

# Structural Work (Site Work) Completion using Image Processing

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**Abstract:-** In the field of construction, it is not possible to predict or analyse the time needed for the completion of the work. The idea procured after coming across the difficulties faced by construction site employees (beginners) to compute the time needed for the completion of the task. To tackle this challenge, we decided of giving all standards rules of basics of construction to an application and let it work of completion recognition using image processing. This would relieve users who have less experience and knowledge from asking for professional help. The challenge of accurately interpreting completion of the task and producing an application that recognises and predicts the estimated time for completion of the work. The ARKit application with matching algorithm is a form of Apple's Augmented Reality (AR) development platform for iOS mobile devices. Based on the algorithm by Boyer-Moore algorithm for string matching, this algorithm is used for the calculation of the estimated time required for the completion of the work and the daily wages labour payment. Our findings led to conclusion that research in this field has not yet been started and no algorithms have been written with respect to this field. But there are few systems which have been implemented using ARKit and currently in testing phase.

## I. INTRODUCTION

Image Processing using ARKit systems are designed to recognise a particular work site, captured by the camera of a handheld mobile device and predicts the estimated time needed for the completion of the work and calculating the daily wages. A professional user can easily predict with it's years of experience in this field.

Image processing using ARKit works in four general steps i.e., Image Sets, collection of necessary image sets, image processing based on ARKit module or library and shape classification. It then calculates the estimated time needed for the completion of the work and calculation of the daily wages. This application will be in scope for any users who wants to calculate the time needed and payment of the daily wages.

## II. DATA COLLECTION

Everyday routine handheld device camera can be used for capturing images, image processing technique requires image data collection parameters concerned are aspect ratio, orientation must be taken care. Further study depicts how above parameters are handled with the introduction of Augmentation Reality for Image Processing.

## III. IMAGE PROCESSING USING AUGMENTATION REALITY

Image processing[1] in this course of study refers to interpreting the real world in the form of numeric or symbolic data that can be used for computation or estimation of work and time[2], [3]. The main goal of Image processing phase is to adjust the scanned image of structural work to bring about the recognition process to be more robust and efficient.

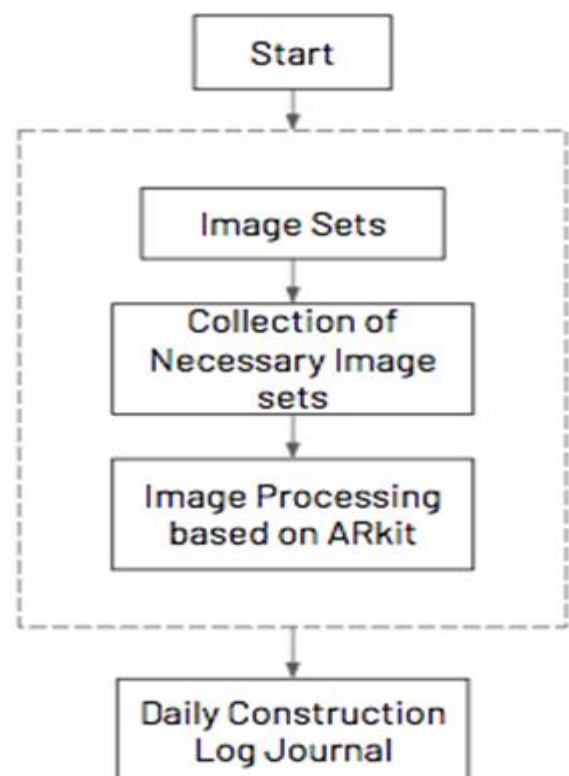


Fig 1:- Image Processing using ARKit

The above algorithm can be compared with Haar Cascade algorithm[8], A Haar Cascade is basically a classifier which is used to detect the object for which it has been trained for, from the source. The Haar Cascade is trained by superimposing the positive image over a set of negative images. The training is generally done on a server and on various stages. Better results are obtained by using high quality images and increasing the amount of stages for which the classifier is trained. YOLO[9] is an extremely fast real time multi object detection algorithm. YOLO stands for “You Only Look Once”. The algorithm

applies a neural network to an entire image. The network divides the image into an S x S grid and comes up with bounding boxes, which are boxes drawn around images and predicted probabilities for each of these regions.

ARkit[4] does not involve generic algorithm on real-time detection. Different methods are typically used such as Image sets, Collection of necessary image sets, image processing using ARKit. The most crucial step is ARKit, the resulting phase will create an auto-generated Construction Log Journal.

Algorithm	Area (in meters)	Accuracy	Complexity & processing rate	Set-time (in minutes)
Haar Cascade	500	89%	Very Low	18
YOLOv3	500	90%	Normal	10
ARkit Algorithm	500	98%	High	2

Table 1:- Comparison between different matching algorithm

**IV. CONSTRUCTION LOG BOOK**

A Construction Log Journal/Book is a daily documentation that must be maintained by a Junior

Supervisor. The purpose of having a Construction Log Book is to reduce the traditional means of handwritten documentation and pushing it on the corresponding Cloud account.

