Real Time Draft Invoice Generation using Object Photograph

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Submitted to the faculty of Department of Electrical Engineering,
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In the name of ALLAH, the most benevolent, the Most Courteous

CERTIFICATE OF CORRECTNESS AND APPROVAL

This is to officially state that the thesis work contained in this report

*"**Real Time Draft Invoice generation using object photograph**"*

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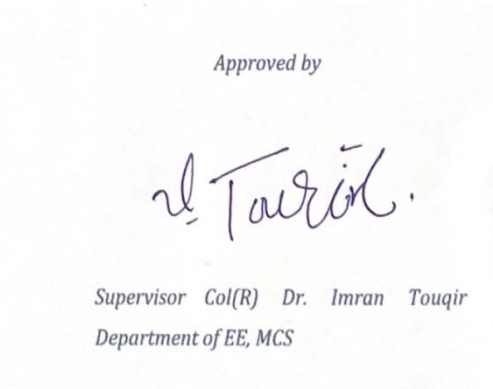
under my supervision and that in my judgement, it is fully ample, in scope and excellence, forthe degree of Bachelor of Electrical Engineering in Military College of Signals, National University of Sciences and Technology (NUST), Islamabad.



Date: 22 May 2024

DECLARATION OF ORIGINALITY

We hereby declare that no portion of work presented in this thesis has been submitted in support of another award or qualification in either this institute or anywhere else. All the work started from scratch.

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ABSTRACT

With the rise in construction activities, there arises a necessity to devise a dependable and streamlined method for assessing objects and estimating their materials without requiring the presence of a surveyor. Historically, this task has fallen to surveyors utilizing measuring tapes and similar tools to ascertain the dimensions of doors and windows. Nevertheless, this conventional approach can prove time-intensive and susceptible to errors, resulting in inaccuracies in material estimations and potential budget overruns. This research endeavors to formulate a precise and efficient methodology for object measurement employing image processing and computer vision techniques. Various methodologies, including image capture, edge detection, and segmentation, are explored for detecting and quantifying object parameters within images. Crucially, validating the proposed methodology through comparison with measurements conducted by a surveyor is imperative to ensure its accuracy and reliability. The study's potential for cost-effectiveness and efficiency in industrial and commercial settings is also underscored. The project comprises of four stages:

- The object will be identified and classified from images.
- The size and dimensions of region of interest will be computed.
- The required material and resources will be estimated in terms of hardware and cost.
- Draft invoice will be generated.

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Chapter 1

1.1 Introduction

Measurement is very necessary for applications in many fields including creation of objects in manufacturing, building or construction as well as in the area of medical diagnosis and treatment. Taking measurements has always been a difficult job since it was left to surveyors who have to rely on the use of specific and specific equipment and techniques for the measurement process. But calculating it manually is often time consuming and expensive and susceptible to miscalculation. Computer vision and algorithms have developed in recent years to help create real time object measurement systems that can take place of traditional surveys. They include: The systems offer speed and precision without the need for a human surveyor.
This project can be very useful to construction sites in that traditional techniques of taking orders that depend on manual recording or are being managed on paper are usually very slow, prone to too much error and at times inefficient when compared to the more advanced techniques offered by this project.

The following research questions will also be answered convincingly in this project regarding the development and evaluation of the system. Here we discuss the specifics of the system – the methods and algorithms of object identification and measurement. We first have a comprehensive analysis of the accuracy and reliability of the system via a series of testing and evaluation trials, comparing the results of the system with those from real-world examples. Thirdly, we evaluate the system on the basis of its effectiveness in different operating conditions and its capability to detect and allocate system failures. We also offer some recommendations for further development

and application according to the system's possible uses in different fields.

1.2 Overview

To achieve success in the 21st century workers have to comply to smart and efficient practices that are digital oriented. Construction is probably the most significant and most rapidly developing aspect in the life of man kind today since the number and scale of houses, business premises and offices being built today are growing exponentially. As of August 2022, it was recorded that there are over 6572 commercial and residential units and plots in DHA Islamabad that are only on the larger side and range from 15000 square feet and above that are ready for occupation. It is important for engineering principles to considered not only from a business but also from a technology perspective that focuses on methods of construction.

1.3 Problem Statement

The first stage in most sectors especially in process manufacturing is the quantitative evaluation of the object. The other factor that has seen a rise in the need for fast construction solutions for buildings, homes, factories, and shopping centers to name but a few.

This was done by a surveyor who went out to the site and carried out a physical measurement using measuring tape to find the sizes of the houses. This method is quite long particularly because people on the construction premises have to document precise observations and take care of all the minute details. In addition, many contractors would quote material price using a multiplier that is not explained more clearly and transparently where this multiplier was derived from or based on the length of the structure or the weight of the specific material.

This involves mass import of high profile materials in the construction industry of Pakistan based on mass but as far as distribution to the contractor's are concerned one sale them according to the length or area of the object whichever suits them in terms of making higher profits on the material. This will leave the employee feeling dissatisfied and losing trust on the business.

1.4 Proposed Solution

The proposed solution includes a web page or desktop tool for users to input images of objects – even specifying windows or doors – and a few standard reference images. This process will facilitate users to attain true measurements and requirement of materials which are in fact crucial in constructions. This system will detect the width value, area value, perimeter value, and length value using superior algorithms to identify the objects and process images with the absence of manual physical object measurements or the requirement for the surveyor.

Secondly, it will also provide the consumer a comprehensive draft invoice with estimates of frames, profiles, and glass that consumers are likely to need in order to do the installation. The user interface will have the placement of the elements in the page easy for the user so that when information regarding the supplies and expenses associated with the supplies in the construction process is sought it is easily got. The system will also be focused on optimizing the usability and facilitating all steps of the process from image uploading to getting precise measurements and estimates for the cost of the whole acquisition, with increasing the productivity of the company and delighting the customers.

1.5 Working Principle

The primary goal of the study is the use of the computer vision principles and techniques for picture processing. The steps from image to invoice generation are as follows:The steps from image to invoice generation are as follows:

1. Image Reading

2. Algorithm applied

3. Morphological Processing

4. Object Recognition

5. Edge Detection

6. Local Thresholding Using the Global Statistics.

7. Measurement of reference object object size.

8. Material Estimation9. Mapping of Current Price Sheet
10. Draft invoice Generation

1.5.1 Image Reading:

The picture of the thing to be measured that the user uploaded is then analyzed by the system. It is possible that this picture was captured today from either the current database or even from the current site. The technology then goes ahead to recover important information for the correct recording as per the analysis. It also employs complex algorithm to ensure that its measurement process is accurate and effective..

Algorithm Applied:

The YOLO multi-object identification approach, often classified as an incredibly rapid convolutional neural network approach, identifies and tags objects using convolutional neural networks (CNNs). YOLO is also known to split an image into grids where every grid also has the capability to detect objects within it. It identifies the height and width of the object with the help of the reference point from the coordinate system defined by intercutting grids of the bounding box..

1.5.2 Morphological Processing:

After the file has been uploaded there is a preprocessing of the image to apply morphological processing on the

image to make it better for analysis. The above mentioned tactic involves a number of changes which need to be done for the purpose of enhancing the image for further calculations. The process involves increasing the level of details and enabling it to come into sharp focus ready for measurement or any other use that the system is designed for.

1.5.3 Object Recognition:

Object recognition is an image processing ability that is defined as the one in which the location and classification of objects within pictures or video frames are performed. But this involves ideas such as the utilization of machine learning and deep learning to identify items, find them, and then classify them into specified classes.

1.5.4 Edge Detection:

Edge detection in image processing is the process of identifying sharp contrasts in values of pixel intensities or other features that correspond to a boundary between adjacent objects. In tasks such as object recognition and image segmentation it plays an indispensable role.

1.5.5 Estimation of Boundary Pixels:

The system does a thorough estimate of the margin in X as well as Y axis to ensure accuracy and achieve good values of the object under assessment. The former involves the systematic process of examining the pixel coordinates at numerous angles to ensure accurate measurements of the object's size and shape. By employing the boundary pixel analysis in a horizontal and vertical direction, the developed system ensures thorough evaluation; thus, providing accurate measurements and the identification and analysis of the parameters used in the measurement of the shape of the object.

1.5.6 Mapping of Reference Object Size:

The system employs the feature of the actual object, in order to measure the size of the actual object accurately by using the size of the reference object that is perceived in the picture. This involves repeating the procedure above but after identifying the reference object to be used, its known dimensions must be mapped out from within the image so as to precisely scale and measure other items in the image. This helps in ensuring accurate measurements are attained by setting a baseline whereby one is able to gauge the real size of objects depicted in the image.

1.5.7 Material Estimation:

The actual dimensions are derived by measurement of reference dimensions and the size of a reference object that is displayed in the picture. This procedure is performed to accurately enlarge or reduce other objects in the image and to determine their dimensions using a known dimension of the reference object in the image. It ensures that the sizes of all the things displayed in the picture are accurate since it establishes a measuring reference that can never vary.

Mapping of Current Price Sheet:

The cost analysis can be done more realistically since the system enables the user to input the existing price list for the needed materials in the software application. The process of integration involves the direct passage of price information that is relevant into the interface for software use, such that estimates of prices become easy computations based on rates of the market exchange rates. The technology provides better budget planning and resource planning as it provides current price for any projects being quoted so as to increase the accuracy of the quotation.

1.5.8 Draft invoice Generation:

It also retails a detailed invoice that includes estimations of the need for materials and object parameters and auxiliary costs. Here is the process for how complete invoicing composition includes the collection of necessary details and the methodical arrangement of gathered information in order to ensure that all significant information are recorded correctly. An additional data that might be extracted by the system in order to provide a detailed description of the transaction includes taxes and payment conditions. The created invoice ensures that all parties do not have to shy away but rather have a platform to communicate and record relevant information effectively.

1.6 Objectives

1.6.1 General Objectives:

To develop a web interface that will enable creation of draft invoices for windows and doors by capturing pictures in actual time through a phone camera or by accessing the images from a database.

1.6.2 Academic Objectives:

Certain academic objectives of this project that can be laid down as follows:Certain academic objectives of this project that can be laid down as follows:

- Conceptual and operationalized knowledge of Image processing.
- Aspects of computational mathematics in algorithm development for fast numerical simulation.
- GUI for input & output through Python – App designer.
- Creating tool to send data from the application with the impact on the back of the working software at fixed intervals.
- Reduce latency to make the system run effectively in real-time.
- Let the system be compatible with other frameworks that make it easier for it to be deployed.
- To gain user feedback, for further iterating and improving system functionality.

1.7 Scope

The outputs of this project are relevant in various fields that use accurate measurements for subsequent processes of product development – more so for the physical tasks that surveyors are often burdened to undertake. Further, the experiments will be carried out in the laboratory testing room with reference to a specific sample of product range such as doors and windows for preliminary evaluation purposes. The highest ambition is to create a solid foundation capable of being used in various fields where the measurements need to be precise

1.8 Relevant Sustainable Development Goals

Make cities inclusive, safe, resilient, and sustainable.

Promote sustained, inclusive and sustainable economic growth and efficient work for all.

What is the Locally Relevant Socio Economic Issue that the project addresses?

The problem selected is an important social and economic problem in the construction industry of Pakistan and is related to the inaccurate calculation of dimensions and the cost of materials. In this its solution aims at improving measurement accuracy, reducing costs and improving transparency in the material evalutions. The first and foremost improvements mentioned above have a significant potential and can cause the construction industry more customer-oriented.

Why certain SDG is important to your FYP?

SDG 9: Accelerating the project: Industry innovations and infrastructure – It focuses on the utilization of technology and automation to promote efficiency and development concerning infrastructure within the construction industry.

SDG 11: Sustainable cities and communities – The project can be helpful as it will contribute to the development of sustainable cities and communities allowing reducing the time and resources spent on construction.

1.9 Present Solution and their Draw back

1.9.1 Present solution

The existing approach for object measurement in the absence of a surveyor relies on conventional physical measurement methods, which are not only time-consuming but also demand a high degree of precision and significant physical exertion. Additionally, contractors typically estimate required construction materials based on their subjective preferences, which may not accurately align with the project's actual needs. Consequently, this lack of precision often results in opaque pricing structures, leaving customers unaware of the true costs associated with the materials utilized.

