Report on

"BARCODE READER"

Submitted in partial fulfillment of the requirements for ***Sem IV***

IMAGE PROCESSING AND DATA VISUALIZATION USING MATLAB

Bachelor of Technology
in
Computer Science & Engineering

Submitted by:

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Problem Statement:

A barcode scanner written in matlab which detects and recognizes the EAN-13 barcode.

Description:

EAN-13 barcodes store a total of 13 digits. The first two digit are the GS1 Prefix, which identify the product's country of origin. Then is a 5-digit company number, to identify the brand, followed by a 5-digit item number, to identify the product itself. After that, there is a check number, to ensure the code's accuracy.

→EAN-13 barcode:

The barcode reader performs a search on selected rows of the input image, called scanlines. Once all pixels are transformed, the scanline sequences are analysed.

While designing the code we have used mostly used image processing toolbox for image processing, analysis, visualisation and algorithm development.

High level Design/Architecture.

MATLAB code receives the width of each strip in terms of the number of intervals (n1, n2, n3.....etc). Now, these numbers have errors due to the imprecision in the measurement. So, we define an error bound Δn (got by trial and error). So, if the number lies between the actual no $\pm\Delta n$, then it is considered as that number. This process is done for every strip on the barcode.

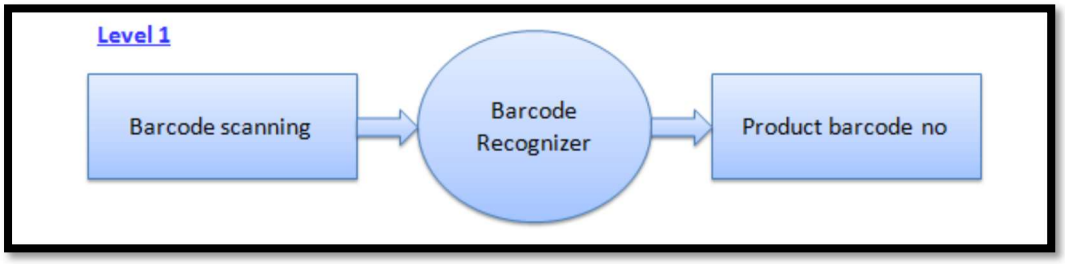
Breakup of Tasks Performed:

AARUSHI: Detection of the barcode.
ARJUN: Detection of the barcode.
ADITHYA: Decoding the barcode.
Deepali: Decoding the barcode.

Implementation:

Our project aims to scan the barcode, detect and decode the image that been read and give the result as the barcode detected.

→Conceptual analysis diagram



Algorithm:

1. Read the image.
2. Image processing (morphology, resizing, and detecting)
3. Decoding the processed image.
4. Output (Barcode number)

Platform:

Matlab (matlab R201a)

Tools used:

Image processing toolbox, version 11.3 (add-on)

Code:

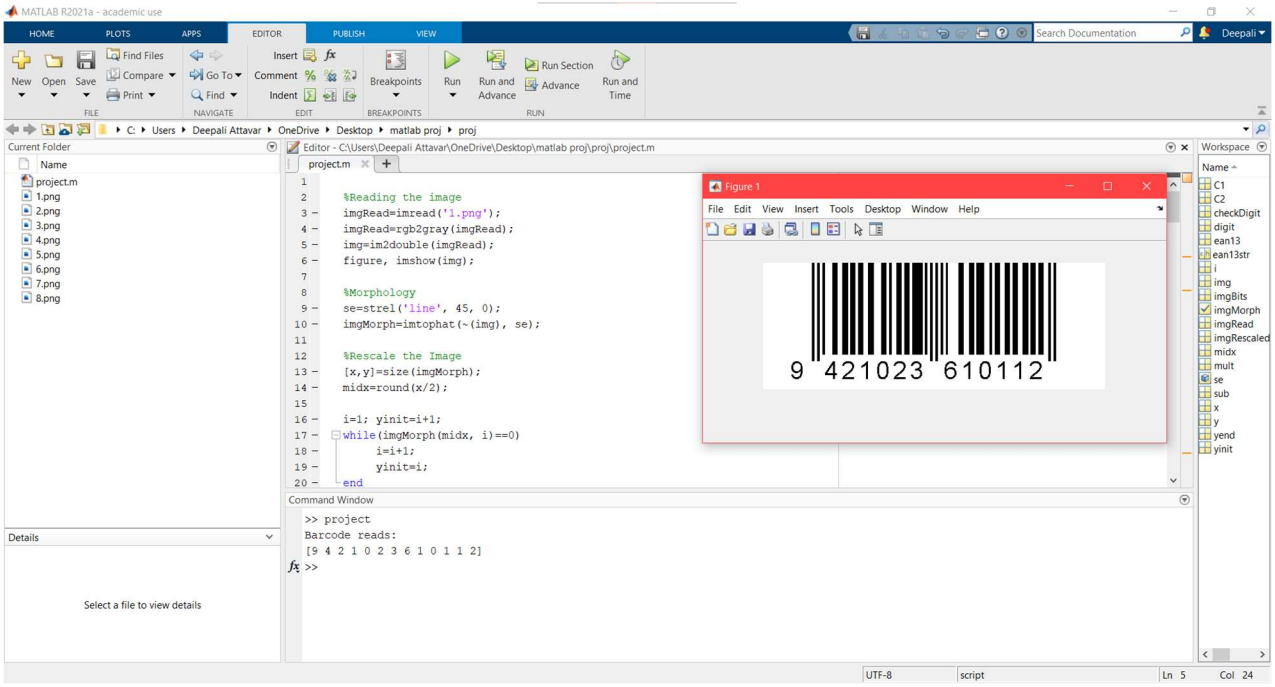
```
%Reading the image
imgRead=imread('8.png');
imgRead=rgb2gray(imgRead);
img=im2double(imgRead);
figure, imshow(img);

%Morphology
se=strel('line', 45, 0);
imgMorph=imtophat(~(img), se);

%Rescale the Image
[x,y]=size(imgMorph);
midx=round(x/2);

i=1; yinit=i+1;
while(imgMorph(midx, i)==0)
     i=i+1;
     yinit=i;
end

i=y; yend = i-1;
while(imgMorph(midx, i)==0)
      i=i-1;
      yend=i;
end

imgRescaled=imgMorph(midx:midx, yinit:yend);

imgRescaled=imresize(imgRescaled, [1 10*95]);

imgBits=zeros(95);
for i=1:95
    imgBits(1,i)=imgRescaled(1, 10*(i-1)+5);
end

imgRescaled=imgBits(1,:);

%  BarCode Decodification

%check c1
digit=1;
C1=imgRescaled(digit:digit+2);
digit=digit + 3;
```

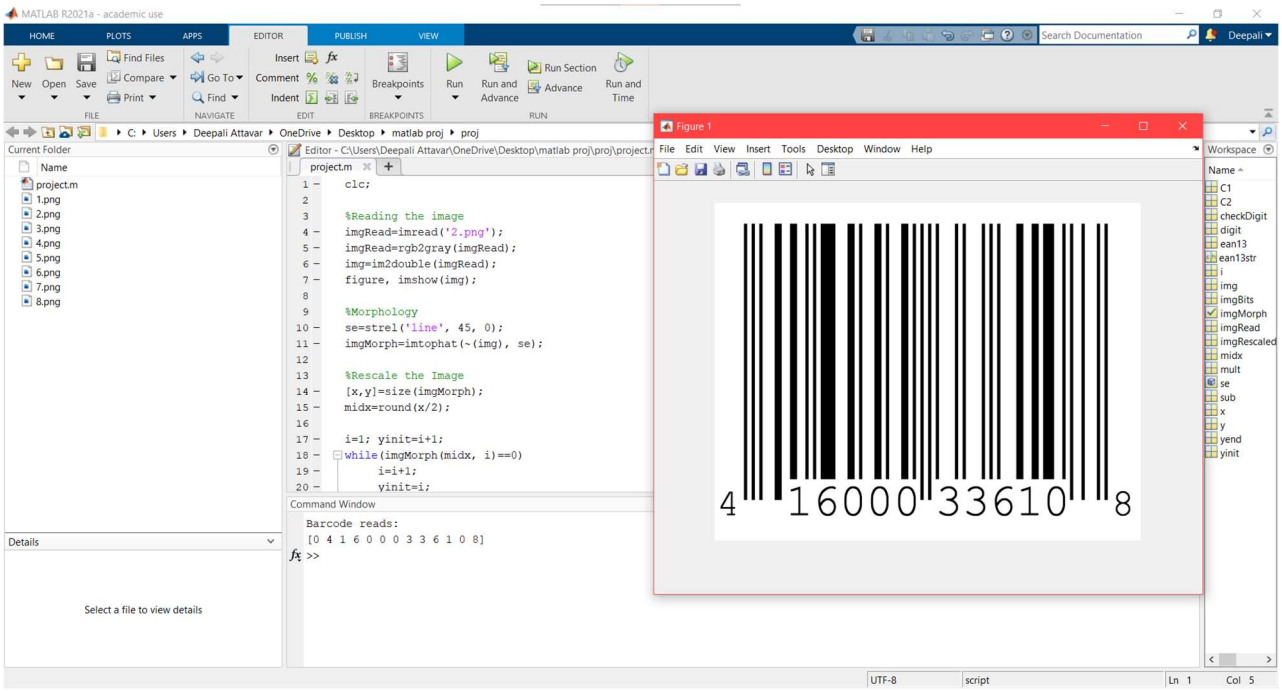
```
if(C1~=[1 0 1])
     disp('Error on C1');
end

ean13 = [0 0 0 0 0 0 0 0 0 0 0 0 0];

ean13 (2) = EAN13digits(imgRescaled(digit: digit+6));
digit = digit + 7;
ean13 (3) = EAN13digits(imgRescaled(digit: digit+6));
digit = digit + 7;