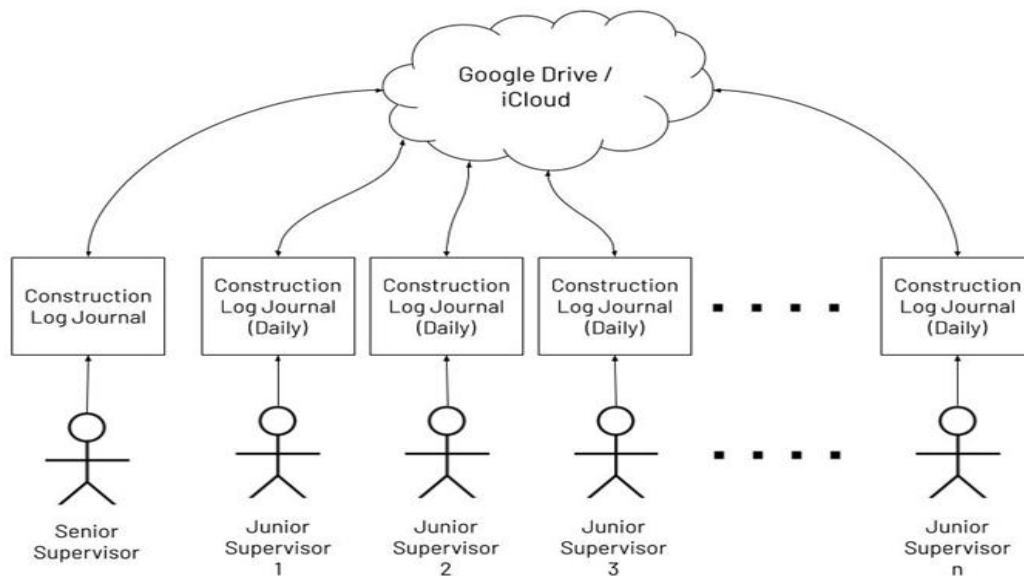


Fig 2:- Construction Log Book over Cloud.

**V. CALCULATION**

The concept of Phase II is to produce a detailed estimation of the time needed to complete the work in real-time. The main focus in computation of distance is use a handheld mobile device rear camera for real-time experience[5].

Reality technology can be used to create real-time AR experience using devices rear or front camera.

The main algorithm being developed for ARKit, Augmentation Reality (AR) describes user experience that maps 2 dimensional or 3 dimensional to live using the devices rear or front camera in such a way that makes elements appear to inhabit in real world. Augmentation

The main concept in ARKit is the ARWorldTrackingConfiguration[6] which provides AR experiences using the rear camera of the device. ARWorldTrackingConfiguration tracks the devices orientation and position and detect the surroundings. A gyroscope, a sensor in smartphones provides more detailed description about the device’s orientation which are usually described as rotational axis (roll, pitch and yaw) and translation axis (x, y and z).

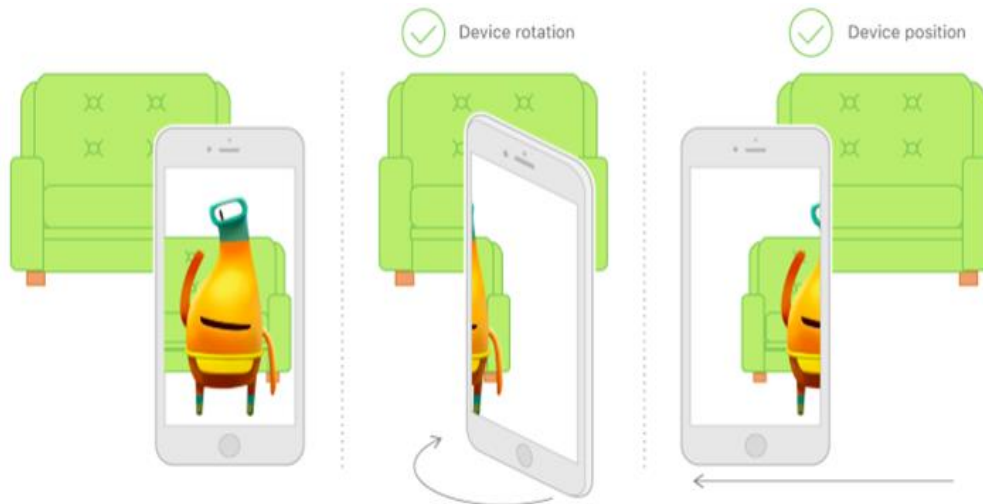


Fig 3:- ARWorld Tracking Configuration maintains device's illusion regardless of rotation or movement.

Using the concept of ARKit's ARWorld Tracking Configuration, the algorithm basically uses a set of nodes (Source node and destination node). Figure 3, indicates the distance computation from source node to destination node and these nodes are manually placed[7].



Fig. 4. Distance Computation from Source node to Destination node.

As mentioned earlier, the algorithm is based on Augmentation Reality experiences for Image Processing. Basically, the Source node (Start Node) and Destination Node (end node) are two separate functions but are somewhat similar in context.

## VI. CONCLUSION

This research shows that a handheld mobile devices single camera can be used in real-time to determine the measurement with precision of 95-100% and compute the estimated time for the completion of the work. With the advancement in the field of Image Processing traditional techniques like OpenCV, Scikit etc. Augmentation Reality can be used for many indoor and outdoor environments for many other motion or detection algorithms.

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