Design and implementation of static and dynamic objects store systems using line follower robots

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Abstract—This paper introduces static and dynamic methods for objects store system using the line follower robot. The static means the robot moves on static lines to reach to any store location while the dynamic means that the arranged of the following lines is changed according to the location of the storage box. The static objects store system is represented by the Digital differential algorithm DDA and the dynamic objects store system is represented by the Bezier curve algorithm. In both environments the propose store system consists of several boxes that arranged in several columns. These boxes can be used to store and return small objects like mobile phones according to a secret code that entered from a user interface unit. The principle of store and restore of these objects is dependent on using line follower mobile robots. Both the methods are designed and software implemented in an environment with thirty boxes arranged in four columns. The comparisons between these algorithms are shown with respect to the length of the paths and time of arrival.

Keywords— N-ary tree algorithm; Digital differential algorithm; line follower robot; Bezier curve algorithm.

I. INTRODUCTION

Object storage systems have gained great popularity in enterprise data centers for its ability to provide scalability, reliability. Object storage aims to deal with the situation where a large number of objects are stored and restored [1]. Object stores simplify the process of a store and restore objects in the shortest time [2]. The object storage systems can be designed by using either static or dynamic environment. The static environment is known as the environment which doesn't contain any moving objects other than a navigating robot; while the dynamic defined as the environment which has dynamic moving objects (i.e. human beings, moving machines and moving robots) [3]. In general the dynamic environment has more problems than static path planning since the robot uses sensory information for detecting the current position and direction of moving objects in the environment [4]. The static refers to the environment that not changed over time while the dynamic refers to the environments that change over time and this leads to reduce the delay by draw only the specified route [5]. In this object store system the Differential Drive Robots are used. A differential drive robot is the simplest type of mobile robot, it has two independently driven coaxial wheels and in sometimes the differential drive robot can has another wheel called the caster wheel [6]. Digital differential robot is the configuration used by most wheelchairs, and it's used by mobile robots because of its simplicity [6]. The motion of the digital differential robot in this system depends on the properties of the line follower robot. A line follower robot is basically a robot designed to follow a line or path already selected by the user. This line or path may be as simple as a physical white line on a black floor (or black line on the white floor) or as complex path marking schemes e.g. embedded lines, magnetic markers and laser guide markers [7]. In order to detect these lines, various sensing schemes can be employed. These schemes will be selected depending on the accuracy of the sensor and the flexibility required. In the static environment the moving trajectories are enhanced by using the digital differential algorithm, while in the dynamic environment the moving trajectories are enhanced by using the Bezier curve algorithm.

In this paper the object store system is designed with several boxes to store and retrieve objects. A line follower robot is used to store and retrieve object by moving on black lines which arranged as an N-tree in both dynamic and static environment. The design of the object storage system whether by using dynamic or static environment will give us more security for store the objects [8].The rest of the paper organized as follows: Section II explains the underline mathematics, section III describes the object store system in details, section IV shows the simulation result, and finally section V discuss the results.

II. UNDERLINE MATHEMATICS

This section describes the algorithms used in construction the static and dynamic environment of the object store system. The construction of both environments depends on the N-ary tree algorithm. The digital differential analyzer algorithm is used to reduce the rabble occurs in the straight paths in the