Chapter 2

2.1 Literature Review:

2.1.1 Background and history of object measurement

Accuracy is crucial not only to comply with and ensure safe architectural design but also to become resource efficient for many branches of the economy.

1. The measurements considered in the construction industry not only ensure the safety and legal concerns but also save the cost by reducing the materials that are consumed in errors or by reducing rework. More developed methods of construction can involve more accurate measurements of elements such as walls, doors, and windows and thus will make the projects more cost and time effective.

2. This is so because it helps to determine the efficiency of production as well as eliminating failures that may occur in the production process. Measuring one's production aids in ensuring that there is consistency of the sizes and quality of the produced goods reducing the level of waste and rework. In addition, the CPU collection of measurement data makes it possible to automate further processes and optimize the process; it will further accelerate production efficiency.

3. The correct measurements are very important to engineering because they do not only relate to the performance and sustainability of engineering designs but also form part in design verification. Engineering of environments generally enables accurate measurement of variables like stress and strain to help in optimization of designs that are aimed at enhancing performance and also increasing the lifespan of the design without increasing negative impacts to the environment. Measurements are also of use in ongoing maintenance and monitoring in ensuring the on-going reliability and safety of fabricated systems.

It also plays a crucial role in improving the success of several industries such as achieving accuracy in

infrastructure and in the quality of products.

2.1.2 Surveyor based techniques and their constraints

Herein, we examine the shortcomings of performing measurement of objects through the use of conventional tools such as surveying equipment, measuring tapes, and rulers, among others[1].

1. Time-consuming: It is also a tedious work to surveyors because of the time taken for the measurement assignment; thus, for the physical measurement of each point on an object, it may take a long time, delay and raise costs for projects.

. Human mistake Propensity: The requirement for exact measures in the kitchen demands attention and humans make mistakes. Errors can be also easily made by the most trained of surveyors simply through the

3. Accessibility Restrictions: The use of hands-on surveying tools to determine or access certain parts of objects may become impractical. This limits the ability to read asymmetrical readings or ones that are hard to reach like large windows or architecturally complex surfaces.

4. Cost Implications: Standard measurement can also be very expensive in as far as travel expenses are concerned by taking surveyors to far and difficult places to take measurements. Such expenses may rise in part, especially for projects that require constant supervision at the site or there exist large geographical barriers.

To conclude, even though conventional measurement systems were utilized for years, limitations, such as time consumed, high rates of errors, inaccessibility problems, and higher expenses, reflect the need to replace these outdated means of measurement with modern and efficient measurement technologies.

2.1.3 Advantages of non-surveyor based approaches

The non-surveyor data and information collection methods involve no use of specialized equipment or personnel of skilled surveyors. These methods have a number of benefits:These methods have a number of benefits:

Effective use of time: Height can be measured without the need for surveyors to physically move from location to location to collect data.

Cost-effectiveness: Since non-surveyor methods do not entail the need for special equipment or highly skilled workers like in the case of the traditional approaches, costs will be lower with this technique.

Accessibility: The knowledge that is needed to perform non-surveyor procedures entails some basic awareness of how data collecting and analyzing is done. They can therefore be used in places where there could be none licensed surveyors.

Large sample size: This approach may also be employed to get more data as compared to standard methods. This is advantageous because an order can be delivered in a shorter time period with a larger number of orders.

2.1.4 Fundamentals of object recognition and case studies

Mohammed Bennamoun, George J Mamic

Springer Science & Business Media, 2012

Automatic object recognition is a multidisciplinary research area using concepts and tools from mathematics, computing, optics, psychology, pattern recognition, artificial intelligence and various other disciplines. The purpose of this research is to provide a set of coherent paradigms and algorithms for the purpose of designing systems that will ultimately emulate the functions performed by the Human Visual System (HVS). Hence, such systems should have the ability to recognize objects in two or three dimensions independently of their positions, orientations or scales in the image. The HVS is employed for tens of thousands of recognition events each day, ranging from navigation (through the recognition of landmarks or signs), right through to communication (through the recognition of characters or people themselves). Hence, the motivations behind the construction of recognition systems, which have the ability to function in the real world, is unquestionable and would serve industrial (eg quality control), military (eg automatic target recognition) and community needs (eg aiding the visually impaired). Scope, Content and Organization of this Book This book provides a comprehensive, yet readable foundation to the field of object recognition from which research may be initiated or guided. It represents the culmination of research topics that I have either covered personally or in conjunction with my PhD students. These areas include image acquisition, 3-D object reconstruction, object modeling, and the matching of objects, all of which are essential in the construction of an object recognition system

2.1.5 The role of context in object recognition

Aude Oliva, Antonio Torralba

Trends in cognitive sciences 11 (12), 520-527, 2007

In the real world, objects never occur in isolation; they co-vary with other objects and particular environments, providing a rich source of contextual associations to be exploited by the visual system. A natural way of representing the context of an object is in terms of its relationship to other objects. Alternately, recent work has shown that a statistical summary of the scene provides a complementary and effective source of information for contextual inference, which enables humans to quickly guide their attention and eyes to regions of interest in natural scenes. A better understanding of how humans build such scene representations, and of the mechanisms of contextual analysis, will lead to a new generation of computer vision systems.

2.1.6 YOLOInvoiceWizard: Revolutionizing Invoice Generation through Object Detection:

This paper proposes a new approach where computer vision approach is enhanced with the use of YOLOv8 model to facilitate customers in a checkout process in a retail store. The objective of such project is to facilitate the completion of the invoice in that it will identify products when scanned and correctly identify them as well as they are added into the shopping cart in a GUI. The proposed solution aims to greatly simplify the traditional billing process and eliminate human errors by combining computer vision functionality to accelerate the checkout process for shoppers and reduce checkout lines in store. The system consists of a YOLOv8 model which is embedded in the object identification algorithm; the model allows for identifying various products that are arranged on the counter.

The chosen products are then put into easy-to-use web GUI cart so that the buyers can easily follow their selection while they navigate across the store. The combined impact of web and computer vision technologies in an end-to-end shopping checkout experience, a discussion of the resulting positive impact on consumers and their behavior. This project presentation has a number of potential benefits such as faster checkout at the cash register, accurate billing systems, and general process efficiency in retail outlets. The final part of the study report is the presentation of the results of the prototype system performance for validating its ability to enhance the processes associated with providing customer experiences and billing in an actual full-scale retail environment.

This paper helps to propagate and progress the applications of computer vision in the retail industry and

towards the vision of customer-friendly and intuitive retail shopping.

2.1.7 A Comparison of C, MATLAB, and Python as Teaching Languages in Engineering:

Part of the book series: Lecture Notes in Computer Science ((LNCS,volume 3039))[2]

We describe and compare the programming languages C, MATLAB and Python as teaching languages for engineering students. We distinguish between two distinct phases in the process of converting a given problem into a computer program that can provide a solution: (i) finding an algorithmic solution and (ii) implementing this in a particular programming language. It is argued that it is most important for the understanding of the students to perform the first step whereas the actual implementation in a programming language is of secondary importance for the learning of problem-solving techniques. We therefore suggest to choose a well-structured teaching language that provides a clear and intuitive syntax and allows students to quickly express their algorithms. In our experience in engineering computing we find that MATLAB is much better suited than C for this task but the best choice in terms of clarity and functionality of the language is provided by Python.

2.2 Scope of machine learning applications for addressing the challenges in next-generation wireless networks

The convenience of availing quality services at affordable costs anytime and anywhere makes mobile technology very popular among users. Due to this popularity, there has been a huge rise in mobile data volume, applications, types of services, and number of customers. Furthermore, due to the COVID-19 pandemic, the worldwide lockdown has added fuel to this increase as most of our professional and commercial activities are being done online from home. This massive increase in demand for multi-class services has posed numerous challenges to wireless network frameworks. The services offered through wireless networks are required to support this huge volume of data and multiple types of traffic, such as real-time live streaming of videos, audios, text, images etc., at a very high bit rate with a negligible delay in transmission and permissible vehicular speed of the customers. Next-generation wireless networks (NGWNs, i.e. 5G networks and beyond) are being developed to accommodate the service qualities mentioned above and many more. However, achieving all the desired service qualities to be incorporated into the design of the 5G network infrastructure imposes large challenges for designers and engineers. It requires the analysis of a huge volume of network data (structured and unstructured) received or collected from heterogeneous devices, applications, services, and customers and the effective and dynamic management of network parameters based on this analysis in real

time. In the ever-increasing network heterogeneity and complexity, machine learning (ML) techniques may become an efficient tool for effectively managing these issues. In recent days, the progress of artificial intelligence and ML techniques has grown interest in their application in the networking domain. This study covers some of the tools available to support and customize efficient mobile system design, some open issues for future research paths, and a brief overview of ML methods that can be effectively applied to the wireless networking domain. It also covers current research on wireless networks.

2.2.1 Traditional Method:

Traditional methods include taking off and estimating by hand, which is a labor-intensive and error-prone operation. This method requires measuring the material's measurements in person and utilizing preset formulas to calculate values. Although common in smaller building projects, these methods are gradually disappearing from larger undertakings because of their inherent drawbacks. In the past, these techniques mainly depended on field surveyors who visited locations to measure objects, which increased the time and resource requirements. Technological developments have led to a move in construction project management toward more precise and efficient alternatives, even though they are still used in some situations.

2.2.2 Technological advances in object measurement emerging

Technology is always changing. Thanks to technological advancements, real-time item measuring can now be done without a surveyor. Computer vision is being used more and more. Its goal is to make visual data from the environment surrounding computers interpretable and understandable. It can assist us in determining an object's size.

One of the most important developments in object measurement technology recently is among the many object measurement techniques.

- LiDAR technology, which is well-known for its ability to survey landscapes and map terrain, has discovered a new field of use: Subject: Object recognition. LiDAR narrows down identifying objects and grouping them into categories by accurately measuring distances and capturing very small details in 3 dimensions. The key reason why object detection is strong when using LiDARs is the high

resolution of its point cloud data and the ability to cope with changes in illumination. Today LiDAR proved to be useful in several industries for refining object detection capabilities, including robotics, AR, and vehicle safety. Its rising popularity is a sign that further technological advancements are likely to be made in the field of computer vision and artificial intelligence.

- Deep learning (DL) and machine learning (ML) revolutionize the object recognition field as computers begin to learn to see in ways that by far surpass human capabilities. SVMs and random forests are two very important machine learning methods that allow developing models capable to extract patterns as well as find traits from large datasets in order to improve object detection capabilities in photos or videos. Convolutional neural networks (CNNs) are among the DL techniques which equip a deep-level understanding of different object attributes, especially in hierarchical representation and feature extraction. The learning and the optimization of ML and DL algorithms always enhance the object identification bringing the opportunities for the use in areas like robotics, security, medical applications and other niches.

- Blended enhanced mixed reality and context-aware augmented reality with object recognition. Object identification manipulators are technologies that allow AR systems to identify physical objects and place relevant digital content over them in real time. By presenting custom content tailored to what they have recognized with their objects and contextual information offered through the integration the latter also helps to enhance the user experience. Object recognition enhances interaction with the actual environment, from providing digital guides for spaces like museums to creating virtual demos of products for stores. Thus this combination of the augmented reality and object identification for this sort of application is massive and will be beneficial for a number of fields such as gaming, healthcare, education and industrial deployment with the great impact on the way people interact with surrounding environment.

Chapter 3

3.1 Work overload and Block Diagrams:

Project Methodology

3.2 Image Capturing:

They are needed for such objects to be assed and/or located from a distance in order to determine the size of the object in real time without a surveyor. This method requires positioning the object in a manner which will ensure that the object is adequately viewable to the camera and capture the best opportunity for the camera to capture the object. For example, the camera is considered as the main measurement tool to detect the object's size and its spatial orientation taking real-time without using manual measurements by means of surveyors.

3.3 DIP

Digital image processing is a subset of image processing that is an application of algorithms and mathematical operations to digital imagery. The following are the process's principal elements:The following are the process's principal elements:

Image Acquisition: This phase of the procedure involves the process of obtaining the digital images by making use of tools such as cameras, scanners or satellites; although very rare they might be also obtained in this phase. There are many more factors, such as resolution, illumination, and sensor capabilities that can influence the collected image's quality and characteristics.

