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Box Volume Measurement using Camera and ArUco Marker

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Abstract: *This paper presents a volume measurement system based on image processing. The suggested plan offers reasonable costs, good accuracy, and convenience of manpower. The extra specifications like item alignment during measurement and putting the objects at a specific Place in the measurement area. Instead of using a single cell phone for the measurement, two cameras will be used, each of which will be positioned on a different plane to increase precision. To speed up processing, the application will be created on an Android platform and only be available on mobile devices. For precise measurement, images will be taken from two distinct perspectives (one from a top view and the other from a side view). First, a calibration procedure tailored to the problem at hand was carried out, and after that, the Hough transform was used throughout the image processing stage. The proposed method gives a rough volume measurement for objects with random shape even though it was originally designed to assess the volume of box-type objects. The system will yield satisfactory results when tested with different external disturbances.*

Keywords: Volume, Measurement, Camera, Specification, Mobile device

I. INTRODUCTION

In order to save time and money, logistics firms and postal service providers are interested in volume measurement devices. Non-destructive measurement systems, which are mostly based on image processing techniques, have become the focus of this field's trends. Various Hardwares such laser-based sensors, infrared sensors, stereo systems, and acoustic systems are currently in use. Laser sensors are essentially a combination of expensive 2D laser scanners and point lasers. Inaccurate calculations may result from misalignment between the reference and the package in these systems. Another significant issue with these measuring techniques is package surface deformation. The precision should be improved by adding more sensors. Using a point laser source and camera together, volume can also be measured on a moving platform. Studies using these sensors for volumetric analysis have been conducted using this strategy, which is also employed in 3D laser scanners. measured across numerous research. The study presented in has been able to offer measurements that are precise to within 1 mm. Applications for measuring volume also use camera-based techniques. Stereo camera and structured light systems can be categorized as image-based volume measurement methods. A pair of calibrated cameras' depth data is used by stereo systems. An illustration of such a study is given. The volume and location of a box were measured by the authors using two calibrated cameras. To create the 3D model, they estimated the box's border's vanishing points. These systems' measuring accuracy is dependent on depending on a number of variables, including accurate stereo calibration, image resolution, and camera and lens quality. Moreover, different visible light conditions may negatively impact such systems. As a result, environments where artificial light sources are used to manipulate the amount of light are often necessary for camera-based systems.

1.1 Motivation

The idea of measuring the volume of box using only camera and aruco marker is unique because the same machine is available in market but with very complex structure. It is very rare but relevant topic considering the scenario, so the curiosity regarding the study proof to be an eminent source of motivation This product is available for very high cost. Hence only large capital intensive business are using these systems. So, to provide this product with good accuracy at low cost we are developing this system. To reduce time and bring the time to measure and calculate single object from minutes down to seconds. All these types of system which are available in market are “made in foreign” product. So,

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this will be the first indian system for measuring and calculating objects volume. Small scale industries cannot afford such system due to very high cost of machine which leads to low productivity and more man power. So, to overcome these problems we are trying to built low cost machine which will work same.

1.2 Need of the Topic

Measurement and calculation of any object using labour will take approximately 2-3 min per object but using this application it can be done within 2-3 sec. To eradicate human error and maintain accuracy and efficiency, this system will be helpful. To reduce paper or any physical resources, this system uses cloud services to decrease the usage of physical resources. This system will be cost effective with respect to other such volume measurement system which are costly and require lots of hardware and real-estate. If this low cost system is available in market then it will directly contribute to the country's GDP which will make the country economically stronger.

In present scenario, the machines which are available are of high cost due to which small scale business, start-ups, etc. are not able to afford it and hence it is the biggest obstacle in their revenue generation and efficiency in the work. So, to overcome these difficulties there is need of such low cost machines which can do the same work as the previous machines are doing. This system will eliminate the human error in measurement. Since we are using cloud services it will also reduce the consumption of the paper and physical infrastructure. This system will be cost effective with respect to other such volume measurement System which are very expensive.

II. LITERATURE SURVEY

According to [1] a brand-new supervised learning model that can measure the aruco marker displacement. This paper has helped us understand the basis and composition of aruco marker and how we can use it instead of other sensors to obtain the distance between the object and the camera in a image.

According to [2] the volume measurement of a box was done using Kinect sensor. The output of this project and our project is very similar and the aim is also similar it's the approach which is different. This paper helped us understand the methodology of camera calibration and how images are preprocessed to generate accurate results. This project uses Hough transform to make the transformation neutralization and then process the images and get the output.

According to [3] the desired result is obtained through image processing and laser. In this approach a sony camera us used with 2 lasers to measure the dimensions of objects and then calculate the volume. This paper helped us understand the image processing algorithms and working and how a camera is calibrated. The 2D image understanding and plotting. Object detection an zooming.

III. PROPOSED METHODOLOGY

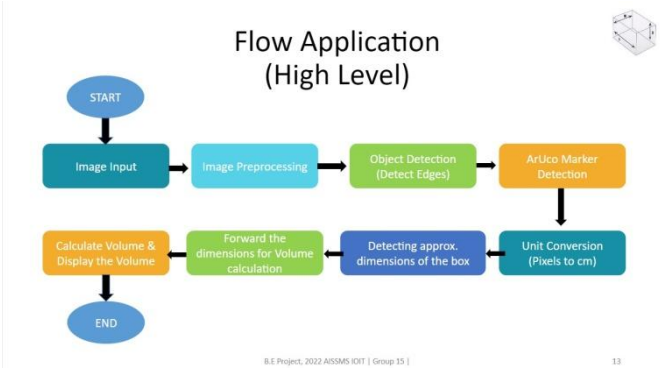

Figure 3.1: Process Flow

[Refer Fig.3.1]The system starts by taking two images as input in jpeg/jpg format. Then the image is preprocessed (i.e. checking if the resolution is correct, image gray scaling, etc.). The next important step is to detect the objects in the image, this is done by Haar cascade Algorithm which is running underneath OpenCV, which detects the objects and detects the ArUco marker here the object boundaries are identified from the grayscale image and the ArUco marker is also detected. Now the ArUco package from OpenCV lib works and detects which ArUco marker is present. Then the boundary corners are marked by the ArUco marker and object and the pixel distance is measured. This pixel distance is

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then converted to centimeters by a formula. This returns the height and width of the object and ArUco marker. The above procedure is performed on two images simultaneously and the values are obtained. Then the common side is neutralized and we get the dimensions of the three edges of the box. These obtained dimensions are then multiplied and the volume is calculated.

IV. CONCLUSION

The model proposed in this paper is used for measuring the volume of the object. In traditional method it was not possible to measure the volume of objects through camera of devices like mobile phones. With the help of our model we can measure the area of an object with our device cameras.

We have used the Aruco marker in our project for object detection. With the help of Aruco marker we can nullify the distance between camera and the object.

We attempted and detected the objects of different dimensions. We have designed web page where images of an object are to be uploaded. The image is first selected and then validated. If the image is not in required format then error message is displayed for the same and if image is perfect then its name is replaced by its respective GUID. These images are stored in S3 bucket from there they are retrieved efficiently and effectively.

The dimensions of various objects are detected with 98-99% accuracy.

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