ean13 (4) = EAN13digits(imgRescaled(digit: digit+6));
digit = digit + 7;
ean13 (5) = EAN13digits(imgRescaled(digit: digit+6));
digit = digit + 7;
ean13 (6) = EAN13digits(imgRescaled(digit: digit+6));
digit = digit + 7;
ean13 (7) = EAN13digits(imgRescaled(digit: digit+6));
digit = digit + 7;

%check c2
C2 = imgRescaled (digit:digit+4);
digit = digit + 5;
if(C2 ~= [0 1 0 1 0])
    disp('Error on C2');
end

ean13 (8) = EAN13digits(imgRescaled(digit: digit+6));
digit = digit + 7;
ean13 (9) = EAN13digits(imgRescaled(digit: digit+6));
digit = digit + 7;
ean13 (10) = EAN13digits(imgRescaled(digit: digit+6));
digit = digit + 7;
ean13 (11) = EAN13digits(imgRescaled(digit: digit+6));
digit = digit + 7;
ean13 (12) = EAN13digits(imgRescaled(digit: digit+6));
digit = digit + 7;
ean13 (13) = EAN13digits(imgRescaled(digit: digit+6));
digit = digit + 7;

% Check Digit
mult = [3 1 3 1 3 1 3 1 3 1 3 1];

checkDigit = ean13 (2:13).*mult;
checkDigit = sum(checkDigit);

sub = ceil(checkDigit / 10) * 10;
```