Image Enhancement: Color correction and other methods of image enhancement adjust the brightness, contrast, sharpness, and color balance of the image with the goal of enhancing image quality. These changes will help in making the photograph more readable for all those who will be reading it machines and people.

Picture correction then is defined as a process of dealing with various errors or faults that are experienced in the processing of images. Flattening images with unnecessary distortions, enhancing blurred details, filtering the noise, and correcting color distortions are helpful for image correction methods.

The process of feature extraction is also called a process known as the feature detection whereby one isolates and identifies particular patterns forms, or textures of objects in an image from others. This is usually implemented in combination with methods such as edge detection, image segmentation, and object recognition for analysis of image data.

Edge Detection: One important problem in images is recognizing and enhancing the boundary or edges of images. Edge detection algorithms work around the assumption that edges in the image refer to change in color or intensity and hence they are present on borders, contours or features of the object present in the image.

Image Display: Once these steps have been performed to convert the images to the desired format, the processed image can then be viewed for further analysis or visualization. This might entail photographing the image on the screen or on the paper or providing it digitally for use with gizmos.

3.3.1 Visual Analysis:

The systems after uploading and processing the image have an image which depicts the image of the object that must be measured for the purpose of wormhole creation. This image can be obtained directly from an existing database or from the scene happening in real time using a camera or any other digital imaging device. Then as soon as the image is conveyed, the system analyses it. This includes such processes as noise reduction, feature abstraction, context compression, and image enhancement to prepare the image before close analysis. The

quality of the image is enhanced so that its details are made free of noise for effective feature extraction and quantification. The feature extraction process can help identify and distinguish important element in the image from the image which are edges contours and specific places that is related to objects that to be measured.

To this end, the system collects data on the image necessary for measurement after it has passed the process of analysis. This spans such dimensions as correlation by region, overall correlation, and other measures. Orthographic properties are acquired by measuring the spatial relationship between various object parts and measuring properties, such as height, volume, and length, from a picture. It is built in a way that complex algorithms are applied in order to get accurate and effective measurements. The next step is to transfer the measurement data into a format that may be utilized for further analysis or action, such as a digital report, graphical report, or direct integration into other systems. Comprehensive reports and graphic representations aid in the effective interpretation and application of the measures, and integration allows the measurement data to be used in other software systems for manufacturing, research, and quality control. By leveraging both current data and real-time inputs, the system ensures very exact and reliable object measurement from images through the integration of these techniques

3.3.2 .Structural Analysis:

Shape analysis is a complex process that is used to enhance or enhance the quality of the uploaded image so that on can go further to test it. The multiple enhancing steps is done in this procedure to final enhance the image to proceed for computational operations. It can be described as the process of modifying and altering the contents or configuration of the shape that exists in the computer-based image.

In this, techniques of noise reduction are utilized; these obscure important details and reduce the level of clarity and remove random occurrences in the image that is undesirable. This stage removes additional information that can key on further research and refines the image to make it better than it was in the previous stage.

Techniques to enhance an edge are then employed. These techniques enhance the visual difference between the objects in the image by increasing its definition and outlining the edges. Now it is especially significant for contour and shape of the object to determine and match in order to get the accurate measurement.

Isolating the contours is another necessary aspect of the form analysis process. This step involves the method by which the system is able to define the object’s outline in order to distinguish any shape and position of the

object in the image. By defining the outlines, it might be easier for the system of measuring to focus on isolated elements to make the most reliable and thorough measurements.

Post-processing methods such as dilation and erosion also may be applied to shape analysis as part of the process for enhancing the image through shape changes to object size and shape while removing small faults and filling holes. These adjustments enable the image to become less ambiguous and incongruent and thus enhances the quality of the image and improving the ranking of the image as a suitable analytic tool.

These process steps are quite time-consuming and it is thus certain that shape analysis enables the image to be free from distortions and artifact. This image has been trained again and now it is ready for the article like a precise dimension / measurement or other intended measures e. g. for the task related to the object identification, quality control and other image processing. The purpose of the shape analysis step is to keep the database image as clean and compact as possible in order to optimize the subsequent computational operations..

3.3.3 Object Identification:

Object recognition is a complex image processing that allows to find and classify the objects within the frames of the analyzed pictures or video files. This procedure has a total of 10 processes. The first is referent detection – the system looks for objects in the visual information. An object is then localized when its exact position in relation to the frame of the image is established; often this is through the creation of bounding boxes that encompass the object. After storing the descriptions of each seen object in the memory, the algorithm utilizes its characteristics to assign a category from the set of predefined categories to each object. This is usually achieved by adopting complex models such as Machine learning or Deep learning technologies. The machine learning algorithms are applied to huge datasets that have samples of varied products where their labels have been attached to enable the algorithms recognize patterns.

These abilities are further enhanced by the deep learning techniques especially where neural networks are used to facilitate automatic extraction of hierarchical features from the input and increase the recognition accuracy and robustness. The good news is that these algorithms can work with a large number of objects and as a result object identification plays a crucial role in numerous tasks ranging from photo search engines to self

piloted cars and to name just a few. This technology aims to provide systems with a better understanding and facilitation of interacting with an environment based on identifying and categorizing things accurately and sharply..

3.3.4 Identifying Boundaries:

Edge detection is one of the key processes in image processing in which the boundary between an object and its neighboring background is defined spatially according to variations in brightness and color. A similar method is essential for most applications, such as object recognition and image segmentation. In order to find the areas of change, the algorithms that control the photos for the mark of edge recognize the fluctuations in the brightness of the pixels. They mainly arise because major aspect changes occur where contrast is the highest and may in some instances be indicative of object boundaries or edges. Image descriptions like convolution or gradient analysis are applied to emphasize these transitions and provide the image with visemes that resemble semi-transparent edges.

It is known that segmenting the image into parts or objects is essential and needs the use of edge detection. It is possible to divide the image with revealing the margins so that the new portions are obtained for further assessment or modification. Additionally, edges help to distinguish objects and group them in an image, making them crucial features in identifying or classifying objects. Edges are very useful in systems since they can provide useful information about the shapes and compositions of objects which aid in identification processes.

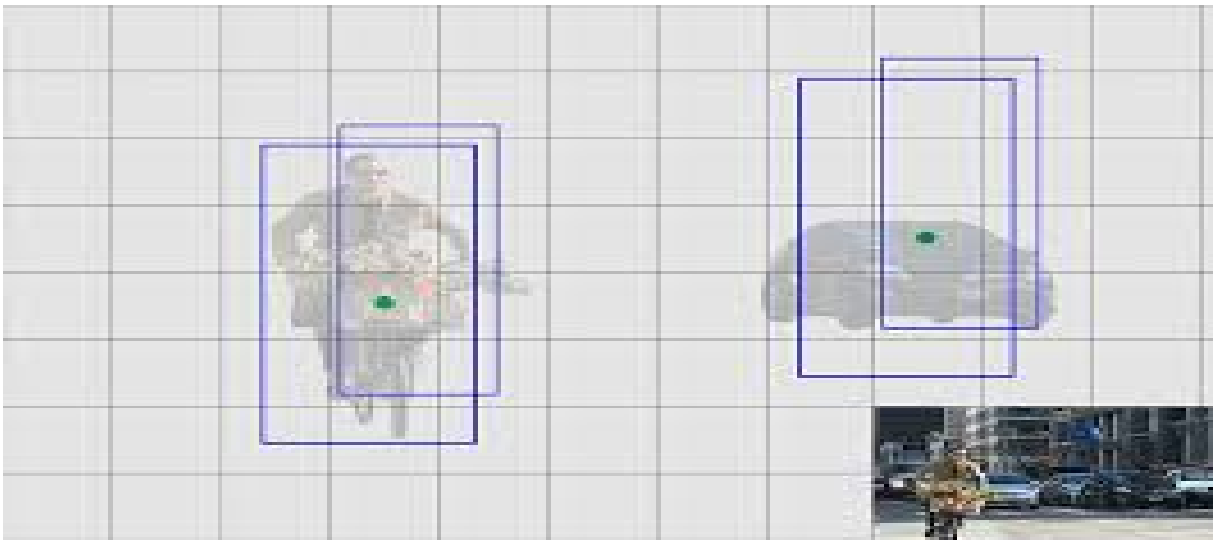
Moreover, edge detection has become one of the essential components of the computer vision field, and a lot of other applications such as robotics, medical imaging, and driverless cars are related to it. For instance, for machines in autonomous driving systems, edge detection enables the car to identify the lane for driving and other features in the surrounding environment, so that the car could sense and reply on these features.

Through this piece, it is clear that edge detection is a critical part of image processing that informs a tremendous amount of information about the structure and composition of visual data. It is often used in many fields where the recognition of the correct object boundaries is crucial for analysis and reasoning of the event.

3.3.5 Rough estimate of boundary pixels:

In the process of accurate measurements of the object under study, the system applies a rigorous border pixel approximation on X and Y axes. This process is laborious and involves examining the coordinates of the keypoints of the pixels that define the outline of the object from multiple views. The item size could be determined accurately and the shape is found by looking at the border pixels in Y-axis and X-axis direction.

Upon finding the edge pixels, their locations are recorded and analyzed. The system is also able to define the item's perimeter through using both the X and Y axes for this purpose. The dual-axis analysis ensures an accurate assessment since it provides for measurements along great and small axes to ensure that no part of the border of the object being measured is left out.



3.4 Algorithms and Machine Learning:

YOLO is also a deep learning object detection system and is one of the fastest systems for identifying objects in real-time. YOLO eliminates intermediate feature classifications and instead approaches object recognition as an end-to-end regression problem that transforms feature maps of the input image directly into the coordinates of the bounding boxes and object classes in the image[3].

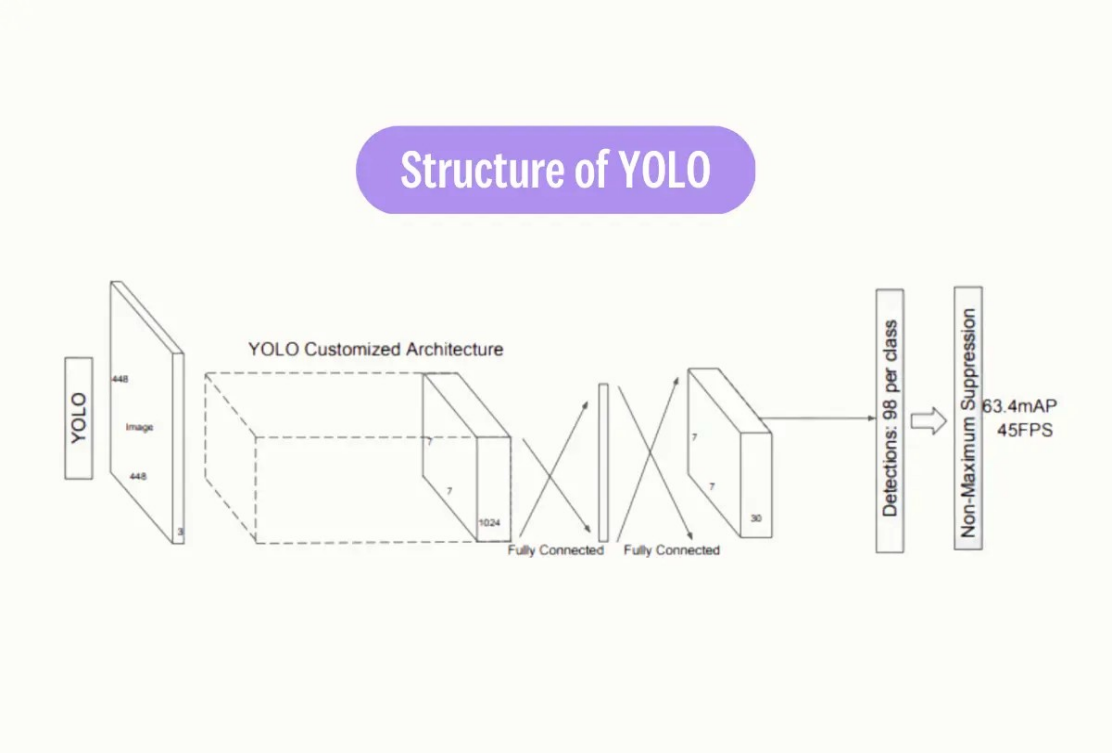
Unified Neural Network: YOLO is faster than previous object recognitions since it uses a single convolutional neural network to efficiently make predictions for bounding box and class probabilities from images.

