Image Creation Using Coordinate Information

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Abstract
In today's world if one thinks of making of image, the idea that comes will be of using digital camera .But if image is not to be used by human for reference and it is to be made for processing than it is better to go for economical way of creating image rather than using digital camera. This paper provides a method to create an image using a distance sensor data that can be processed by computer. This method uses a ping ultra-sensor to get distance information and provide it to processor to create an image. Processor creates an image which is black & white. This image is sufficient to process for some system like Home Surveillance System. This method converts distance into according black & white pixel value ranging from 0-255. Each pixel value gives accurate information about object in form of color value.

Keywords
Color Histogram, Distance Matrix, Frequency Image Matrix, Image Matrix.

I. Introduction

In Recent years, Most of the common monitoring work is done by automatic robots. Each Robot is required to have vision in most cases. So the challenge is to make a cheaper and affordable image creating system which can give image data to robot. Robot analyzes this data and takes decision. So image created by system should be having enough data for interpretation by Robot.
This research is proposed to make an image from distance information provided by sensors.

II. Getting Distance Information

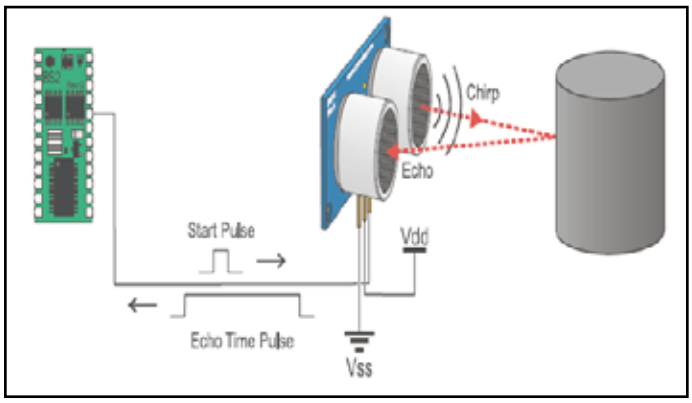

Fig. 1: Ultrasonic Sensor [2]

We are required to give an starting pulse to sensor to start the sensor. On getting starting pulse sensor emits an ultrasonic wave and change output pulse to high. When sensor receives back the wave it changes output state to low. Finding this interval of high output pulse we can find the distance information of an object. fig. 2 shows starting operations of Ping Ultra sensor.
Distance matrix is a matrix having information about distance of that point given by distance measuring sensor. Format of distance matrix is shown in fig. 3. We want resolution of m x n pixels than distance matrix of m x n is to be created using sensor data about m x n points.

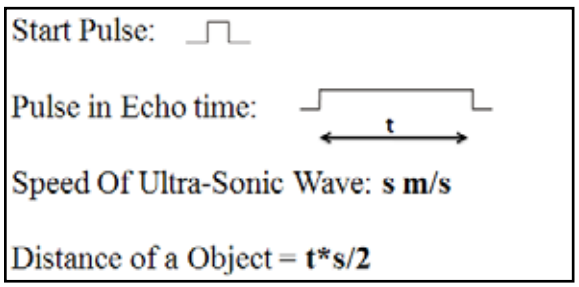

Fig. 2: Starting of Ultrasonic Sensor

Distance matrix is denoted by distance[m][n].

$$\begin{bmatrix} d11 & d12 & . & . & d1n \\ d21 & d22 & . & . & d2n \\ . & . & . & . & . \\ . & . & . & . & . \\ dm1 & dm2 & . & . & dmn \end{bmatrix}$$

Fig. 3: Distance Matrix

III. Creating Image Matrix

We will first find out minimum value and maximum value in distance matrix. From minimum and maximum values we find distance value range denoted by interval.

Minimum_value = minimum ({distance[i][j] | 0<i<=m,0<j<=n})

Maximum_value = maximum ({distance[i][j] | 0<i<=m,0<j<=n})

Interval = Maximum_value - Minimum_value
Now we have 255 color values. (0-black to 255-white). So we calculate increasing factor from Interval value.

