SHIP BLOCK ARRANGEMENT SYSTEM BASED ON IMAGE PROCESSING

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ABSTRACT... This paper proposes an image based method for arranging ship blocks in a dockyard. The problem of appropriately arranging numerous blocks has to be carefully planned because it has close relation to the effectiveness of the whole working process. To implement the system, the block shape and feature points have to be obtained from block image. The block arrangement system can be implemented by the fusion of the block shape extraction and image matching technology.

KEY WORDS: Ship Block, Image Matching, Block Arrangement

1. INTRODUCTION

The ship block which is the base unit for assembling the ship in a dockyard is made up the iron material; it is large iron construction with 15m × 15m size. The problem of appropriately arranging numerous blocks has to be carefully planned because it has close relation to the effectiveness of the whole working process.

When a block is arranged, the information about block arrangement DB of the yard and the shape of the block are very important in order to reduce the movement which is not planned of a transporter, a trailer carrying blocks.

However, because the block arrangement process at a dockyard is dependent on the experience of the arrangement administrator and judgment of TP driver, the movement of TP which is not planned is frequent.
The research for utilizing the general positioning sensor in order to solve this kind of a problem is in progress but it doesn't still come out in the clear solution.

This paper proposes the block arrangement method based on image recognition that can obtain the practical result. This system is divided into two major subsystems, acquisition of block shape and estimation of block position. The overview and detail explanation of the system are described on chapter 2.

2. BLOCK ARRANGEMENT SYSTEM

2.1 Overview

This system is for making in advance with determination whether the block can be appropriately arranged to the stacked place or not. Therefore, the system can prevent the error which can be generated when a block is arranged to the yard.

Presently, because the block arrangement manager is making determination by using only the block arrangement DB on the yard and block dimension, occasionally, the space for arranging a block is not secured.

In order to solve the problem, there is the attempt to judge the location of a block by using GPS or the optical wave device, and etc. after unloading a block from TP. However, because the block is made up iron materials, the equipment using an electric wave had a lot of the case of getting the result which is not good.

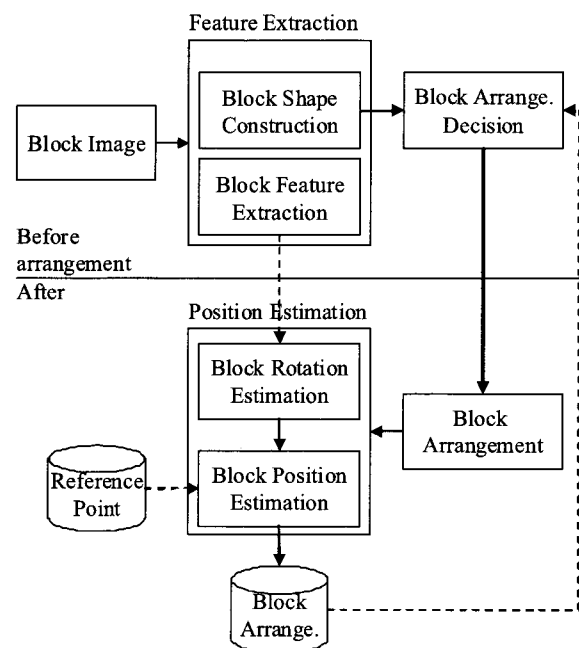Figure 1 shows the structure diagram of the proposed block arrangement system.

Figure 1. Image based Block Arrangement System

The proposed system is composed of two subsystems. One manages two functions before loading a block; block shape and feature point extraction. Another manages also two functions after unloading a block; rotation degree of a block and estimation of block position.

Each function will be explained in the section 2.2 and 2.3.

2.2 Block Shape and Feature Extraction

2.2.1 Block Shape: The shape extraction of a block is the task that has to be most preceded for the block arrangement. In this time, we must decide what a part of a block is photographed to extract a shape. The matter which has to be most considered when a block is arranged is the breadth of a block. That is due to be the essential element for determining whether a block can be arranged to space of the adjacent block or not.

Therefore, it is necessary to have the top view image in order to extract the breadth in block shape. Sometimes it needs to have a stereo camera to generate a 3D shape in block image, but if it processes with 2D type, it is sufficient even if the single camera is used.

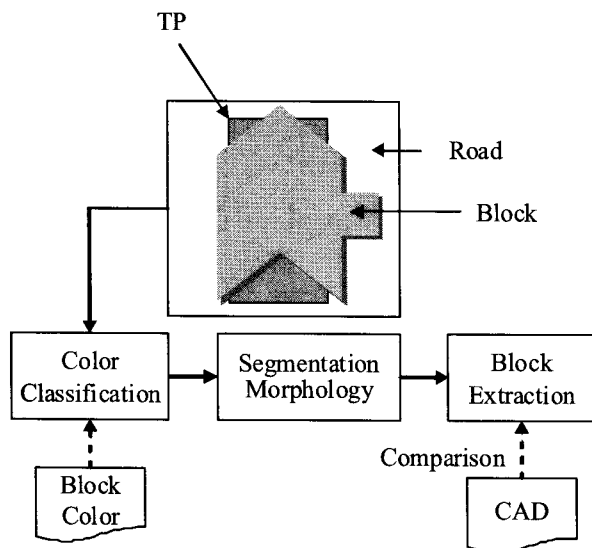Figure 2 shows the procedure for extracting a block shape in block image.