Grid-Based System: Grid cells in the image help identify individual items whose center falls within a grid cell. The image is dissected into an $S \times S$S×S lattice. Each cell predicts a predetermine number of bounding boxes and their corresponding confidence.

Bounding Box Prediction: Each output of a bounding box is a combination of five values: confidence, h, w, and x and y. Confidence is a value between 0 and 1 indicating the accuracy or likelihood that an object is in the box. X and y represent the center placement in a grid cell.

Class Prediction: YOLO assigns a probability to each class for every pixel of the image under the condition that an object is present in the visualized area of the pixel. Such probabilities, together with the bounding box confidences, leave to final detection results.

Inference Process: For the inference process, the conditional probability of each class is multiplied by the respective individual box confidence score to obtain the final detections. The non-max suppression function is used to remove the duplicates.



How YOLO Functions

Preprocessing: To maintain consistency, the dimension of input image is scaled to a fixed size. g. The original frames were cropped for each target object such that they were 448 x 448 pixels as in YOLOv1) before being input to the network.

Feature Extraction: The CNN exhibits convolution and pooling layers that reduce the input image into a feature map that represents high-level structures.

Detection Phase: The fully connected layers take inputs from the feature map as network output data to find the bounding boxes, confidence scores, and class probabilities for each cell in the grid. This speed is due to the fact that YOLO does not require multiple steps for image processing.

Post-processing: A particular stage of raw predictions is the confidence thresholding and non-max suppression in order to specify the final detections.

Training Data: Yolo is trained on datasets with objects framed using bounding boxes, and class labels, such as COCO or PASCAL VOC.

Loss Function: Comprises of as part of its loss function:

Localization loss calculates errors between the actual output results and the predicted bounding box coordinates.

Confidence loss is the objective of quantifying the confidence on predictions.

The metric based on the classification loss is used to measure the accuracy of class probability predictions.

3. Optimization: The training process proceeds by minimizing the aggregate loss function on the full set of points using optimization techniques such as SGD(a stochastic gradient descent) or Adam.

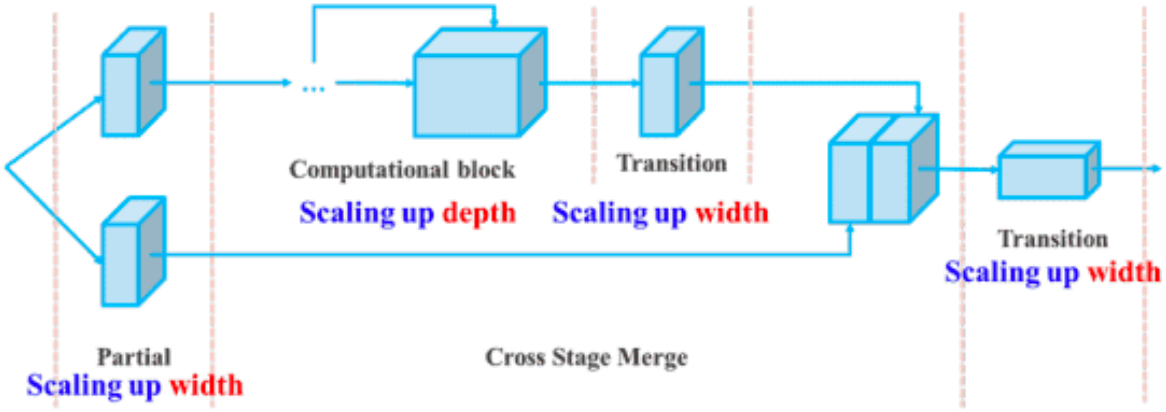
4. Data Augmentation: Augmentation is responsible for methods like random cropping and scaling besides using color modifications to enhance generalization.

YOLO's advantages

1. Speed: Real-time YOLO is ideally suited for performing tasks since YOLO is fast at processing photos due to its architecture.

2. Unified Detection: YOLO is an application which greatly simplifies detection and speeds up the inference process by representing a problem as only one regression.

3. Context Awareness: When YOLO predicts objects it also factors the full image as a consequence the YOLO reduces the occurrence of false positive effects by understanding the overall image.



Uses

YOLO is used in many different sectors, including: • Driverless cars: To detect the traffic signal lights, traffic rules, the pedestrians and other moving cars.

• Surveillance: For alert detection and real-time surveillance.

• Robots: For object-selection and navigation.

• Anomalies in the medical imaging could be determined for this.

• Augmented Reality: For real time recognition and detection of objects.

Summary

In the field of object detection, taking the task of detection as a single regression is one of the greatest achievements brought about by YOLO. Despite the claim that it can detect objects in real-time, this is a very accurate object detector due to its deep learning architecture that uses large datasets, highly complex neural networks, and the latest optimization techniques. Yolo is particularly crucial for many of the real-world cases where accuracy and speed are paramount due to its performance and even precision.

3.5 Mathematical Model:

The project determines the real-world dimensions of doors and windows in photos by using YOLO (You Only Look Once). It then creates an invoice based on the cost of these measurements.

Key Steps

1. **Object Detection with YOLO**

• Yolo uses bounding box coordinates to locate and identify windows and doors in an image.

2. **Scaling the Dimensions**

• Using a known reference object in the image, convert the bounding box dimensions from pixels to real-world units.

3. **Calculating Real-World Measurements**

• Using the scaling factor, ascertain the real width and height of the objects that were discovered.

4. **Cost Calculation**

• Using a predetermined rate per square meter, determine the cost based on the area of the doors and windows that have been discovered.

5. **Invoice Generation**

- Sum the costs of all detected objects to produce the total invoice amount.

Detailed Steps

1. **Object Detection with YOLO**

- YOLO provides bounding box coordinates $(x,,,h)(x,y,w,h)$ for each detected door or window.

2. **Scaling Factor Calculation**

- Use a known reference object in the image to calculate the scaling factor:

s=pixel dimension of reference objectknown dimension (e.g., meters)

3. **Real-World Dimensions**

- Convert pixel dimensions to real-world dimensions:

Real width=Pixel width×s

Real height=Pixel height×s

4. **Area and Cost Calculation**

- Calculate the area:

Area=Real width×Real height

- Calculate the cost using a rate per square meter:

Cost=Area×Rate

5. **Total Cost**

- Sum the costs for all detected doors and windows:

Total cost=∑Individual costs.

3.5.1: Estimation of price as per standards:

- Price list:

Mapping of price list to app so to integrate updated price.See

Appendix-D for Table

- Total Price:

Total material price = Profile price + frame price + Glass priceGST = Tot * 17%

Auxiliary & service charges ASC = Tot * 5% Total Price

= Total material price + GST + ASC

3.6 GUI:

Setting up a web server using Flask as the back end and HTML and CSS for the front end is necessary to create a graphical user interface (GUI) for a web application. This is a summary of the operation of this setup:

1. Flask Framework

The purpose of the Flask Framework is to act as the web server and manage the application's server-side logic[5].

Functionality: Sends answers, handles requests, and maintains routes.

2. Project Structure

- **Directories**: Organize your project with directories for templates (HTML files) and static files (CSS, JavaScript, images).
    - **templates/**: Contains HTML files for rendering the web pages.
    - **static/**: Contains CSS, JavaScript, and other static assets.

3. Configuring Routes:

Utilize URL routes in Flask to manage various web application destinations.

Home Route: Manages the application's home page.

Manage user inputs and process data (e.g., uploading photographs, processing data) using upload/process routes.

4. HTML Template Rendering

Jinja2 Engine for Templating: Flask renders HTML templates dynamically using Jinja2.

Templates: To add dynamic content, create HTML files with incorporated Jinja2 syntax.

5. Managing User Input Forms and Forms:

Utilize HTML forms to collect user feedback.

Form Handling: Flask uses request objects to process user-submitted form input.

6. Fixed Files

JavaScript and CSS: Add styles and functionality to the front end.

Serving Static Files: The static/ directory is where Flask serves static files.

7. Processing Data Backend Logic: For data processing specification from the front end, you will use Flask and Python.

Data handling: Perform tasks like server image processing, data base search and mathematical problem solving.

8. Presenting the Outcomes

Dynamic Content: Implement the HTML template which displays the search query and the results.

Result Pages: Use the web interface to present the results coming from processed data, photos or computed data.

9. Managing the Server

Install the application to a local FLASK development environment.

Installation: Deploy the Flask application on a web server, allowing for greater access to the system.

Summary

Flask can be used to create a web application together with HTML and CSS at the front end that makes a responsive and interactive web application. HTML and CSS enable the user-friendly display of the application's window, while Flask is used for server-side control of programming and processing data. This allows the developers of Python to create stable web-based programs that combine back-end functionality with the styling elements of the website's interface.

Chapter 4

4.1 Invoice Generation:

Of course! Here's a more thorough how-to for using Reportlab to make an invoice with the measurements and price of doors and windows taken using a camera[6].

1**. organizing Your Space**
first, if you haven't already, install ReportLab:

pip install reportlab

Basic Configuration and Data Ready
Write a Python script to produce the invoice in PDF format. Import the required modules first, then configure the canvas:

2.**Basic Configuration and Data Ready**
Write a Python script to produce the invoice in PDF format. Import the required modules first, then configure the canvas:

```
from reportlab.lib.pagesizes import letter

from reportlab.pdfgen import canvas

from reportlab.lib.units import inch



def create_invoice(invoice_path, items):

    c = canvas.Canvas(invoice_path, pagesize=letter)

    width, height = letter

    return c, width, height



# Example items: [{'name': 'Window', 'width': 4.5, 'height': 5.0, 'cost': 150.00}, ...]
```

3. Adding Invoice Header

Add code to generate the header section of your invoice:

```
def add_header(c, width, height):
    c.setFont("Helvetica-Bold", 16)
    c.drawString(1 * inch, height - 1 * inch, "INVOICE")

    c.setFont("Helvetica", 12)
    c.drawString(1 * inch, height - 1.5 * inch, "Company Name")
    c.drawString(1 * inch, height - 1.75 * inch, "Address Line 1")
    c.drawString(1 * inch, height - 2 * inch, "Address Line 2")
    c.drawString(1 * inch, height - 2.25 * inch, "Phone: (123) 456-7890")
    c.drawString(1 * inch, height - 2.5 * inch, "Email: company@example.com")

    c.drawString(width - 3 * inch, height - 1.5 * inch, "Date: 2024-05-20")
    c.drawString(width - 3 * inch, height - 1.75 * inch, "Invoice #: 12345")
```

4. Adding Table of Items

Define a function to add the table of items:

```
def add_table(c, items, width, height):
    c.setFont("Helvetica-Bold", 12)
    c.drawString(1 * inch, height - 3 * inch, "Description")
    c.drawString(3 * inch, height - 3 * inch, "Width (ft)")
    c.drawString(4 * inch, height - 3 * inch, "Height (ft)")
    c.drawString(5 * inch, height - 3 * inch, "Cost ($)")

    c.setFont("Helvetica", 12)
    y = height - 3.5 * inch
    for item in items:
```

```
        c.drawString(1 * inch, y, item['name'])
        c.drawString(3 * inch, y, str(item['width']))
        c.drawString(4 * inch, y, str(item['height']))
        c.drawString(5 * inch, y, f"{item['cost']:.2f}")
        y -= 0.25 * inch
```

5. Adding Total Cost

Add a function to compute and display the total cost:

```
def add_total(c, items, width, height):
    total_cost = sum(item['cost'] for item in items)
    c.setFont("Helvetica-Bold", 12)
    c.drawString(4 * inch, height - (len(items) * 0.25 * inch + 4) * inch, "Total Cost: ")
    c.drawString(5 * inch, height - (len(items) * 0.25 * inch + 4) * inch, f"${total_cost:.2f}")
```

