real-time with better accuracy.	It can detect the object in real-time with high-speed time.	It performs with higher accuracy whennumber of bounding boxes increase.
Disadvantage	It has a drawback thatcannot detect the small object very clearly.	Test time to detect the object is so slow.	It has shallow layers in neural network thatmay not generate enough features to predict the smallobjects.

2.4. Common Application Related to Image Recognition

2.4.1. MOLO 17

There are mobile apps that using point of sale system and integrated with image recognition. This mobile apps are to recognize the items when customer add their item that they want to buy to the personal customer's shopping cart. The customer's desire to be able to identify products using a mobile application quickly and easily that is integrated with an image recognition technology. The system would then have to present the user with alternatives and securely exchange the information with the point-of-sale checkouts. The apps that have been given name as MOLO17 which is known as Mobile App for Zebra TC8300. For the proprietary LINUX-based cash system, there are handheld devices and an integration layer. The devices frame and picture articles, allowing the image recognition system to identify and locate the article in question, as well as provide alternative articles for readers to choose from. This information is then sent straight to the till from the mobile workstation, allowing for faster processing of data while reducing errors and saving time.

2.4.2. Amazon Go

"Just Walk Out Technology" is what Amazon Go is known for. This technology oversees keeping track of things stolen from the store's shelves and, in some situations, restore to them. It also keeps track of the virtual shopping cart of everyone [20]. This technology has been improving from used technology that is like the self-driving cars technology. Sensor fusion, computer vision, and deep learning techniques are all used prominently in the system. We can go for more details about how the shopping process will work in the Amazon Go apps. So, to shopping in the Amazon Go store the customer need to have their amazon go app downloaded so that amazon go store can keep the track of the customer that want to buy the item in the store. When a customer enters a retail store, they scan their Amazon Go app on their smartphone and they can just take any item in the store and go out store without having to queue or need to wait at the checkout. Amazon Go relies significantly on technical innovation to achieve these gains in the operational model of retail buying. Amazon Go's technology detects when an item is picked up and placed back on the shelf, as well as who performed the activity [21] [22].

2.4.3. Comparison of the similar applications about Image Recognition

From the application that has been elaborate above, this is the comparison between apps about what advantage that the apps have and the drawbacks about the apps. The details that need to be compare from these applications will be compare in the Table 2.

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Table 2. Comparison between Common Application

Application	MOLO 17	Amazon GO
In-App Purchase	Yes	Yes
Platform	Android / System Application	Android / System Application
Features	- Scan the item direct fromthe phone - Purchasing item withpoint-of-sale.	- Money will be deduced directly from the back thatlink with the apps - Do not have checkout, thatcustomer can just take item from the shelf and go. - The item will be recognizedby system when item has been taken from shelves using image recognition
Another Payment Method	Physical QR Code	Pay directly at the shop
Shopping time	Fast which the item can justbe buy using phone apps.	Fast which is the amazon gothat did not have checkout isconvenient for customer thatno need to queue to buy an item.
The technology	Computer vision, mobileapplication	Sensor fusion, computer vision, mobile application, and deep learning algorithm

3. Methodology

The framework that this research work on will be based on the agile method and all the steps in agile method will be important to follow. For this research Agile Method will be used because this research is a system that can recognize the object and total the price for the object. All the phase in the agile will be explained. The system architecture for this research will show how the system works and how the system will affect the people involved. Lastly, the hardware and software requirement for this research will be state to make sure that this system will run smoothly without having any casualty. To fulfill the objective one, which is to study the current performance of grocery store, the requirement phase is the phase that need to do when fulfill the objective one. In the requirement phase, the data will be collected to study about how the current performance for grocery store point of sale system nowadays. The questionnaire will be use as a method to study the current performance of grocery store point of sale system.

This study will use research method which questionnaire approaches to solve the research problem which is to compare current performance grocery store point of sale system. To conduct a survey for this question development, review and validation is a few steps to build a good questionnaire. Creating questionnaire to users to ask about how the users feel when they are using the current grocery store point of sale system. This is to ensure that the questionnaire will get a good result and this research know what to improve to the point-of-sale system and improvise from the previous one. There are three parts in questionnaire which is part A, Part B and Part C has included in Appendix A. The first part will ask the users about what their background for example what is their job, gender, and age. From this questionnaire, information that this research get will be tremendous because many users with different perspective about grocery point of sale system. Part B is the real questionnaire which is to ask about what the respondent is thinking about grocery point of sale system and the performance of the system. What is the best to improve the system from the users' point of view. Part C was about the knowledge of machine learning among the users.