Figure 2. Block Shape Extraction

As above figure, in order that the only area of a block is extracted from image photographed by the top view, first of all, it has to classify only the part corresponding to the intrinsic color of the block. Because the color of the block is not uniform in some area, in advance, it is necessary to define the color which are appeared to a block(Thakoor, N., 2005)

The segmentation method is applied to areas with the block color, and the morphology technique is also applied to remove unnecessary regions. Because the extracted area or shape extracted by this way is different from a real

block, the CAD information can be used for verifying the accuracy of the extraction.

2.2.2 Block Feature: The extraction of feature point in a block is needed so that a block can determine how much it was rotated in the reference line after a block is unloaded. The feature point has to be detected about the part in which the edge characteristic is strong over 2 minimums.

The feature point is not sensitive from the surrounding environment, and its detection has to be possible easily. After the extracted feature points are saved to temporary storage, the rotation accuracy of a block is measured through the feature matching after unloading.

2.2.1 Block Shape Management: According to the block kind, the separate management method is needed because the extracted shape in section 2.2.1 is very various. Therefore, the arrangement simulation of a block and management method of the block shape can become very complicated in case of like that utilizing the shape of a block.

In order to solve the problem, this paper proposed the following method. The extracted topology data of the block is separately stored, but the outer shape of a block managed in the square covering the whole block.

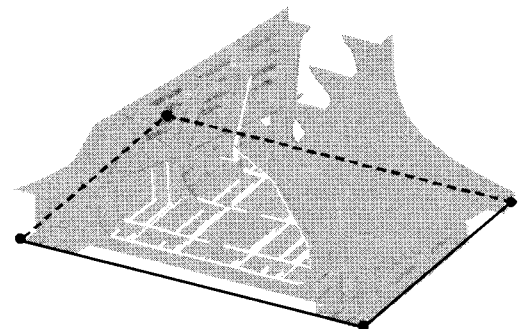Figure 3 shows the concept diagram to apply the method.

Figure 3. The Concept for Block Management

Even though the shape of a block is three dimensions, we can determine the possibility of an arrangement with two dimensional planes. A shape and standard of a block are together handled if a block is managed as the form like figure 3.

2.3 Block Rotation and Position Estimation

2.3.1 Block Rotaion: After a block is unloading, a front image of the block is captured from a camera on the predefined reference line, and some feature points has to be fined in the image. This method is performed by the general matching of image technique and the matching has to be made about minimum 2 feature points(.Odone, F., 2001; Feng, G., 2000; Wu. J., 2001)

The method of estimating the rotation accuracy of a block after it finds two feature points by the image matching is shown as figure 4. In the figure, If two feature points A, B which are obtained when a block is loading are moved to A' and B' respectively, the angle formed with T and T' which are the axes of two feature points means the rotation degree of the block. At this time, the value obtained from two feature points has to be within θ that is the limit of error.
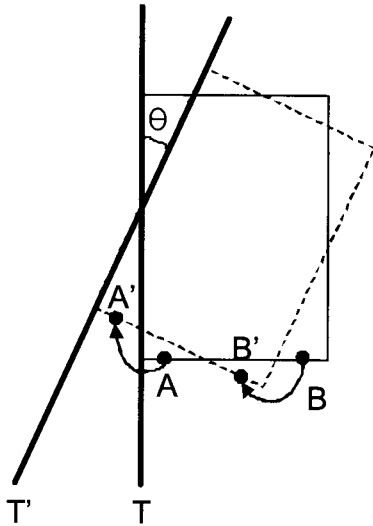

Figure 4. Block Rotation Estimation

2.3.2 Block Position

To find the position of unloaded block is very hard problem. Even in case of utilizing the positioning equipment in which a performance is good, an error is generated according to environment. Moreover, there are many limitations for aiming at the automation.

The reference point has to be secured by RFID and etc method at least in order to estimate the location of a block by the pure image recognition mode. If the reference point is secured and rotation accuracy of a block is given, the location of a block is easily predicted as shown figure 5.
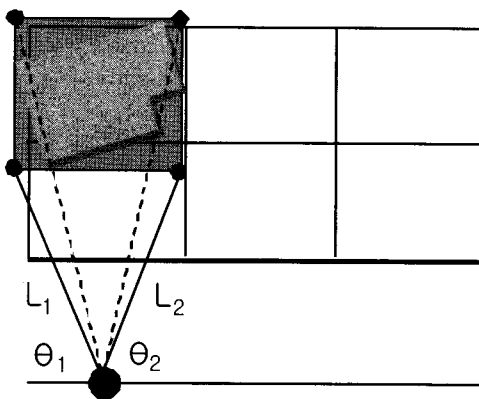

Figure 5. The estimation of block position

3. COCLUSION

This paper was shown the implementation possibility for the block arrangement system based on a pure image recognizing technique in the ship building yard. To satisfy the system, we suggest some technologies such as the shape and feature extraction of a block, and the estimation of a block rotation and position.

Because the image processing has the constraint condition in the external environment, there always exists the problem to solve. Therefore, the exact information extraction at each step will be the key of the system implementation.

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