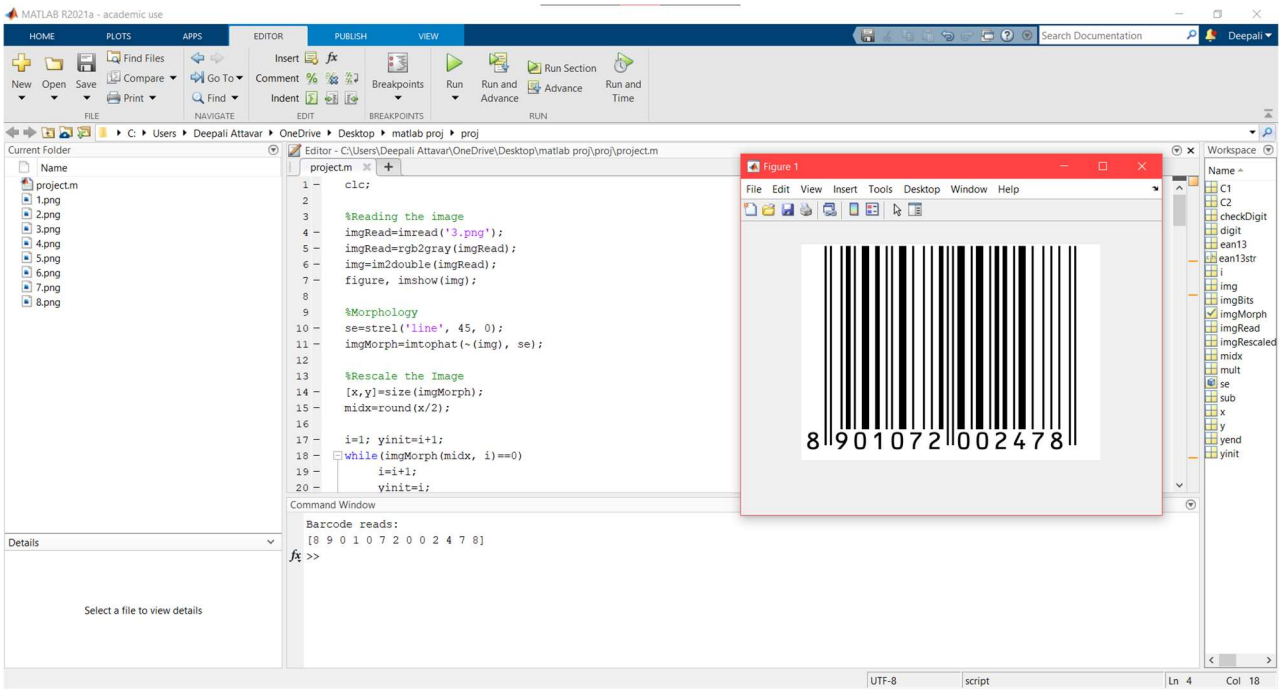
```
checkDigit = sub - checkDigit;

ean13(1) = checkDigit;

ean13str = mat2str (ean13);

disp ('Barcode reads: ');
disp (ean13str);

%EAN 13 digit function
function [number, code] = EAN13digits( vector7)

    if isequal(vector7, [0 0 0 1 1 0 1])
        number = 0; code = 1; return;
    elseif isequal(vector7, [0 1 0 0 1 1 1])
        number = 0; code = 2; return;
    elseif isequal(vector7, [1 1 1 0 0 1 0])
        number = 0; code = 3; return;

    elseif isequal(vector7, [0 0 1 1 0 0 1])
        number = 1; code = 1; return;
    elseif isequal(vector7, [0 1 1 0 0 1 1])
        number = 1; code = 2; return;
    elseif isequal(vector7, [1 1 0 0 1 1 0])
        number = 1; code = 3; return;

    elseif isequal(vector7, [0 0 1 0 0 1 1])
        number = 2; code = 1; return;
    elseif isequal(vector7, [0 0 1 1 0 1 1])
        number = 2; code = 2; return;
    elseif isequal(vector7, [1 1 0 1 1 0 0])
        number = 2; code = 3; return;

    elseif isequal(vector7, [0 1 1 1 1 0 1])
        number= 3;  code = 1; return;
    elseif isequal(vector7, [0 1 0 0 0 0 1])
        number = 3; code = 2; return;
    elseif isequal(vector7, [1 0 0 0 0 1 0])
        number = 3; code = 3; return;

    elseif isequal(vector7, [0 1 0 0 0 1 1])
        number = 4;  code = 1; return;
    elseif isequal(vector7, [0 0 1 1 1 0 1])
        number = 4; code = 2; return;
    elseif isequal(vector7, [1 0 1 1 1 0 0])
        number = 4; code = 3; return;
```

```
    elseif isequal(vector7, [0 1 1 0 0 0 1])
        number = 5;  code = 1; return;
    elseif isequal(vector7, [0 1 1 1 0 0 1])
        number = 5; code = 2; return;
    elseif isequal(vector7, [1 0 0 1 1 1 0])
        number = 5; code = 3; return;

    elseif isequal(vector7, [0 1 0 1 1 1 1])
        number = 6;  code = 1; return;
    elseif isequal(vector7, [0 0 0 0 1 0 1])
        number = 6; code = 2; return;
    elseif isequal(vector7, [1 0 1 0 0 0 0])
        number = 6; code = 3; return;

    elseif isequal(vector7, [0 1 1 1 0 1 1])
        number = 7;  code = 1; return;
    elseif isequal(vector7, [0 0 1 0 0 0 1])
        number = 7; code = 2; return;
    elseif isequal(vector7, [1 0 0 0 1 0 0])
        number = 7; code = 3; return;

    elseif isequal(vector7, [0 1 1 0 1 1 1])
        number = 8;  code = 1; return;
    elseif isequal(vector7, [0 0 0 1 0 0 1])
        number = 8; code = 2; return;
    elseif isequal(vector7, [1 0 0 1 0 0 0])
        number = 8; code = 3; return;

    elseif isequal(vector7, [0 0 0 1 0 1 1])
        number = 9;  code = 1; return;
    elseif isequal(vector7, [0 0 1 0 1 1 1])
        number = 9; code = 2; return;
    elseif isequal(vector7, [1 1 1 0 1 0 0])
        number = 9; code = 3; return;

    else number = -2;  code = 0; return;

    end

end
```

Result snapshots:



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PUBLISH
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Search Documentation
Deepali
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Find Files
Compare
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Details
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Editor - C:\Users\Deepali Attavar\OneDrive\Desktop\matlab proj\proj\project.m
project.m
1 – clc;
2
3 %Reading the image
4 – imgRead=imread('3.png');
5 – imgRead=rgb2gray(imgRead);
6 – img=im2double(imgRead);
7 – figure, imshow(img);
8
9 %Morphology
10 – se=strel('line', 45, 0);
11 – imgMorph=imtophat(~(img), se);
12
13 %Rescale the Image
14 – [x,y]=size(imgMorph);
15 – midx=round(x/2);
16
17 – i=1; yinit=i+1;
18 – while(imgMorph(midx, i)==0)
19 – i=i+1;
20 – yinit=i;
Figure 1
File Edit View Insert Tools Desktop Window Help
8 901072 002478
Command Window
Barcode reads:
[8 9 0 1 0 7 2 0 0 2 4 7 8]
>>
Workspace
Name
C1
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digit
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