The development of the system will be explained more in details in these two phases which is design phase and development phase. In the design phase, the system was designed to make sure that system design was meet the requirement of the objective. The use case diagram, system architecture, will be done in this phase. For the development, the system will be focused more on how to develop the system. The back-end coding and front-end coding will be used during this phase to develop the point-of-sale system. The back-end coding will be more focused on how the to make system works while the frond-end coding was the design of the point-of-sale system. The machine learning also

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need to train and evaluating the model to make sure that the model can detect the grocery items. After that, it can be deployed into the point-of-sale system.

Research methodology is important for the research because a well-defined set of logically related techniques and processes that will establish how to best plan and deliver research from start to finish. Research methodology will allow us to control the entire management process, and this will make the decision making for the research and problem solving become more effective while ensure the success for specific processes, techniques, and methods. For this study, it will use Agile Method. Agile is initiation, analysis, design, implementation, and maintenance through disposal, the total process of designing, implementing, and retiring information systems through a multistep process (Radack, 2002). There are many different agile models and approaches, but they all have a set of processes or phases in common. Information security must be integrated into any Agile model used to ensure that the information delivered, processed, and stored by the system is protected (Radack, 2002). There are six phases that this research needs to follow by using agile method.

3.1. Requirement Phase

The information that been collected will be analyzed to see that how it will improve this research more and what is the best feature for users that can be implement into the research. After collecting the information from users, this research will plan the time that take to develop the system. Object detection that needs to be implement to this system using machine learning is the main feature that will be put in the point-of-sale system. The information that been collect will be the data that can be uses to add additional feature that users recommend.

3.2. Design Phase

This design phase is to decide another feature that can be added and a good flow about how the system works so that the system can works properly without meet any casualty. The outcomes for this design phase will be how the design for the system and how the system works that can be represent with use case and layout interface. Figure 2. shows the use case for this research.

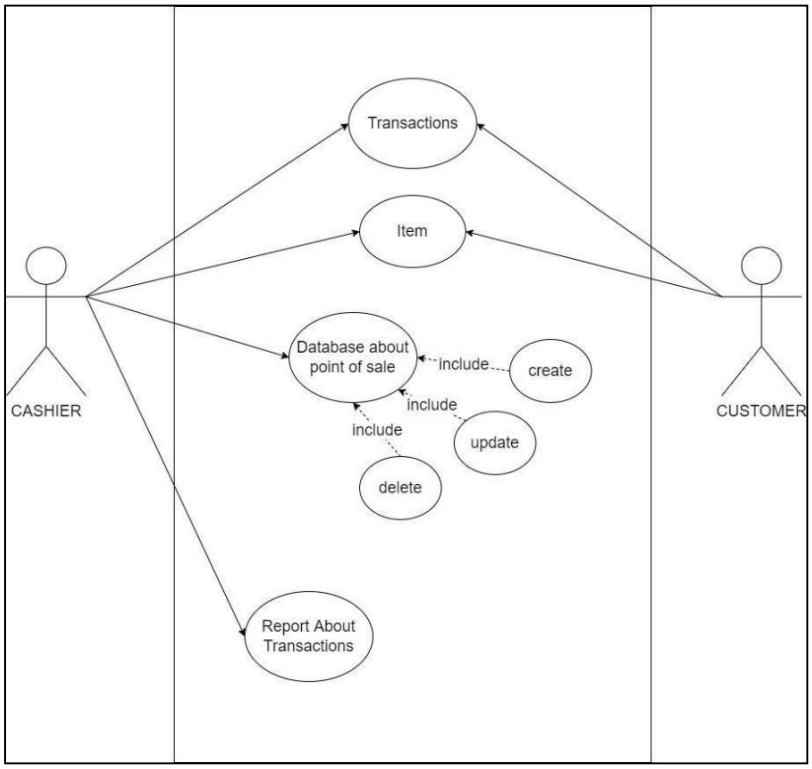

Figure 2. Use Case Diagram About Point-of-Sale System

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System architecture is a conceptual model that shows specific flow or interactions that has been made in the system. Many components in the system will interact with each other to get a result of this research (Gacek et al., 1995). It has also been defined as components, connectors, and combinations, as well as elements, shape, and rationale (Gacek et al., 1995). Figure 3. shows the architecture about the research.