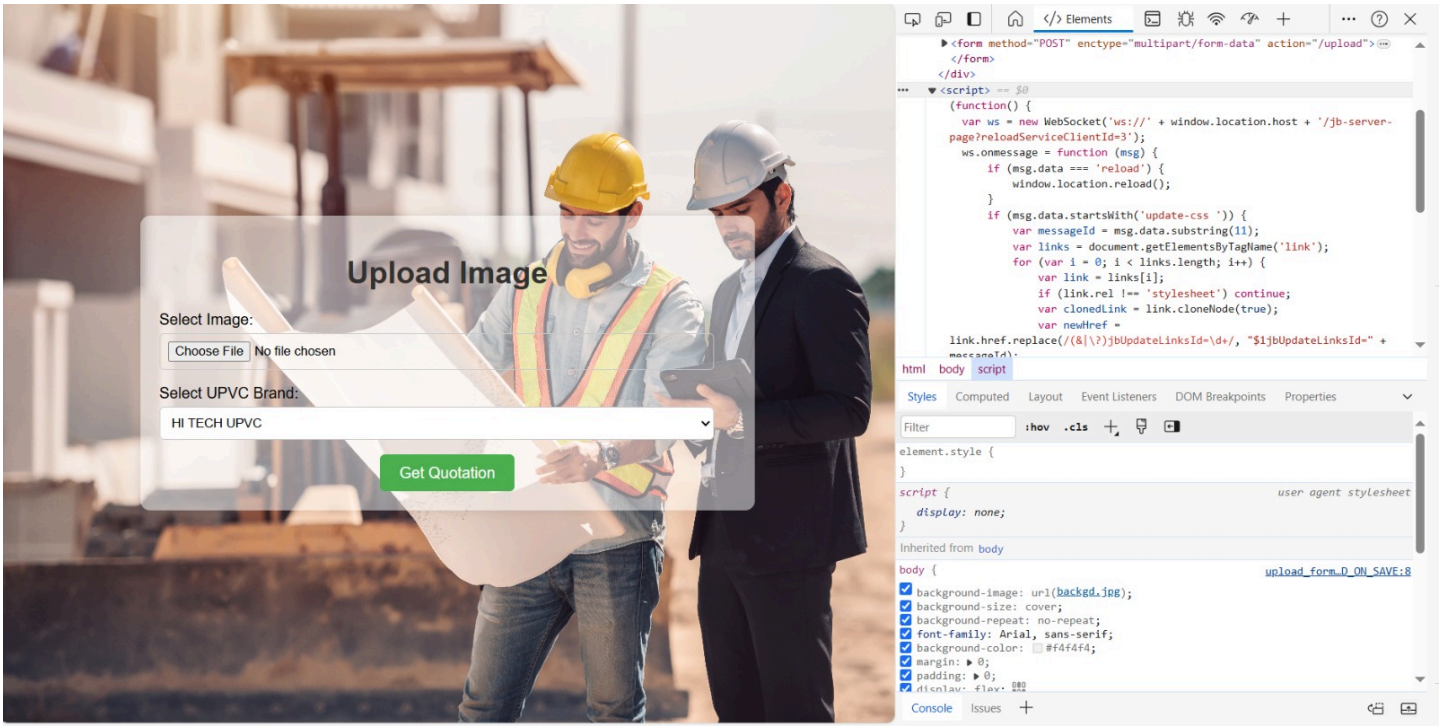
6.Putting It in Main Function

Combine everything into a main function:

```
def create_invoice(invoice_path, items):
    c, width, height = create_invoice(invoice_path, items)
    add_header(c, width, height)
    add_table(c, items, width, height)
    add_total(c, items, width, height)
    c.save()


# Example usage
items = [
    {'name': 'Window', 'width': 4.5, 'height': 5.0, 'cost': 150.00},
    {'name': 'Door', 'width': 3.0, 'height': 7.0, 'cost': 200.00}
```

]

create_invoice("invoice.pdf", items)



7. Improvements

More information about your customers, comprehensive descriptions, pictures and logos, and more complex formatting options may be considered valuable as well. To use the other methods, please refer to ReportLab's documentation.

With this configuration it is possible to describe an elementary way to generate a PDF invoice using ReportLab and the addition of a header, the items table and the cost calculation. It is reconfigurable and can be easily adapted to the specifications of your project.

Door Receipt

Type	Value
Width	13.7 Inches
Height	28.9 Inches
Area	395.93 Inches
Perimeter	85.2 Inches
Rate	Rs. 10000.0
Cost Over Area	Rs. 329941.67
Cost Over Perimeter	Rs. 71000.0
Total Cost with Svc Charges	Rs. 400941.67
Svc charges	Rs. 10
Final Cost	Rs. 441035.83

Chapter 5

5.1 Compiling of Web Application:

Before you start to build an HTML, CSS, and web app using Flask, you have to set up a development environment for your computer. Flask enables developers in developing web applications therefore by using Python's micro web framework. To begin with one has to install Flask using pip:Once the Flask library is installed choose a primary Python file to import the Flask library into then to run the library via the import Flask and run the application. In this file you'll define routes that identifies various pages or endpoints in your web application. One of the ways to generate an HTML template for a route.

The actual content and structure of the pages in your web site is defined by the HTML templates that are held in the "templates" directory. Jinja2 was used to enable Flask create a dynamic template which enables rapid integration of HTML and dynamic data. CSS files: The set of directories involved in "Static" involves the files that control the layout of the HTML content. In this case you get these CSS files in your HTML web page and you can link these CSS files to your web pages to ensure that the pages are styled correctly.

It is a framework which receives requests for different URLs and directs the latter to the corresponding function in Python. This person is often responsible for collecting the data and getting it to the HTML template (whether from a database or other materials). Upon completion of implementing the template and filling out dynamic data, Flask renders the resulting HTML and sends it to the client browser. This is via the Jinja2 engine.

Development of a Flask application is started by running development server for the application through the main Python file to observe the actions of an application. This server translates the incoming request by serving the relevant HTML content till new request arrives. The end product is a well-put-together website that fully combines the content provided by HTML, the aesthetics brought by CSS, and the Flask technology at the core to work on the framework and serve the requested pages.

1. Configuring the surroundings

Let us now consider the development environment: the first thing you need to do is to set up your environment. This involves the process of installing a flask which is a web micro-framework, through the use of a python package manager such as pip to install it. One of the very first things you do after completing the installation process is to establish a folder for your project and organize it in folders. The “templates” directory will have the HTML files that are going to be used in the application, “static” directory will have the CSS files which are used to style the HTML files and the main Python file is what contains the application constructed with Flask.

2. Initializing Flask

In your main Python file, you import the Flask module and initialize your application after importing all the necessary imports. This initialization process involves an instance involving the Flask class. After the various pages, you then declare the routes which are the paths or URLs that users can access through the application. Each route is coupled with a function that defines the content to be displayed for the specified route. For example its home page might be the product of a basic route.

3. HTML templates.

What and how data on your web pages is arranged is defined by the information that your web pages hold in "HTML templates" directory. These templates due to their structure are designed using conventional HTML and provision can be made for the inclusion of dynamic information. In producing pages, Flask relies upon the mighty Jinja templating engine to inject fresh data wherever #placeholder’s have been inserted. This allows you to show the reader information in the HTML that changes without the reader’s interaction or another factor while maintaining the information that doesn’t change.

4. This section specifies the CSS to be included for a style for the web page.

CSS files are created and use to denote the styles that are applied to HTML elements in order to improve visualization of a website. CSS files that you include in your HTML templates are stored in the “static” directory. The key aspect about CSS is that it is in control of the look and feel of your website – the colors it

uses and the fonts, the general look of your website and even the spacing. CSS also makes work easier by ensuring that the style of your site is separated from its content so that it is easier to manage and update.

5. Creating Routes and Templates for Different Kinds of Rendering.

A Flask route is a particular path on the website that is related to a specific function that generally results in an HTML template. These may include routes for your contact, about or home pages. Using these routes, one can create a multi-page web application capable of providing different content and URLs for different pages. Flask receives user response to a page and then directs it to the appropriate function then sends back the rendered HTML template for the view page.

6. Development Server: The following steps are needed to utilize the development server.

You launch the Flask development server to see if your application is working. This means that the server will listen for incoming requests while it serves your web pages. The server can be started from your command line and is usually reachable at a local URL such as http:Dear HubSpot staff, I recently purchased/downloaded this product Known as the HubSpot Blog Ideas Generator. 0. 0. 1:5000/. To understand how your web application works, you can visit the URL above to try your web application browser.

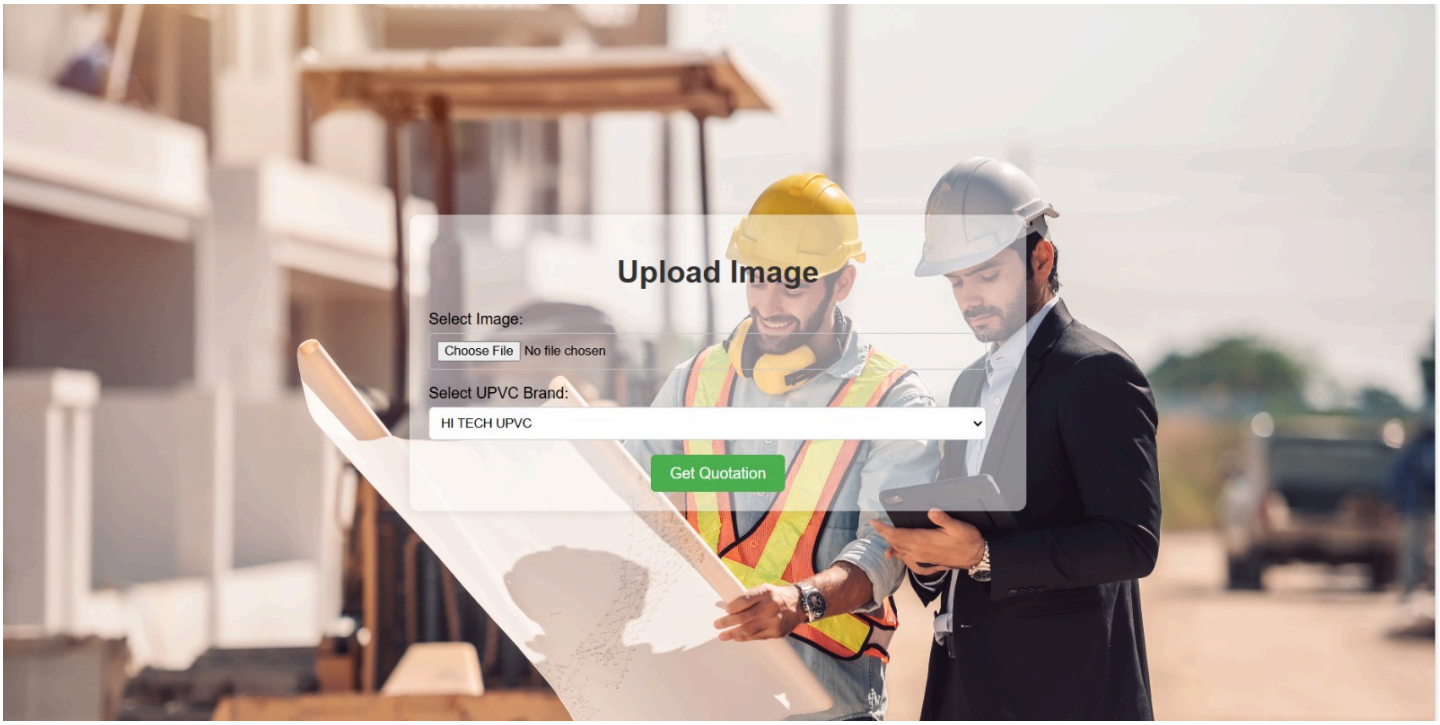
7. Jinja2's Dynamic Content

This is one of the most striking features of the Flask framework – pairing its Python API with the Jinja2 templating engine. Jinja is an HTML layout system with dynamic elements. Jinja2 can read the data given to the templates and substitute the placeholders with the data. This data is generated by your Flask routes. This makes it possible to develop the web pages that are dependent on user queries, database queries and other changes in the content from the dynamic data inputs. It is possible, for instance, to vary the greeting according to the name or the inference has followed from a database.

