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Computer Vision

Assignment #3

Rectangles detection

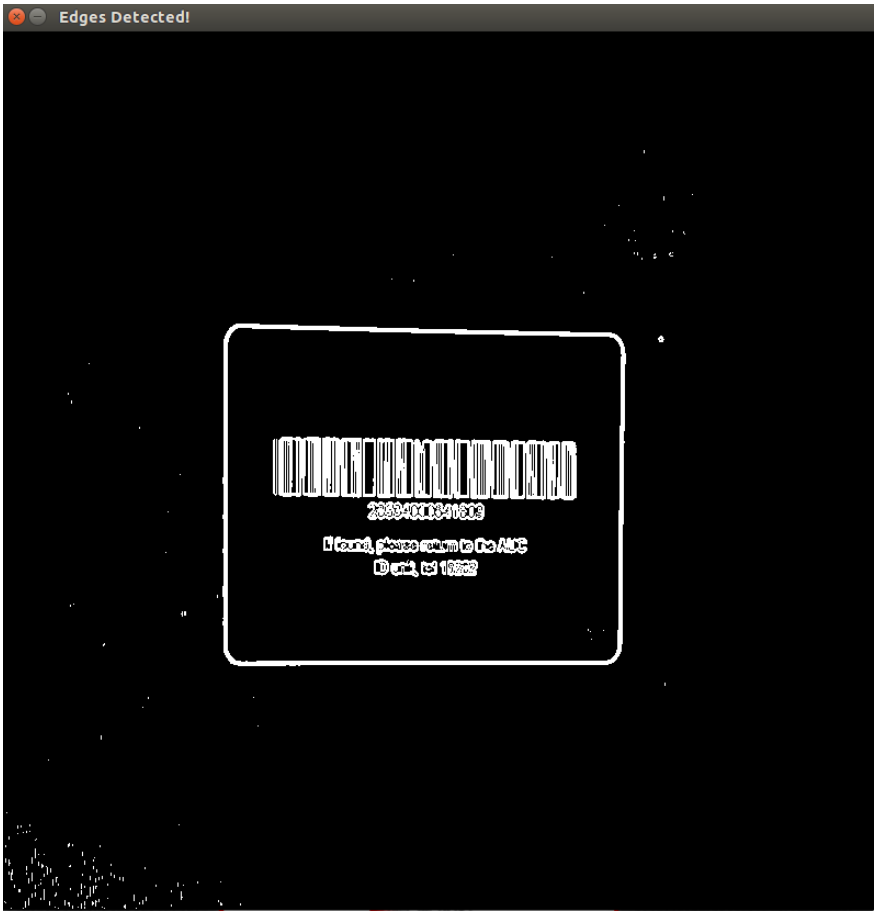
Using different real-life images, I followed the following algorithm:

1. After doing Gaussian blurring to the image, I did edge-detection for the image and converted it to a binary image based on some threshold (60 , 75).
2. Then I used "HoughLinesP" functions from OpenCV to detect the lines in the image. The result is a vector of lines detected; each line is identified by its starting point and end point.
3. Then , looping through the vector of lines , I computed the intersections between each pair of lines using this rule of Determinants(Wikipedia: https://en.wikipedia.org/wiki/Line%E2%80%93line_intersection) but this method gets the infinite intersection between lines so I limited it to only (20 to 50) pixels far away from the points intersected. The result is a vector of intersection points. This is implemented in function (Get Intersect).
4. The result from "Compute Intersection" had a lot of close and overlapped corners. To reduce the number of corners, I looped through the vector and removed the corners that are close to each other with distance of 5 pixels. To reduce it much further, I checked whether each point is a possible corner or not by checking its neighbors in the binary image. If more than half of its neighbors is white, it is possibly not a corner of a rectangle.
5. Then, it is time to determine which four corners form a rectangle. Looping through all the corners in "FinalCorners" vector, we check whether each four corners are a rectangle or not by getting the center and check if the distance between the corners and the center is equal or not (not exactly equal, threshold = 5). Finally, we draw the rectangles defined by two vertices. (2 points)