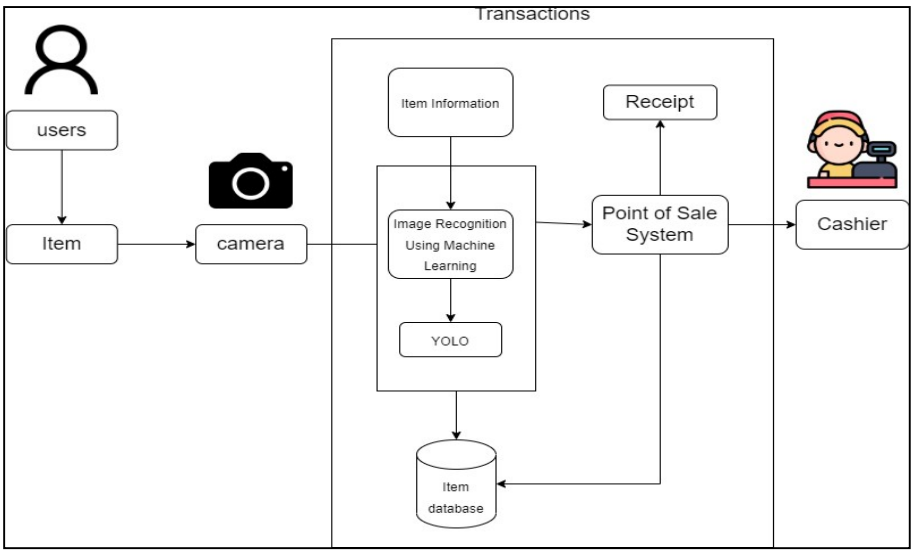

Figure 3. System Architecture

3.3. Evaluation the Usability of the Grocery Store Point of Sale System

This phase included an evaluation of the usability. The evaluation gives feedback from the users about the system. It was to gain a better understand of any drawback of the system. This data used to improve the system's quality and design process. The following section was described the construction of the usability questionnaire based on PSSUQ and the procedure of the PSSUQ.

3.3.1. Post Study System Usability Questionnaire (PSSUQ) Construction

Post-Study System Usability Questionnaire is referred to as PSSUQ. It is used to evaluate how satisfied consumers are with the system. Additionally, it was created to measure user satisfaction with the system's usability. In this study, the PSSUQ was altered to produce a more focused questionnaire catered to a research interest. PSSUQ score ranges from 1 (strongly disagree) to 5 (agree) (strongly agree). The usability improves with a higher score. The four categories of the PSSUQ are as follows:

1. System Usefulness: Question 1 to 4
2. Information Quality: Question 5 to 9
3. Interface Quality: Question 10 to 12
4. Overall Satisfaction: Question 13 to 15

3.3.2. PSSUQ Procedure

The PSSUQ evaluation procedure in this study was conducted online. This research evaluation is to evaluate the system by the users. Next, when the users agree to evaluate the research, the PSSUQ will be given to the users. The users were given explanation about the flow of system. The questionnaire which is PSSUQ that been included in Appendix B. The PSSUQ procedure consists of three steps which introducing the system to the users, evaluation of the system and lastly interview session to get the feedback from the users.

1. Introducing the Grocery Point of Sale System to the users
   The system will be introduced to the users and the details about the system will be given to the users.

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2. Evaluation of the Grocery Point of Sale System
   The evaluation had 2 stages (Jadhav, 2011). The first stage was to train the users to use the point-of-sale system while the second stage was the users will evaluate the system.
3. Interview After Evaluation
   After the evaluation of the system by users, the interview session was carried out to know feedback from the users and their opinion about the grocery point of sale system.

4. Finding and Discussion

In this study, a survey was conducted among the users of point-of-sale system in grocery store. It was to determine whether the performance about grocery store in point-of-sale system is good or there are some unsatisfaction among the users. The survey was conducted and 20 user's respondents. Besides, the survey was constructed using Google Forms to collect users' feedback, in which users may describe the experiences about performance point of sale system in grocery store. This was discussed about the outcomes of the users' feedback. The result was being examined by using the chart that been generated in the Google Forms.