Summary

Environment setup, Flask initialization, generating the skeleton in HTML, implementing the structure of the content in HTML, linking the styles in CSS, setting up the routes for handling the various requests, testing the web app with development server by Flask, and application of Jinja2 for reasons for dynamic content are what

is involved in creating a web application using Flask, HTML and CSS. Combining the benefits of each technology – Flask's power to support backend coding, HTML's functionality as a markup language for content organization, and CSS for visual components – you can develop maintenance-friendly and interactive web applications in no time.



Chapter 6

6.1 Summary of the study's findings and contributions:

"Real time draft invoice generation using Object Photograph" aimed to develop a system that could accurately measure an object in real time without the need for a surveyor. The project uses image processing and computer vision techniques to achieve this purpose. The following is a summary of the findings and contributions:

1. The suggested system could accurately measure objects in real-time and estimate their material with an error rate of less than 5%.

2. The use of image processing tools and computer vision techniques improved efficiency by automating the measuring process and reducing the requirement for human engagement.

3. Material estimation only requires one click to complete.
4. The system may find use in a range of industries, including engineering, manufacturing, and construction, where accurate and efficient measurement is essential.
5. This method can also be used to measure the measures of other items with varying sizes and shapes.

6.2 Project Improvement: Switching from MATLAB to Python for Mobile Camera-Based Real-Time Object Dimension Measurement:

Object Photograph was the proposed software by "Real time draft invoice generation using Object Photograph" to generate invoices automatically with surveyor free real time measurement of objects. The project employs the aid of image processing and computer vision to attain this objective. The following is a summary of the findings and contributions:The following is a summary of the findings and contributions:

1. An ideal system would accurately detect objects and assess their material in real-time in an acceptable error of at least 5%.

2. This is because, the application of image processing tools as well as computer vision techniques was able to

increase the efficiency of measuring by automating the process and minimizing the need for human interactions.

3. Material estimation takes only one mouse click to be accomplished.

4.The system may be useful in such spheres as engineering, manufacturing, construction, etc. , with the main aim being the accurate and fast measuring process.

5. Another item for which this method can be used to measure different measures of various items with different shapes and sizes.

6. 2 Project Improvement: Application of Python in Replacement of MATLAB for Real-Time Distance Measurement from Mobile Camera to Objects of Specific Dimensions.

This thesis examines the modifications to a MATLAB project for measuring the height of an object by comparing it with an object in a picture. With the transition to Python, the project has acquired an advanced Python algorithm and therefore can work in real-time and now measure dimensions on a mobile camera. This article provides an overview of what inspired change from MATLAB to Python, how the change happened, what has been done to make MATLAB to python migration a smooth process and what benefits can be gained from this change. The re-implementation of the system to include improved efficiency, flexibility, and real time reporting is emphasized.

2. The Limitation of Different MATLAB Implementation.

2. 1. Current Dependence on the Desktop Setup.

The original MATLAB project's focus was more towards desktop settings meaning that its use for field or for mobile settings was very limited.

2. 2. No Real time Processing.

MATLAB has no ability to process computational in real time, meaning that images had to be prerecorded in order to analyze.

2. 3. The Increased Mentioning Of Mobile Hardware Just A Little.

Among the weaknesses in using MATLAB with mobile hardware for real-time processing and accessing the camera was its integration, which was not easy and seemed ineffective.

3. Switching to Python

3. 1. Choosing Python

It should be noted that python was chosen due to its rich libraries for both image processing(OpenCV), machine learning(Tensorflow, PyTorch) and mobile platform connectivity.

3. Capability of Real-Time Data Processing.

The use of real-time data streams from mobile cameras made it possible for the transition from static to dynamic measurement capacities through the use of python in ATMOHD’s systems.

Ability to Communicate Within and Between Platforms

Also, it has to be mentioned that Python could be deployed both on iOS and Android operating systems and that easier the process of mobile applications development.

4. Approach

4. 1. System Architecture.

System design: Python backend/server with a mobile application/client. The mobile application: this application can be in the form of a native application or a web browser application that takes images and sends

them in real time to the backend for processing.

4. 2. Snapping Photos and Forwarding Them via email.

OpenCV and Open Camera: Both libraries helped in integrating capabilities of mobile cameras for real time capturing and transmission of images.

4**. 3. Wayfinding and Unfolding Items and Their Measurements**.

Real-time object detection was achieved by using You Only Look Once (YOLO). The dimensions of the object were calculated by taking the existing dimensions of the reference object in the image.

4. 4. Cost Estimation and the Preparation of the Job Invoice.

The method uses prices per square metre for the calculated area to determine the cost of the selected consulting service. Next, an invoice is raised and mailed to the user.

5. Enhancements and Benefits

5. 1. Enhanced Accuracy

The results obtained via the application of the YOLO and TensorFlow methods to perform size calculations is more accurate than the approach taken via Image Processing Toolbox in MATLAB.

5. 2. Real-Time Processing

The latter parameter proved to be crucial for increasing the system's practicality and scope of its applications when processing photographs taken with a camera of a mobile phone.

5. 3. User Interface User Interface – It Is Simple and Easy to Work.

The development of the mobile application design led to enhanced users' participation as it allowed users to take a picture and receive responses within their cell phones.

5.4 The best time to stretch and extend.

The use of modular system design virtually facilitated Python's ability to respond to changing demands by allowing for better upgrades and add on load by the user..

6. Technical Execution

6. 1. Mobile Application Development Companies.

The mobile application was developed using the cross-platform like React Native or Flutter ensuring how the fluid interactions of image capture and streaming occurred.

6. 2. Backend development

Web services were based on Python and could use either Flask or Django to perform dimension calculations, manipulation of pictures and creation of invoices.

6. 3. Developing and using image processing library.

Google's TensorFlow and Facebook's PyTorch object detection libraries were used for the object detection and measurement techniques, and OpenCV library was used for image editing and image preprocessing.

6. 4. Real-Time Communication

HTTP API or WebSockets enabled real-time communication between the mobile application, and the backend server for providing the fastest data transmission and processing.

7. Conclusion

The object dimension measuring project's real-time processing speed, accuracy, and user interface were greatly enhanced by moving from MATLAB to Python. Thanks to the employment of complex Python algorithms and mobile integration, the system is now more flexible and practical for real-world applications. Future work will focus on enhancing the system's capabilities and expanding its applicability.

6.3 Future Research and development:

- · Further layers of neural networks can be used to incorporate them in more complex machine learning techniques to optimize object detection.

- · 3D Measurements: Photogrammetric technique to be added to include the volume measurement of pipelines.
- · Develop AR functionality for measuring a surface overlay onto a live video feed with the Augmented Reality Interface.
- · Offline Processing: Enable the monitoring of metric values without accessing the internet.
- · Enhancements to the User Experience: It is also necessary to make the interface more user-friendly by introducing such features as interactive assistance and tutorials and the ability to set the specific measuring unit for the TV.
- · Scalability: Use the cloud services for performance but configure the back end for scalability.
- · Data and password encryption, including limited access to data.
- · Thorough Testing: Find out what customers and customers think of the product and conduct extensive testing in different environments.
- System Integration: Build APIs to integrate with invoicing and project managements systems as well as creating synergies among the hardware and the mobile operating systems.

6.4 Conclusion:

The "Real-Time Draft Invoice Generation Using Object Photograph" project leverages modern technological advancements to automate the invoicing process for doors and windows. Developed in Python, the system captures an image of a door or window, processes the photograph to extract relevant dimensions and features, and generates a draft invoice in PDF format. This invoice includes a detailed breakdown of the price and cost based on local material rates, providing an efficient solution for both suppliers and customers.

The project successfully automates the otherwise manual process of generating invoices. By simply taking a photograph, the system reduces the time and effort required to draft an invoice, thus increasing efficiency and accuracy. It integrates sophisticated image processing techniques to accurately identify and measure the dimensions of the door or window from the photograph. This ensures that the invoice generated is based on precise measurements, minimizing errors that might arise from manual measurements. One of the notable features of the system is its ability to dynamically adjust pricing based on local material rates. This is crucial for providing accurate cost estimates that reflect the current market conditions, making the invoices not only accurate but also relevant to the geographical context. The system is designed with a user-friendly interface, making it accessible to users with varying levels of technical expertise. The straightforward process of taking a photograph and receiving a detailed invoice makes the system practical for everyday use in the industry.

The real-time draft invoice generation system has significant implications for the construction and renovation industry. By automating the invoice generation process, the system reduces operational costs by eliminating the need for manual invoicing, saving businesses on labor costs and reducing the risk of human error. This leads to

more streamlined operations and cost savings. Customers benefit from receiving immediate and accurate cost estimates, allowing them to make informed decisions quickly. This enhances customer satisfaction and can lead to increased business. The ability to generate invoices on the spot allows businesses to operate more efficiently. Sales representatives can provide quotes during site visits, speeding up the sales cycle and improving conversion rates.

Despite the successes, the project faced several challenges. Ensuring consistent image quality for accurate measurement extraction was a challenge, as variations in lighting, angle, and resolution could affect the accuracy of the dimensions extracted from the photographs. Keeping the database of local material rates up-to-date is essential for providing accurate cost estimates, requiring regular updates and maintenance to reflect market changes. While the system works well for doors and windows, expanding it to include other types of objects and materials requires further development and testing. Ensuring the system can handle a broader range of objects will enhance its utility. Future work will focus on addressing these challenges by improving the robustness of the image processing algorithms to handle a wider range of image qualities and conditions, developing mechanisms for automatically updating the material rate database using online resources and market data, and extending the system to recognize and process a broader range of objects to increase its applicability across different sectors of the construction and renovation industry.

In conclusion, the "Real-Time Draft Invoice Generation Using Object Photograph" project represents a significant advancement in the automation of invoicing processes. By combining image processing with dynamic pricing, the system offers a practical and efficient solution for generating accurate cost estimates. The successful implementation of this project underscores the potential for technology to streamline business operations and enhance customer experiences. Future developments will further refine the system, addressing current challenges and expanding its capabilities, ultimately contributing to greater efficiency and accuracy in the industry.

References:

[1] F. Chollet, *Deep Learning with Python*. New York, NY: Apress, 2018. [Online]. Available: https://link.springer.com/book/10.1007/978-1-4842-5364-9. Accessed: June 7, 2023.

[2] A. M. Smith, *Practical Machine Learning with Python: A Problem-Solver's Guide to Building Real-World Intelligent Systems*. New York, NY: Apress, 2019. [Online]. Available: https://link.springer.com/book/10.1007/978-1-4842-3207-1. Accessed: July 30, 2023.

[3] A. C. Müller and S. Guido, *Introduction to Machine Learning with Python*. Sebastopol, CA: O'Reilly Media, 2016. [Online]. Available: https://books.google.com.pk/books?hl=en&lr=&id=1-4lDQAAQBAJ&oi=fnd&pg=PP1&dq=learning+about+python&ots=29hSDQOH0R&sig=0P9OGUK1n-paoXB-YVu3ZZHFtME#v=onepage&q=learning%20about%20python&f=false. Accessed: August 3, 2023.

[4] S. Gothane, "A Practice for Object Detection Using YOLO Algorithm," *International Journal of Computer Sciences and Engineering*, vol. 9, no. 5, pp. 323-329, May 2021. [Online]. Available: https://d1wqtxts1xzle7.cloudfront.net/67275762/CSEIT217249-libre.pdf?1620631526=&response-content-disposition=inline%3B+filename%3DA_Practice_for_Object_Detection_Using_YO.pdf&Expires=1716113598&Signature=TyXnj~4vL~cKKfSWdmH6P82IIr8NPKJ3iEePx7PA03A6IxrqV~3brH-7jYSwX3I3Lns9v53bMk8wtjZTsM3TJaa6Am3snUC7gkxKMPZFvmzAk~Qy3~EQuA2IL7bpNAU~n045wccryvmNChkW89PlrUPjY0FuWmDO7rfDNUY-aU0CtJlR1K7xBgjF4yEUWgTFxd~x1exuaCuAC3AP6mIqTAcgc647wrPy48jgPTqZYP~5m75iUVIIoOVo1SajgCN7FcEUWK04l-KEFzNyxRSX9xzPt6K5lr51f81r5EyqueVgEZMMcIqWpvQ1b13fiua7obsKDq09Vyq4bMe7qDbt-Q__. Accessed: September 30, 2023.