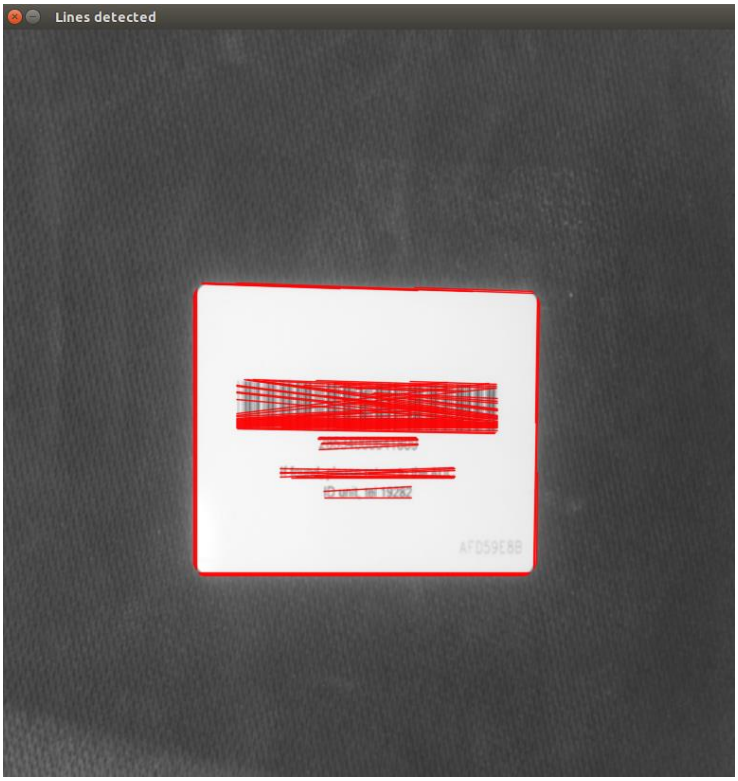
First, One Rectangle:

The following are the result images of the 5 steps shown above for 5 different source images (with different number of rectangles);

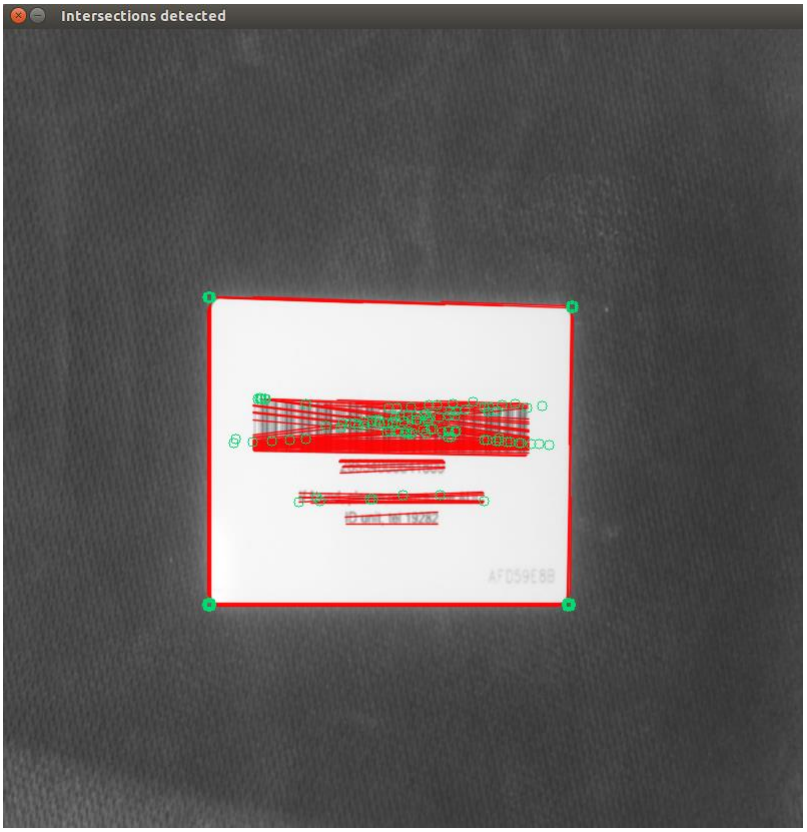
Source Image:



Result of step 1 (blurring and edge detection)

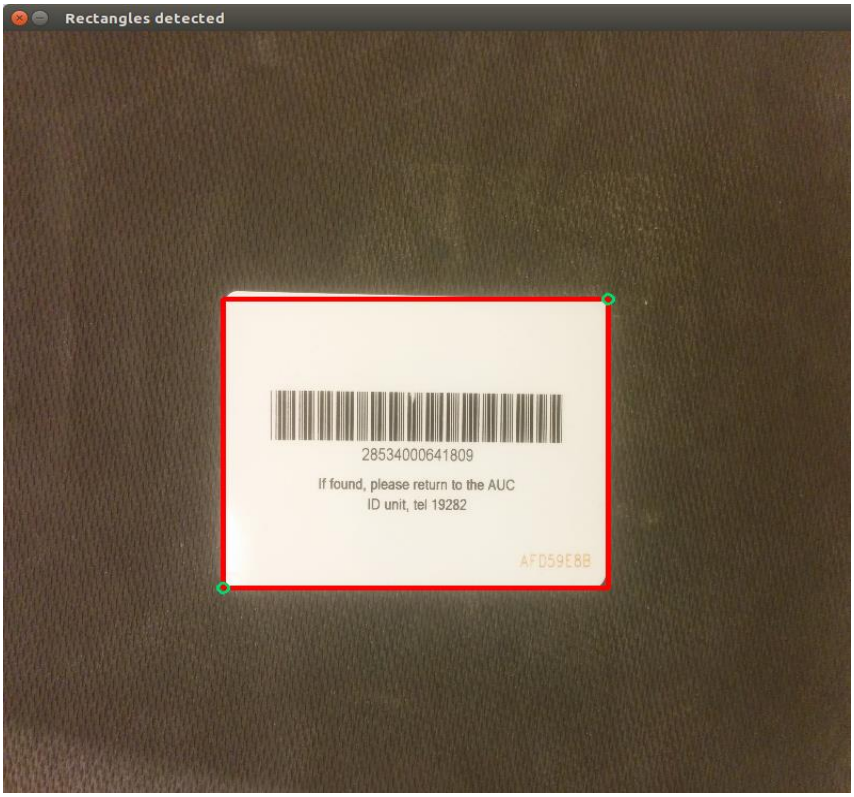


Result of step 2 (hough lines)



Result of step 3 , intersections between lines

Result of step 4 (reduced corners)



Step 5 (Rectangle detected)

```
Terminal
Corners before Elimination: 150 , Corners after:  10
Vertex 1: (206 , 574 ) Vertex 2: (567 , 276 )
Rectangles count: 1
```

Second, Two Rectangles:


Edges Detected!
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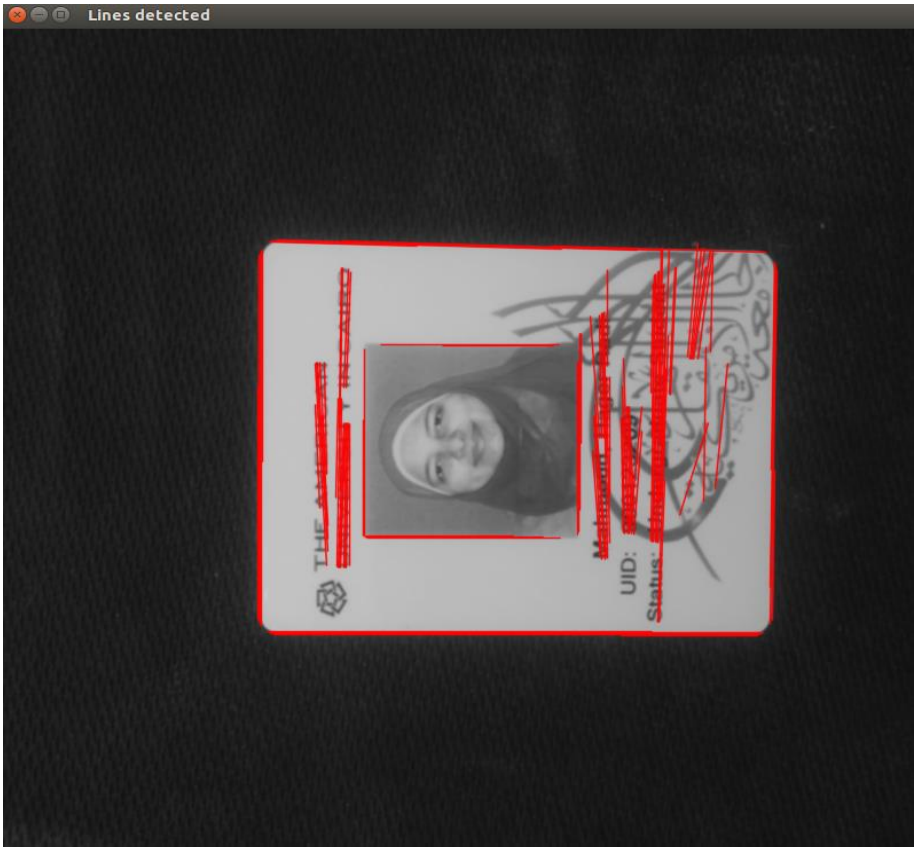
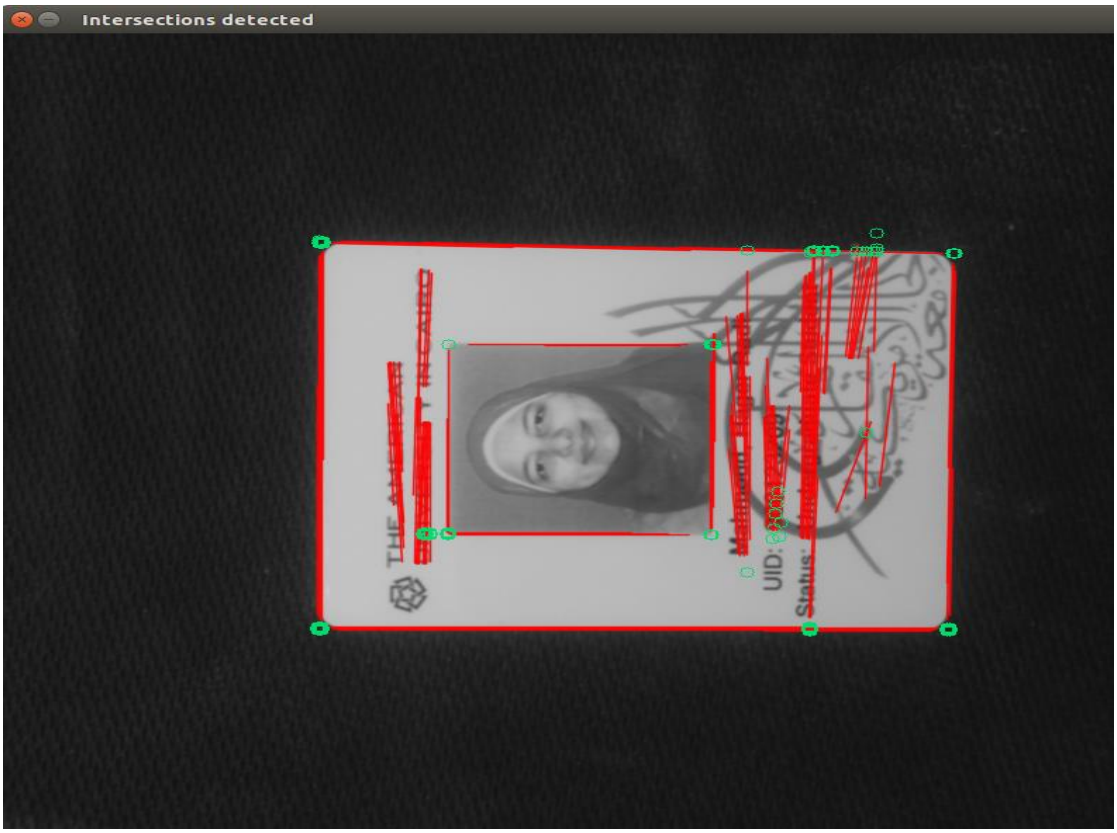