1. The feedback from users about the performance of Grocery Point of Sale System was not good. There were 75 percent that said no which is they unsatisfied with the performance of the system while there were 25 percent that said yes which is they satisfied with the current performance of the point-of-sale system.
2. The capability of the users when using Grocery Point of Sale System was not good. There were 64.3 percent that said they still did not know how to use the Grocery Point of Sale System while there were 35.7 percent were knew how to use the system.
3. The system difficulty for the users is exceedingly high. Most of the users were said Yes were about 55 percent, the users that said no were 5 percent while the option was about 40 percent. It means that the system was difficult to learn for the beginner among the users.

In conclusion, the study was able to identify the problem in the current grocery point of sale system. This study proved that the grocery points of sale system need some new upgrade that can help the user's problem.

4.1. Analysis Requirement of Research Design and Development

During the development of this system, a few types of software and hardware were used. There were few software examples that has been used including Visual Studio Code, Diagram Flow and many more. Thus, this subtopic will explain more about how system been developed, machine learning been trained and software or hardware that been used for the system.

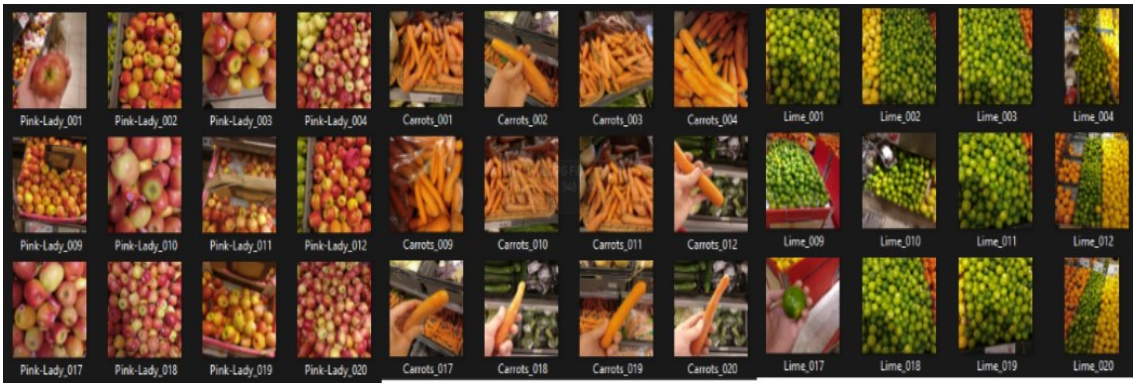

Figure 4. Grocery Item Dataset

The overall finding in the algorithm can be summarized by capturing the grocery item. The camera will capture grocery items and the grocery item details will automatically go into the point-of-sale system. The machine learning model has been trained by a grocery item dataset which can detect the item easily. For example, the item is orange. When the orange was put in front of the camera, the item

will be detected, and the item details automatically go into the point-of-sale system. The grocery item details will be listed on the cashier page which is the main user interface.

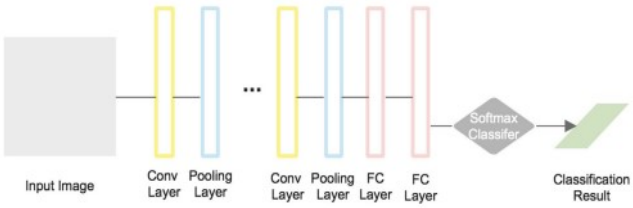

Figure 5. The CNN Model Algorithm

4.2. Evaluating of Machine Learning Model

This research used a machine learning model which is AlexNet. This model is a R-CNN model. The test was being conducted for the model to find out the accuracy for the model. Thus, to make sure the model was working in the system. AlexNet model is the model that detect the object in a real-time. For this research, the AlexNet model was used to detect the grocery item for point-of-sale system in grocery store. To get the best result of the model, the AlexNet model had been trained and tested multiples times.

1. The validation loss decreases from 1.0 to 0.4 when training the model. As epoch number increasing, the validation loss also decreases. This shows that the model was a good model for the system.
2. The epoch number was increasing then the validation accuracy also increases. The accuracy of the model when epoch number at 10 was 0.8.