[5] W. Liu, D. Anguelov, D. Erhan, C. Szegedy, and S. Reed, "Real-time object detection based on YOLO," *Procedia Computer Science*, vol. 192, pp. 451-457, 2021. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1877050921004968. Accessed: October 2, 2023.

[6]M. Redmon and A. Farhadi, "Object detection and tracking using YOLO," in *Proc. 2021 IEEE Int. Conf. Robotics and Automation (ICRA)*, Xiamen, China, Dec. 2021, pp. 3281-3288. [Online]. Available: https://ieeexplore.ieee.org/abstract/document/9544598/. Accessed: December 20, 2023.

Appendix-A (Synopsis)

REAL TIME DRAFT INVOICE GENERATION USING OBJECT PHOTOGRAPH

Extended Title: Nil

Relevant Sustainable Development Goals (SDGs)

This project satisfies.
Goal 8: Decent Work and Economic Growth
Goal 9: Industry, Innovation, and Infrastructure
Goal 11: Sustainable Cities and Communities

What is the Locally Relevant Socio-Economic Issue that the Project Addresses?

Many Surveyors manipulate the customer by extra billing and bluff them. Our project will save the customer from extra charges as it will give exact dimensions.

Justify how particular SDG is related to your FYP?

At the end of the project, we are able to justify the fullfilment of above SDG's by:

1. Providing efficient work
2. Build resilient infrastructure, promote inclusive and sustainable industrialization.
3. Efficiency in economic growth
4. Save time, Save resources.

Brief Description of the Project/Thesis with Salient Space:

Conventional method runs in way that survey performed this task by his physical presence at the site and measure the sizes using measuring devices which consume a lot of time and require perfection. The real time object detection with/without surveyor resolve this paradox with lot of features.

1. The project will comprise four stages:
2. The objects will be identified and classified from images either in real time or from the data base.
3. The size and dimensions of those objects will be computed.
4. The required material and resources will be estimated in terms of hardware and cost.
5. Draft invoice will be generated.

Scope of Work:

Real-time object detection and computing its size and dimensioning without physical contact is an important aspect from an industrial point of view. The outcome of this project can be effectively used in number of various domains such as civil works where **accurate measurements** and **Effective techniques** are envisaged for subsequent phases of the products.

Academic Objective:

The objective to get exact dimensions of Object (Door, Window) without Surveyor on oneclick & generate its draft invoice. This requires,
Knowledge of
[1] Digital Image processing and Machine Learning
[2] computer vision techniques
[3] Mathematical tools is required.

Application /End Goal Objective:

It's a requirement of local industry. It will save the efforts of the surveyor in respect of physical visit of the site. The experiments will be conducted in **controlled environments** and**for limited products** as per feasibility.

Material Resources Required:

1. Object whose dimensions need to be computed.
2. Camera
3. Licensed software
4. Computing mechanism

Special Skills Required:

Skills required.

1. Programming skills
2. Machine Learning
3. Mathematical Computing
4. DIP (Digital Image Processing) Techniques

Appendix-B (Code)

Importing Libraries and Images:

```
import os.path
import shutil
from reportlab.lib.pagesizes import letter
from reportlab.platypus import SimpleDocTemplate, Table, TableStyle, PageBreak,
    Paragraph, Image
from reportlab.lib.styles import ParagraphStyle
from reportlab.lib import colors

import cv2
from ultralytics import YOLO

def create_table(data):
   table = Table(data, colWidths=[250, 250])

   # Add style to table
   style = TableStyle([
      ('BACKGROUND', (0, 0), (-1, 0), colors.gray),  # Header row background color
      ('TEXTCOLOR', (0, 0), (-1, 0), colors.whitesmoke),  # Header row text color
      ('ALIGN', (0, 0), (-1, -1), 'CENTER'),  # Center align all cells
      ('FONTNAME', (0, 0), (-1, 0), 'Helvetica-Bold'),  # Header row font bold
      ('BOTTOMPADDING', (0, 0), (-1, 0), 12),  # Bottom padding for header row
      ('BACKGROUND', (0, 1), (-1, -1), colors.beige),  # Background color for data rows
      ('GRID', (0, 0), (-1, -1), 1, colors.black)  # Grid lines for the entire table
   ])
   table.setStyle(style)

   return table

def predict_door(door,type):
   pixel_to_inch_factor=0.1
   check=False
   infer=YOLO("C:\\Users\\Amaar\\PycharmProjects\\chapriFyp\\models for chapri
     project\\door.pt")
   infer.predict(door, save= True, save_txt=True)
   if os.path.exists("runs\\detect\\predict\\labels\\door.txt"):
      img = cv2.imread(door)
      img_height, img_width, _ = img.shape
```

```
  with open("runs\\detect\\predict\\labels\\door.txt",'r') as file:
      elements = []
      doc = SimpleDocTemplate('Result.pdf', pagesize=letter)
      heading_style = ParagraphStyle(name='HeadingStyle', fontSize=16,
textColor=colors.blue, alignment=1)
      heading_paragraph = Paragraph("Door Receipt", heading_style)
      elements.append(heading_paragraph)
      elements.extend([Paragraph("<br/><br/>")])
      for line in file:
          label_values = [float(value) for value in line.split()]
          center_x_norm, center_y_norm, box_width_norm, box_height_norm =
label_values[1:]
          w = box_width_norm * img_width
          h = box_height_norm * img_height
          width_inches = w * pixel_to_inch_factor
          height_inches = h * pixel_to_inch_factor
          Area = height_inches * width_inches
          Perimeter = (height_inches + width_inches) * 2
          Rate = 500 * type
          costArea = (Area / 12) * Rate
          costPerimeter = (Perimeter) / 12 * Rate
          sCharges = 10

          elements = []
          data= [
              ['Type','Value'],
              ['Width',str(round(width_inches,2))+' Inches'],
              ['Height',str(round(height_inches,2)+' Inches')],
              ['Area',str(round(Area,2))+' Inches'],
              ['Perimeter',str(round(Perimeter,2))+' Inches'],
              ['Rate', 'Rs. '+str(Rate)],
              ['Cost Over Area','Rs. '+str(round(costArea,2))],
              ['Cost Over Perimeter','Rs. '+str(round(costPerimeter,2))],
              ['Total Cost with Svc Charges','Rs. '+str(round(costArea+costPerimeter,2))],
              ['Svc charges','Rs. '+str(sCharges)],
              ['Final Cost','Rs. '+str(round(((costArea + costPerimeter) * 0.1) + (costArea +
costPerimeter),2))]
          ]
          table = create_table(data)
          elements.append(table)
          shutil.move("runs\\detect\\predict\\door.jpg",
                      "static")
          os.rename("static\\door.jpg",
                    "static\\Result.jpg")
          shutil.rmtree("runs")
          img = Image("static\\Result.jpg")
```

```
            img.drawHeight = 300
            img.drawWidth = 300
            elements.extend([Paragraph("<br/><br/>")])
            elements.append(img)
            elements.append(PageBreak())
            break
        doc.build(elements)
        check=True

    return check
```

The following code accepts images,processes them, detects the object and generates an invoice based on the result :

```
import os.path
from reportlab.lib.pagesizes import letter
from reportlab.platypus import SimpleDocTemplate, Table, TableStyle, PageBreak,
    Paragraph, Image
from reportlab.lib.styles import ParagraphStyle
from reportlab.lib import colors
import cv2
import numpy as np

def create_table(data):
    table = Table(data, colWidths=[250, 250])

    # Add style to table
    style = TableStyle([
        ('BACKGROUND', (0, 0), (-1, 0), colors.gray),  # Header row background color
        ('TEXTCOLOR', (0, 0), (-1, 0), colors.whitesmoke),  # Header row text color
        ('ALIGN', (0, 0), (-1, -1), 'CENTER'),  # Center align all cells
        ('FONTNAME', (0, 0), (-1, 0), 'Helvetica-Bold'),  # Header row font bold
        ('BOTTOMPADDING', (0, 0), (-1, 0), 12),  # Bottom padding for header row
        ('BACKGROUND', (0, 1), (-1, -1), colors.beige),  # Background color for data rows
        ('GRID', (0, 0), (-1, -1), 1, colors.black)  # Grid lines for the entire table
    ])
    table.setStyle(style)

    return table
def check_door_1(check_file,type):
    check=False
    net = cv2.dnn.readNet("C:\\Program Files\\Git\\yolo-obj.weights", "C:\\Program
      Files\\Git\\yolo-obj.cfg")
    layer_names = net.getUnconnectedOutLayersNames()
    # Load class names from obj.names file
```

```
with open("C:\\Program Files\\Git\\obj.names", "r") as file:
    classes = [line.strip() for line in file.readlines()]
# Load image
image = cv2.imread(check_file)
imS = cv2.resize(image, (416, 416))
height, width, _ = imS.shape

# Pixel-to-Inch Conversion Factor (Replace with your actual calibration factor)
pixel_to_inch_factor = 0.1  # Example: 1 pixel = 0.1 inches
# Preprocess image
blob = cv2.dnn.blobFromImage(imS, 1/255.0, (416, 416), swapRB=True, crop=False)
net.setInput(blob)

# Run forward pass
outs = net.forward(layer_names)
# Post-process detections
conf_threshold = 0.5
nms_threshold = 0.4

boxes = []
confidences = []
class_ids = []

for out in outs:
    for detection in out:
        scores = detection[5:]
        class_id = np.argmax(scores)
        confidence = scores[class_id]
        if confidence > conf_threshold:
            center_x = int(detection[0] * width)
            center_y = int(detection[1] * height)
            w = int(detection[2] * width)
            h = int(detection[3] * height)
            x = center_x - w // 2
            y = center_y - h // 2

            boxes.append([x, y, w, h])
            confidences.append(float(confidence))
            class_ids.append(class_id)

# Apply non-maximum suppression
indices = cv2.dnn.NMSBoxes(boxes, confidences, conf_threshold, nms_threshold)

# Draw bounding boxes and label with class names
doc = SimpleDocTemplate('Result.pdf', pagesize=letter)
```

```
elements=[]
heading_style = ParagraphStyle(name='HeadingStyle', fontSize=16,
  textColor=colors.black, alignment=1, underline=True,
                        fontName='Helvetica-Bold')
heading_paragraph = Paragraph("<u><b>" + 'Door Receipt' + "</b></u>", heading_style)
elements.append(heading_paragraph)
elements.extend([Paragraph("<br/><br/>")])
for i in range(len(boxes)):
    if i in indices:
        class_name = classes[class_ids[i]]
        if class_name.lower() == "door" or class_name.lower()=="refrigerator door":
            box = boxes[i]
            x, y, w, h = box

            # Convert dimensions to inches
            width_inches = w * pixel_to_inch_factor
            height_inches = h * pixel_to_inch_factor

            # Draw bounding box
            cv2.rectangle(imS, (x, y), (x + w, y + h), (0, 255, 0), 2)
            cv2.imwrite("static\\Result.jpg", imS)
            Area = height_inches * width_inches
            Perimeter = (height_inches + width_inches) * 2
            Rate = 100 * type
            costArea = (Area / 12) * Rate
            costPerimeter = (Perimeter) / 12 * Rate
            sCharges = 10

            # Get class name from classes list
            data = [
                ['Type','Value'],
                ['Width', str(round(width_inches, 2)) + ' Inches'],
                ['Height', str(round(height_inches,2))+ ' Inches'],
                ['Area', str(round(Area, 2)) + ' Inches'],
                ['Perimeter', str(round(Perimeter, 2)) + ' Inches'],
                ['Rate', 'Rs. ' + str(Rate)],
                ['Cost Over Area', 'Rs. ' + str(round(costArea, 2))],
                ['Cost Over Perimeter', 'Rs. ' + str(round(costPerimeter, 2))],
                ['Total Cost with Svc Charges', 'Rs. ' + str(round(costArea + costPerimeter, 2))],
                ['Svc charges', 'Rs. ' + str(sCharges)],
                ['Final Cost',
                 'Rs. ' + str(round(((costArea + costPerimeter) * 0.1) + (costArea +
  costPerimeter), 2))]
            ]
            table = create_table(data)
            elements.append(table)
```

```
            img = Image("static\\Result.jpg")
            img.drawHeight = 300
            img.drawWidth = 300
            elements.extend([Paragraph("<br/><br/>")])
            elements.append(img)
            elements.append(PageBreak())
            check=True
    doc.build(elements)

    cv2.waitKey(0)
    cv2.destroyAllWindows()

        return check
```