Factor = 255 / Interval if Interval != 0
Factor =255 if Interval = 0
Image matrix is m x n matrix which stores information about color value of each point.
Now we need to create image matrix of m x n form. We are required to give unique color value for each distance value .We will represent nearest point with white color (0) and far most point with black color (255). Each entry of Image Matrix is given by following Equation.

Image[i][j]= 255 - (distance[i][j] - Min_Distance)*Factor
Where 0<i<=m and 0<j<=n

$$\begin{bmatrix} i11 & i12 & . & . & i1n \\ i21 & i22 & . & . & i2n \\ . & . & . & . & . \\ . & . & . & . & . \\ im1 & im2 & . & . & imn \end{bmatrix}$$

Fig. 4: Image Matrix

So, we have created an image matrix which is having color value of each point in image. Image created is not having enough distinction in color at edges. So we use color histogram method to find frequency image which is having clear distinction at edges.

IV. Create Edge Image Using Color Histogram

In an image points at edges is having low color frequency [1]. So we can distinguish edges from normal object by frequency value.

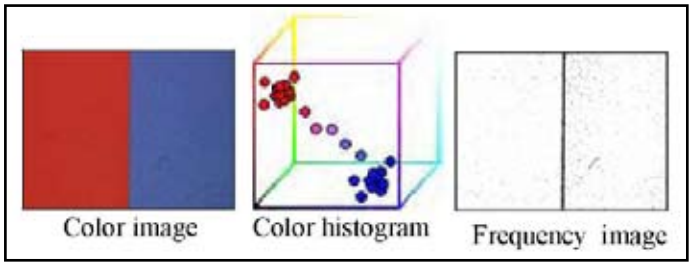

Fig. 5: Color Histogram [1]

We need to find frequency value of each color value existing in image matrix. So we generate frequency matrix of m x n by formula given below.

Frequency[i][j] = frequency(Image[i][j]) where 0<i<=m and 0<j<=n

Here frequency (i) finds occurrences of that color in image matrix.

$$\begin{bmatrix} f11 & f12 & . & . & f1n \\ f21 & f22 & . & . & f2n \\ . & . & . & . & . \\ . & . & . & . & . \\ fm1 & fm2 & . & . & fmn \end{bmatrix}$$

Fig. 6: Frequency Matrix

In frequency_image matrix if frequency of a point is higher than average frequency then it is denoted by high color value and if lower than denoted by lower color value. In fig. 7, average frequency is denoted by avg_frequency.

$$\text{Frequency\_image}[i][j] = \begin{cases} 255 \text{ if frequency}[i][j] > \text{avg\_frequency} \\ 0 \text{ if frequency}[i][j] < \text{avg\_frequency} \end{cases}$$

Fig. 7: Equation for Frequency Image [1]

We have a frequency image in matrix form as shown in fig. 8.

$$\begin{bmatrix} fi11 & fi12 & . & . & fi1n \\ fi21 & fi22 & . & . & fi2n \\ . & . & . & . & . \\ . & . & . & . & . \\ fim1 & fim2 & . & . & fimn \end{bmatrix}$$

Fig. 8: Frequency Image Matrix

V. Application

I. Above method can be used in home surveillance system where image can be generated by microcontroller using distance data provided by distance sensor instead of using costly camera to build image. So it will reduce the cost of home surveillance equipment and systems. So it will change the way human look at home surveillance system and increase popularity of it. It will also make Home surveillance system available to most of the people who are not able to have current home surveillance system because of its costliness.

Another use of this method is in robot vision system. Robot vision system is one of the costliest parts of robot which make price of robot much higher. If this method is used for building an image for robot vision instead of costly high resolution camera then it will reduces the cost of robot considerably.

VI. Conclusion & Future Work

This paper focuses on creating an image using distance data. An another method to create an image instead of using traditional method is described in this paper. We have seen an algorithm to create an image from distance data. This algorithm can be used to create an image which cost much lower than traditional camera. Future work in this topic includes creating much more efficient algorithm to create an image that can lead to image that is more realistic but having much information.

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