4.3. Evaluation the Usability of the Grocery Store Point of Sale System

The evaluation phase was the method that ensures the quality of the system. This phase was important because it allow users to try the system and give an evaluation about how the system can be improved. Thus, the Post-Study System Usability Questionnaire (PPSUQ), was mentioned in the third point methodology. This evaluation was used for data testing in this research. System usefulness, information quality, interface quality, and overall satisfaction were four criteria of the PSSUQ. The questionnaire had been given to the users that use the system. This result was based on the responses to the questionnaire that was provided to them. Table 3. shows the linear scale's indicator in evaluation questionnaire.

Table 3. The Linear Scale's Indicator

Scale	Indicator
1	Strongly disagree
2	Disagree
3	Neither agree nor disagree
4	Agree
5	Strongly Agree

Table 4 displays the description that the point-of-sale system was being evaluated as well as the mean average of the results for each description based on the PSSUQ approach that was provided to the respondents. The PSSUQ was conducted with 10 respondents.

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Table 4. The result of Usability Evaluation of Grocery Store Point of Sale System

Item	Statement about the System	Mean Average
1	I think that I would like to use this point-of-sale system frequently	4.4
2	I think that I would need assistance to be able to use this system	3.8
3	I found the machine learning image recognition in this system works well	3.9
4	I though this point-of-sale system was easy to use	4
5	The information such as grocery items, provided in the system is clear	4.2
6	It was easy to find the grocery item details.	3.9
7	The machine learning was effective in helping me complete the point-of-sale transactions.	3.7
8	The visualization of the cashier page on the system screens was clear	4.2
9	The interface of this system was pleasant.	4
10	The point-of-sale system interface was easy to navigate	4
11	I like using the interface of this system	4.2
12	The functions machine learning in point-of-sale system. I expect it to be.	4
13	Overall, I am satisfied with this system	4.9
14	Overall, I am satisfied with how easy it is using this system	4.2
15	Overall, I felt comfortable using this system	4.3

1. System Usefulness (Item 1 to 4)
   The users were provided with several variation in the system's usefulness specification. The mean average for item 1 is 4.4, it was indicating that users consider using this system. Eventually, the result for item 2 is 3.8 which is users need assistance and variedly with major disagree from the users. This is due to the system that was simple and straightforward, the users would not require the assistance to use the Grocery Point of Sale System. The mean average for item 3 was 3.9, it means all the users agree that machine learning works well. For the item 4, the mean average is 4 which is varied by the users with agree that this point-of-sale system was easy to use. The usefulness of this system varies depending on the users.
2. Information Quality (Item 5 to 9)
   Based on the evaluation, the users were agreed that the information such as grocery item, provided in the system is clear. Meanwhile, the users were agreed as the mean result for the item 5 is 4.2. Item 6 received 3.9 for mean average. All the users agreed that the system was easy to find grocery item details. Next, item 7 received 3.7 for mean average as the result was varied by the users with neither disagree and neither agree. The mean average for item 8 was 4.2 while item 9 was 4. This shows that the users agree with the visualization of the item details on the system screen.
3. Interface Quality (Item 10 to 12)
   The mean average for item 10 was 4 while for item 11 was 4.2. All the users agree with interface of the system as it is user-friendly and simple to operate. Meanwhile, item 12 received 4 for mean average, which was varied by the users with agreed.
4. Overall Satisfaction (Item 13 to 15)
   The mean average for the item 13 is 4.9. It shows that all the users strongly agreed with the item statements. The item 14 and 15 was 4.2 and 4.3, respectively. The users also satisfied with the Grocery Point of Sale System because of the machine learning that works well and simple interface.

5. Conclusion

The outcome in the research objective one findings, was the current performance of grocery point of sale system was not good because of the many factors such as slow to complete transactions. This study was encouraged to develop a new grocery point of sale system based on machine learning image recognition. The evaluation of the machine learning model also shows in the study. It was to show that the machine learning model that has been deployed in the system worked well and detect the grocery items. The machine learning algorithm in the system was based on the CNN algorithm

which is the best algorithm to use. The system worked when the system detected the grocery items, the item details can go into the system. The system was been analyze by using the PSSUQ questionnaire approach. There are 10 respondent that answer the questionnaire and complete it. These respondents were given the instruction about how the system works. After the testing the system, these respondents were given the PSSUQ questionnaire to gain evaluation from the users. Most of the users agreed that this system performed well.

This study was managed to detect the grocery items in the Grocery Store Point of Sale System. This system was able to solve the problem because the machine learning for image recognition in the system can detect the grocery items faster.

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