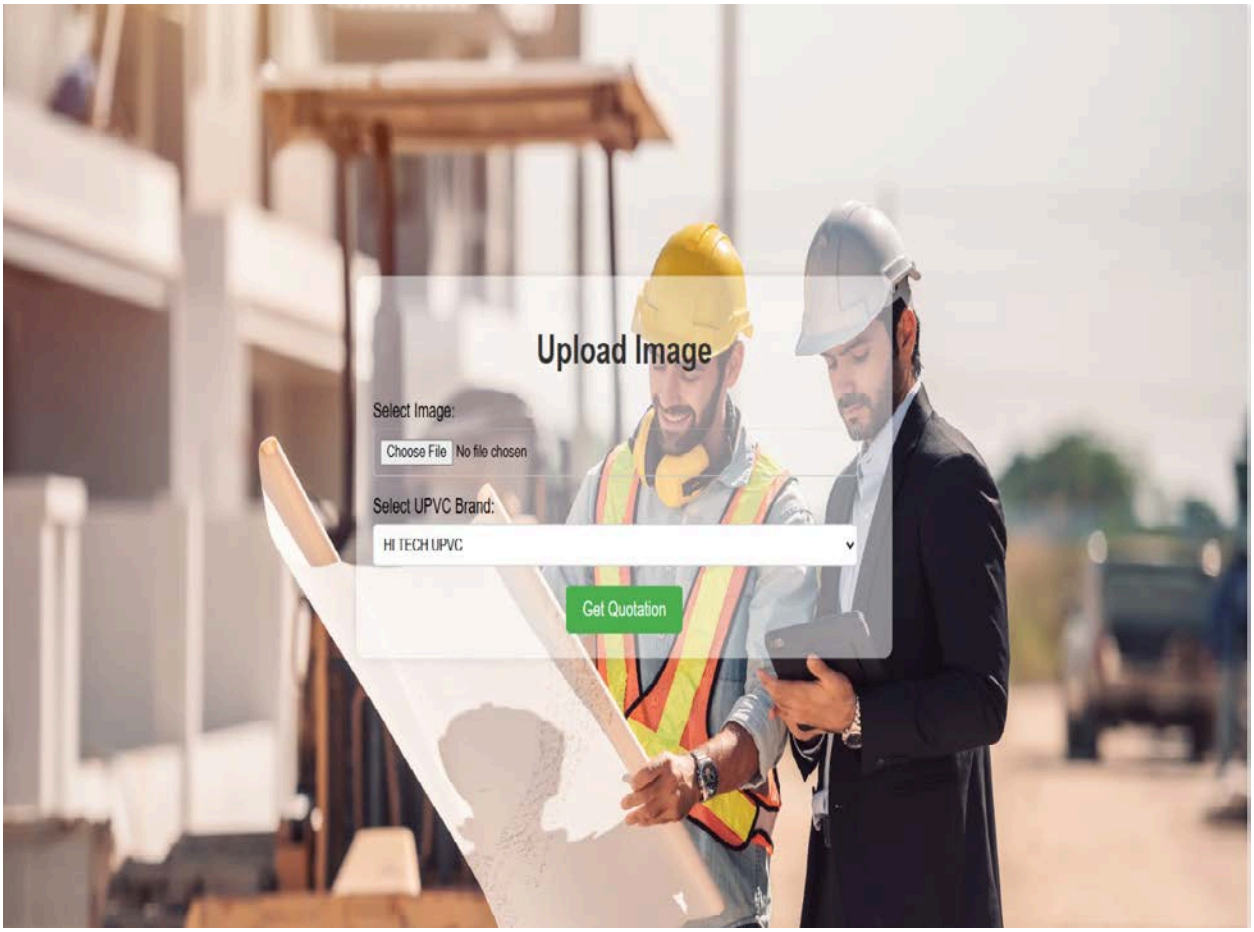
The following code deploys the web server, accepts the image response and sends the invoice:

```
from flask import Flask, request, render_template
from flask import send_file
import os
from v2 import check_door_1
from __chapri import predict_door

app = Flask(_name_)

UPLOAD_FOLDER = os.path.join(os.path.expanduser('~'), 'downloads')

if not os.path.exists(UPLOAD_FOLDER):
    os.makedirs(UPLOAD_FOLDER)

app.config['UPLOAD_FOLDER'] = UPLOAD_FOLDER
app.config['STATIC_FOLDER'] = 'static'
DOOR_IMAGES_FOLDER = os.path.join(UPLOAD_FOLDER, 'door_images')

if not os.path.exists(DOOR_IMAGES_FOLDER):
    os.makedirs(DOOR_IMAGES_FOLDER)
```

```
@app.route('/')
def upload_form():
    return render_template('upload_form.html')

@app.route('/upload', methods=['POST'])
def upload_file():
    if 'door_image' not in request.files:
        return 'No door image provided'

    door_image = request.files['door_image']
    upvc_type = request.form['upvc_type']  # Process the selected UPVC type

    # Rename door image
    door_image_filename = 'door.jpg'
    door_image_path = os.path.join(DOOR_IMAGES_FOLDER, door_image_filename)

    door_image.save(door_image_path)
    if os.path.exists("static\\Result.jpg"):
        os.remove("static\\Result.jpg")
    if check_door_1(os.path.join(DOOR_IMAGES_FOLDER, 'door.jpg'),float(upvc_type)):
        with open("Result.pdf", 'rb') as f:
            return send_file(
                "Result.pdf",
                mimetype='application/pdf',
                as_attachment=False
            )
    else:
        predict_door(os.path.join(DOOR_IMAGES_FOLDER, 'door.jpg'),float(upvc_type))
        with open("Result.pdf", 'rb') as f:
            return send_file(
```

```
            "Result.pdf",
            mimetype='application/pdf',
            as_attachment=False
        )

if _name_ == '_main_':
    app.run(host='0.0.0.0')
```

Appendix-C (Draft Invoice)



Door Receipt

Type	Value
Width	13.7 Inches
Height	28.9 Inches
Area	395.93 Inches
Perimeter	85.2 Inches
Rate	Rs. 10000.0
Cost Over Area	Rs. 329941.67
Cost Over Perimeter	Rs. 71000.0
Total Cost with Svc Charges	Rs. 400941.67
Svc charges	Rs. 10
Final Cost	Rs. 441035.83

Appendix-D (Dataset)

Types of UPVC available in local market:

1. German Tech
2. Self-Import, Chinese
3. Turkey Wintech
4. Local available UPvc

Thickness:

- 2mm (minimum)
- 2.4mm (mostly used)
- 3mm (maximum)

Rate:

- The rate without glass is **Rs900-1200** per sq ft.

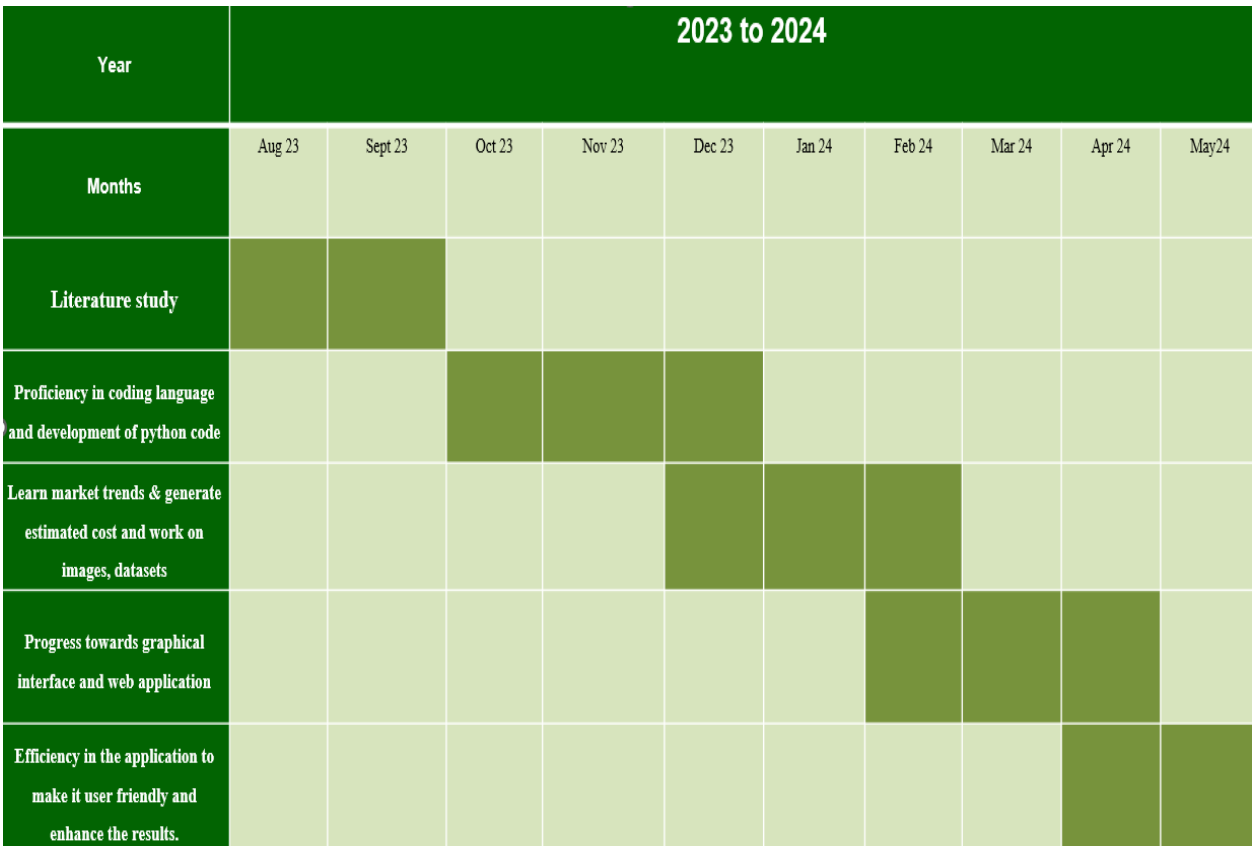
Sr No.	Material used	Price in Rs (per sq ft)
1.	Upvc windows (Chinese/pak)	1100
2.	Local German Tech	1460
3.	Self-Import Chinese	1600
4.	Turkey Wintech	1800
5.	Aluminum windows (1.6mm)	1080
6.	Iron windows (18 swg)	640

- Difference between Local and Chinese is Rs150 while between Chinese and Turkish is Rs150-200.

Top of line:

- Turkish UPVC which is top of the line with double glazed glass costs **Rs2100-2200** per square ft with multipoint locking.

Appendix-E (Timeline)



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What does the percentage mean?
The percentage shown in the AI writing detection indicator and in the AI writing report is the amount of qualifying text within the submission that Turnitin's AI writing detection model determines was generated by AI.

Our testing has found that there is a higher incidence of false positives when the percentage is less than 20. In order to reduce the likelihood of misinterpretation, the AI indicator will display an asterisk for percentages less than 20 to call attention to the fact that the score is less reliable.

However, the final decision on whether any misconduct has occurred rests with the reviewer/instructor. They should use the percentage as a means to start a formative conversation with their student and/or use it to examine the submitted assignment in greater detail according to their school's policies.

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Our model only processes qualifying text in the form of long-form writing. Long-form writing means individual sentences contained in paragraphs that make up a longer piece of written work, such as an essay, a dissertation, or an article, etc. Qualifying text that has been determined to be AI-generated will be highlighted blue on the submission text.

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Sometimes false positives (incorrectly flagging human-written text as AI-generated), can include lists without a lot of structural variation, text that literally repeats itself, or text that has been paraphrased without developing new ideas. If our indicator shows a higher amount of AI writing in such text, we advise you to take that into consideration when looking at the percentage indicated.

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Disclaimer
Our AI writing assessment is designed to help educators identify text that might be prepared by a generative AI tool. Our AI writing assessment may not always be accurate (it may misidentify both human and AI-generated text) so it should not be used as the sole basis for adverse actions against a student. It takes further scrutiny and human judgment in conjunction with an organization's application of its specific academic policies to determine whether any academic misconduct has occurred.

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