



# Generation of Hex File using Robotic Artist

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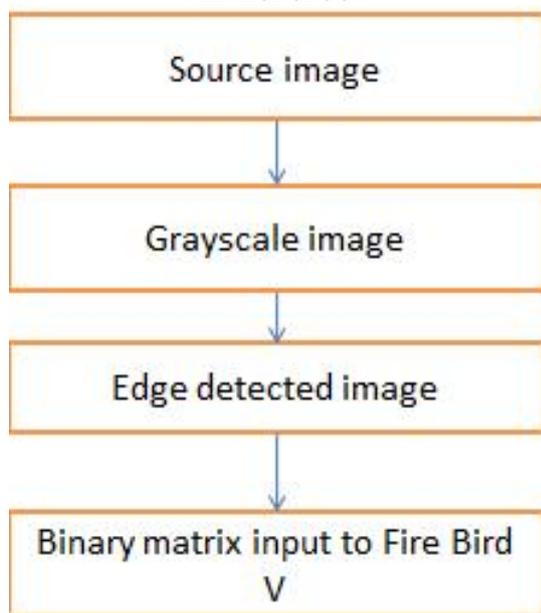
**Abstract-Robo-Artist is an application which creates the drawing using FireBird V Robot through image processing. This is the integration of currently available robotic application with various methods of image processing. Grayscale conversion will be applied to the given drawing and Edge Detection will be performed. Execution in Matlab yields the result in Binary Matrix. To move the robot, the program is executed in the AVR studio and the result is obtained as hex file. Then hex file is burn to the FireBird V through USB cable for the movement of robot to draw an image.**

**Keywords: Grayscale, Edge Detection, Binary Matrix**

## INTRODUCTION

Image processing is a processing of images using mathematical operations by using any form of signal processing for which input is the image, output may be image or the characteristics or parameters related to the image [4]. Matlab is a high-level technical computing language and interactive environment for algorithm, development, data visualization and data analysis. The RGB image is converted into grayscale image using grayscale conversion. Later edges are detected for the image using edge detection technique in the Matlab [9]. Execution of the code in the Matlab generates the matrix. The matrix is given as input to AVR studio which will in turn execute the program and burn hex file. The program is burn to FireBird V robot to create the drawing.

## METHODOLOGY



**Fig 1: steps involved in methodology**

## A. Grayscale

Black-and-white photography actually consists of many shades of gray, images which refers to this shades of gray is referred as Grayscale [1]. There are seven unique gray scale algorithms

- Averaging
- Correcting for the human eye
- Desaturation Decomposition Single colour channel
- Custom# of gray shades
- Custom# of gray shades with dithering

## B. Edge detection

Edge detection is the most common technique for detecting discontinuous values in intensity. The traditional denoising method is the use of low-pass or band-pass filter to denoise [6].

- Differential operator
- Log operator
- Canny operator
- Binary morphology

The sobel operator is very similar to perwitt operator [7] It is also a derivate mask and is used for edge detection. It also used to detect two kinds of edges in an image i.e. Vertical and Horizontal direction [8].

The Roberts cross operator is to approximate the gradient of an image through discrete differentiation.

## C. Matrix Generation

After edges are detected a program is executed when workspace is checked matrix will be generated.

## D. Movement Generation

The movement of the robot is based on the matrix. In the matrix 1's is for the edges and 0's is for non-edges [3]. Robot does the movement from 1's to another 1's. The movement of robot is based on some constraints, they are as follows:

- a. nearest left 1
- b. nearest top and bottom 1
- c. nearest right

If we take a source image as square, Fig 2 shown below the matrix will be generated as per the size of the figure



**Fig 2: source image**

The source is been set to the size of 10 pixels and code is executed in the Matlab to generate the Binary Matrix. The Binary Matrix generated will be of 10\*10 matrixes. The robot uses the above mentioned constraints for the Matrix to movement conversion .Fig 3 displays the Binary Matrix generated for the source image

	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1
2	1	0	0	0	0	0	0	0	1	1
3	1	0	1	1	1	1	0	0	1	1
4	1	0	1	1	1	1	0	0	1	1
5	1	0	0	0	0	0	0	0	1	1
6	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1

**Fig 3: generated binary matrix for source image**

#### E. Creation of Rom Image

The hex file which is generated after the execution of program in AVR studio is send to Firebird v via USB. There rom image will be created inside the Firebird v.

#### LITERATURE SURVEY

Implementing the Grayscale and Edge detection methods is very important, survey is made on the different types of these two methods and importance of these two methods in our implementation is known. FireBird V robot is used; survey is made on the features of this robot and its implementations.

##### 1. Types of Grayscale algorithms and its Application[2]

Grayscale conversion is based on custom of gray shades with dithering. It allows the user to specify any value between 2256 range, then algorithm itself calculates the best value among that selected range [2]. Dithering means applying the knowledge of optical illusion to make an image look more colorful than the actual one. Already available colors is changed into the new patterns using dithering, it confuses the human eye by thinking that the colors are more than the actual color [5]. There are many dithering algorithms we are using simple error diffusion mechanism. There are seven gray scale algorithms namely

1. Averaging
2. Correcting for the human eye
3. Desaturation
4. Decomposition
5. Single color channel
6. Custom # of gray shades
7. Custom # of gray shades with dithering

## 2. Types of Edge Detection and its Application [10]

There are three types namely:

- Perwitt
- Sobel
- Roberts

The Roberts cross operator is used in image processing for edge detection. It is proposed by Lawrence Roberts. Roberts cross operator is to approximate the gradient of an image through discrete differentiation. This is achieved by computing the sum of the squares of the differences between diagonally adjacent Pixels. The properties which an edge detector should have are the produced edges should be well-defined; the background should contribute as little noise as possible.

## 3. Fire Bird V Robot and its Implementations.

As a Universal Robotic Research Platform, Fire Bird V provides an excellent environment for experimentation, algorithm development and testing. Fire Bird V is evolved from Fire Bird IV and Fire Bird II which are being used in IIT Bombay to teach embedded systems and robotics. Its modular architecture allows you to control it using multiple processors such as 8051, AVR, PIC and ARM7 etc. Modular sensor pods can be mounted on the platform as dictated by intended applications. Unique features are:

- Ideal for doing research in the areas of robotics, embedded systems, artificial intelligence and sensor networks etc.
- Modular design: Unique layered design gives versatility in design
- Hands-on learning platform
- Covers wide range of subjects like Microcontrollers, Embedded Systems, Sensor Networks, Image processing.
- Detailed tutorials help in interactive learning.
- Ideal for doing research in the areas of robotics, embedded systems, artificial intelligence, and sensor networks etc.



**Fig 4: FireBird V Robot**

### PROPOSED METHOD

Proposing an integration of the robotic platform with the image processing to draw an image by using a Fire Bird V robot. Integration of image processing into currently available robotic platforms and the Development of simplest computational models to function robotic applications effectively and efficiently. It explores the currently available robotics platforms for the robotic application development and the techniques of image processing. It is an application which creates a drawing using Fire Bird V robot through image processing. By Using AVR studio execute the program and produces hex file. Using Fire-Bird V platform Robot finally creates the drawing. The program is loaded to the FireBird V robot to create the drawing. We use some specific tools to upload the program to robot.

### CONCLUSIONS

Robo-Artist is an application which creates the drawing using FireBird V Robot through image processing. This is the integration of currently available robotic application with various methods of image processing. Image processing is a processing of images using mathematical operations by using any form of signal processing for which input is the image, output may be image or the characteristics or parameters related to the image [4]. Grayscale and Edge detection method are used to process the image.

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