UNIFORM LOAD DISTRIBUTION DEVICE USING GENETIC ALGORITHM FOR AUTOMOBILES

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ABSTRACT

Road tragedies are a serious issue. Heavy loaded vehicles are more prone to accidents than others. These loaded vehicles can meet with accidents due to the heavy load on their container which is not distributed uniformly. One of the key difficulty is to achieve balanced load on these vehicles as the driver cannot determine where to place the new load. In this paper, I have proposed a prototype which will solve this problem. The proposed prototype will determine the position (co-ordinates) where the load will be placed. If the person wants to place a new load onto the system. Using genetic algorithm, the system will find the best position to place this load to get the system uniformly balanced.

Keyword: Genetic algorithm, uniform load distribution device, Load balancing.

1. INTRODUCTION

Genetic Algorithms (GAs) to obtain a near optimal placement of load. GAs use the principles of natural selection as well to obtain this approximate placement of loads. The principles that are used by GAs are: Reproduction, Crossover, and Mutation are used to construct feasible solutions from a set of candidate arrangements that are made. Out of all the best of these are selected and substituted in the space of possible arrangements until convergence to a best result. The method finds a solution without any operator input, and

is applied successively to solve the container overloading problem.

In recent years there are many accidents taking place due to the unbalanced distribution of load. In this project, an attempt is made to avoid the accidents due to unequal distribution of load. This is done using a center of gravity algorithm which will help to check the load distributed in a container. This project will help to place the loads in the place without any misbalance.

Genetic algorithm is used in many of the projects and is an upcoming field of research in mining industries. Even though genetic algorithm has variety of applications, there is not much research done in the domain in packaging.

Our system focusses on providing the best result to overcome misbalanced container. Main goal is to help the vehicles to load in the containers equally in all sides. The proposed system will take the device inputs that are the total mass to be added in the container of the vehicle. And then user keeps adding the weight in small quantity one at a time and then keeps adding the remaining loads to make the cg (0, 0) .The system will take the readings and evaluate the weights and determine the position for the next load to be added into the system or device. Finally determines whether the load is at risk or balanced.

Proposed system uses genetic algorithm. Genetic Algorithms (GAs) are search algorithms based upon natural selection or Darwinism. GA is directly derived from the behavior of genes and chromosomes in nature.

Each Generation is made up of a set of chromosomes which are made up of individual genes. These genes are coding of design variables that are used to evaluate the function being optimized. Although robust, a GA is a simplified model of the process that occurs in nature.

The proposed project can be widely used in the field of packaging industry. This analytical research can be used by the packers to focus on uniform distribution of mass. The research performed is also helpful for all the heavy loading of the vehicles.
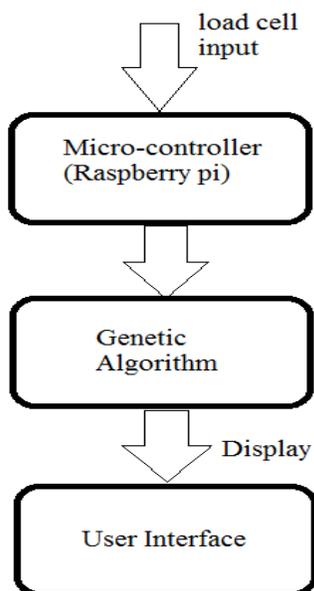
Block diagram

Fig . 1.1   Block Diagram

2. BACKGROUND STUDY

There was lot of problem in truck packing. Mostly problems are while the box containers are. Evaluating each and every load to iterate towards the solution. Global optimal solution is quite expansive to find. So there was a need to find the better result. There are two operations: knapsack problem and Travelling Salesman problem. Knapsack problem, the aim is to find the value that can be placed on the constraint of weight. When it comes to truck packing problem, the loads are the objects that are to be loaded in the container. In the Travelling Salesman problemthe aim is to find the shortest distance that the salesperson will travel from the given set of cities. The packaging is done in minimizing order to get the target. The packing is done by lowest dense box packing. The problem is then repeated with one less box until all boxes are placed.

3. GENETIC ALGORITHMS - OVERVIEW OF GENETIC ALGORITHMS

Genetic Algorithms (GAs) is the algorithm which is based on natural selection. A GA is consists of genes and chromosomes. A GA is a simple model that occurs in nature. Generation is made up of a set of chromosomes which is made up of individual genes. The genes are used to find the optimized function. Each chromosome in a population is used to compute fittest function. The values are checked with the remaining co-ordinates. The one that are most suited and survived move to the next generation.

These are the operators that are then used.

3.1 GENETIC OPERATORS
Selection

Selection is nothing but creating new set of generations. Based upon the last generations the new generations are evaluated using the fitness function. Selection is also known as Rank Based Selection.

Crossover

Crossover is mostly used for finding the new solutions. This can be made possible calculating the closest value to the required value.

Mutation

Mutation is the procedure of swapping the bits known as genes. Rather than global, local optimum is used in mutation.

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4. PROPOSED ALGORITHM

The initial step involved in the development of the genetic algorithm is the selection of the appropriate coding for the definition of the variables.

For the one dimensional case, boxes are initially assumed to be of fixed size and the weight can vary according to the user requirements. This simplification allows us to find the best location to place the new weight. A progressive increase in complexity changes from weight being changed from the similar to different weights. With this assumption, the center of gravity formula is evaluated with respect to the boxes that are present in which there are many varying loads/weights placed.

Objective function Equation:

$$COG_x = \frac{\sum_{i=0}^{N} X_i\ W_i}{\sum_{i=0}^{N} W_i}$$

Where:
W_i is the weight on each box
X_i is the centroid location of each box

The load from an individual box is assumed to be a point load at the centroid of the box

The algorithm for the two dimensional loading can be described as follows:

1. Take the first weight and place in any of the boxes.

2. The centroid location of weight placed in the box is determined.

3. Enter the new weight that is to be placed.

4. Adding the centroid location of the last box as well as last weight placed to the location summation.

5. After checking with all the boxes, it will find closer value to center of gravity(0,0).

6. Add the load to the new unfilled box

7. Repeat steps 3 through 6 until all of the weights are placed.

Advantages
- Easier to understand, robust and very fast.
- Relatively very efficient
- When data set are distinct or well separated from each other it gives best result.

Disadvantages
- There is a necessity of specification of set of points in learning the algorithm.
- The use of Exclusive Assignment.
- It lacks in ability to handle noisy data.
- Criticality in comparing quality of the produced sets.

5. EXPERIMENTAL RESULTS AND IMPLEMENTATION

In order to find the center of gravity the genetic algorithm is used. The experimental results obtained by using the weights of 200gm, 300gm, 400gm. The changing voltages will help in determining the co-ordinate on which it is placed. The center of gravity formula is used to maintain the center of gravity close to (2.5, 2.5).
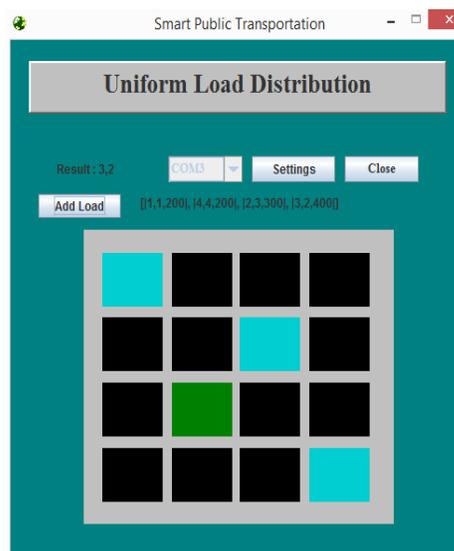

Fig .5.1 Interface for Placing varying weighs

Weights	Co-Ordinate	Box
200	(1,1)	1
200	(4,4)	13
300	(2,3)	6
400	(3,2)	10

Tab . 5.1   Experimental Analysis of varying Weights

The experimental results obtained by using the weights of 200gm, 200gm, 200gm till the 16 boxes are full. The changing voltages will help in determining the co-ordinate on which it is placed. The center of gravity formula is used to maintain the center of gravity close to (2.5, 2.5).

Fig .5.2 Interface when All weights are same

Weights	Co-Ordinate	Box
200	(1,1)	1
200	(4,4)	13
200	(2,3)	6
200	(3,2)	10
200	(2,2)	7
200	(3,3)	11
200	(1,2)	2
200	(4,3)	14
200	(1,3)	3
200	(4,2)	15
200	(2,1)	8

200	(3,4)	12
200	(2,4)	5
200	(3,1)	9
200	(1,4)	4
200	(4,1)	16

Tab. 5.2. Experimental Analysis when all weights are same

6. CONCLUSIONS

In this project we try to build a hardware which will detect the co-ordinate and then asks the user to enter the new weight to be placed. Accordingly with respect to the new load added the center of gravity is calculated. The center of gravity has to be maintained. So that the plate is not misbalanced. The placement of the next load is shown with respect to different colors. The genetic algorithm calculates the CG of the loads placed on it and then determines where to place the next load. The loads will be placed until the all the loads are placed and the plate is fully balanced maintaining the center of gravity.

This project is used for calculating the load that is placed on the container which uses this data to check where to place the next load. As a further study other fields that it can be used is in the packing industries where huge containers are to be loaded. Further enhancements for these algorithms can be made by using different set of points where to place the next load.

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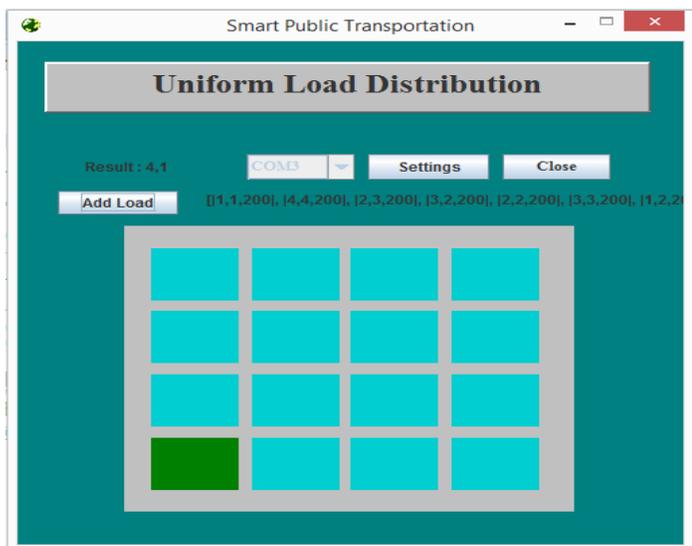
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