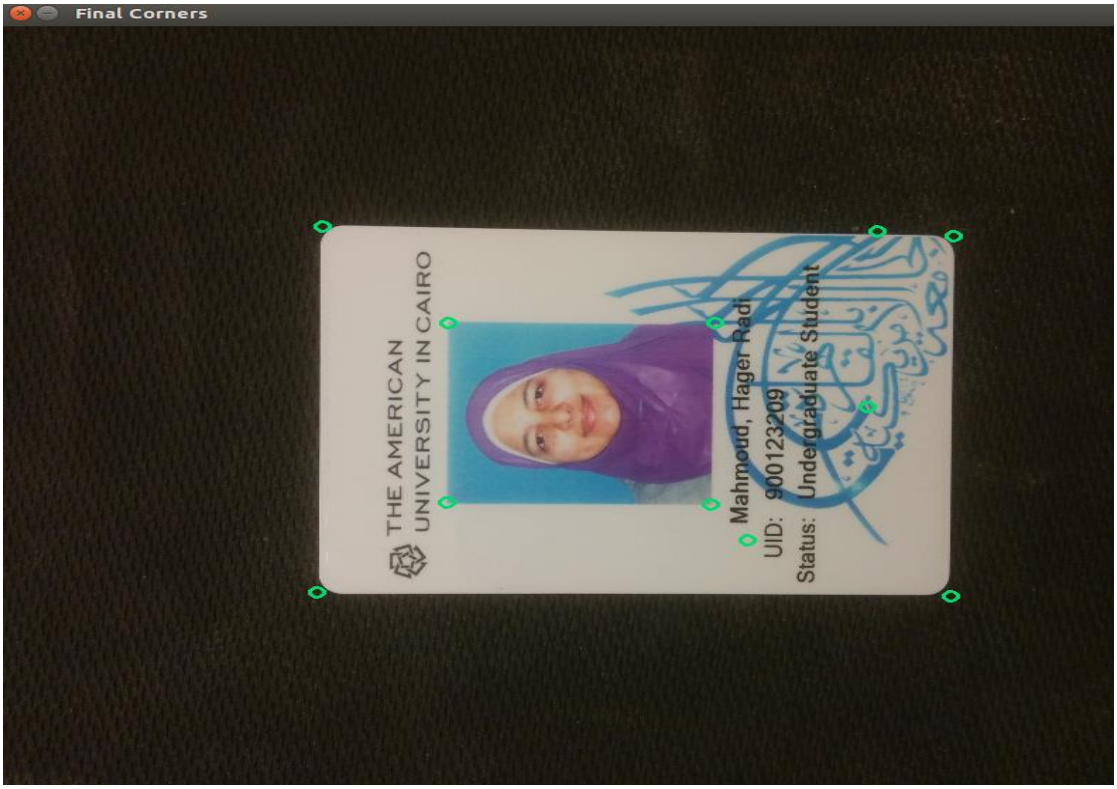
Step 1


Lines detected

Step 2


Intersections detected

Step 3


Final Corners
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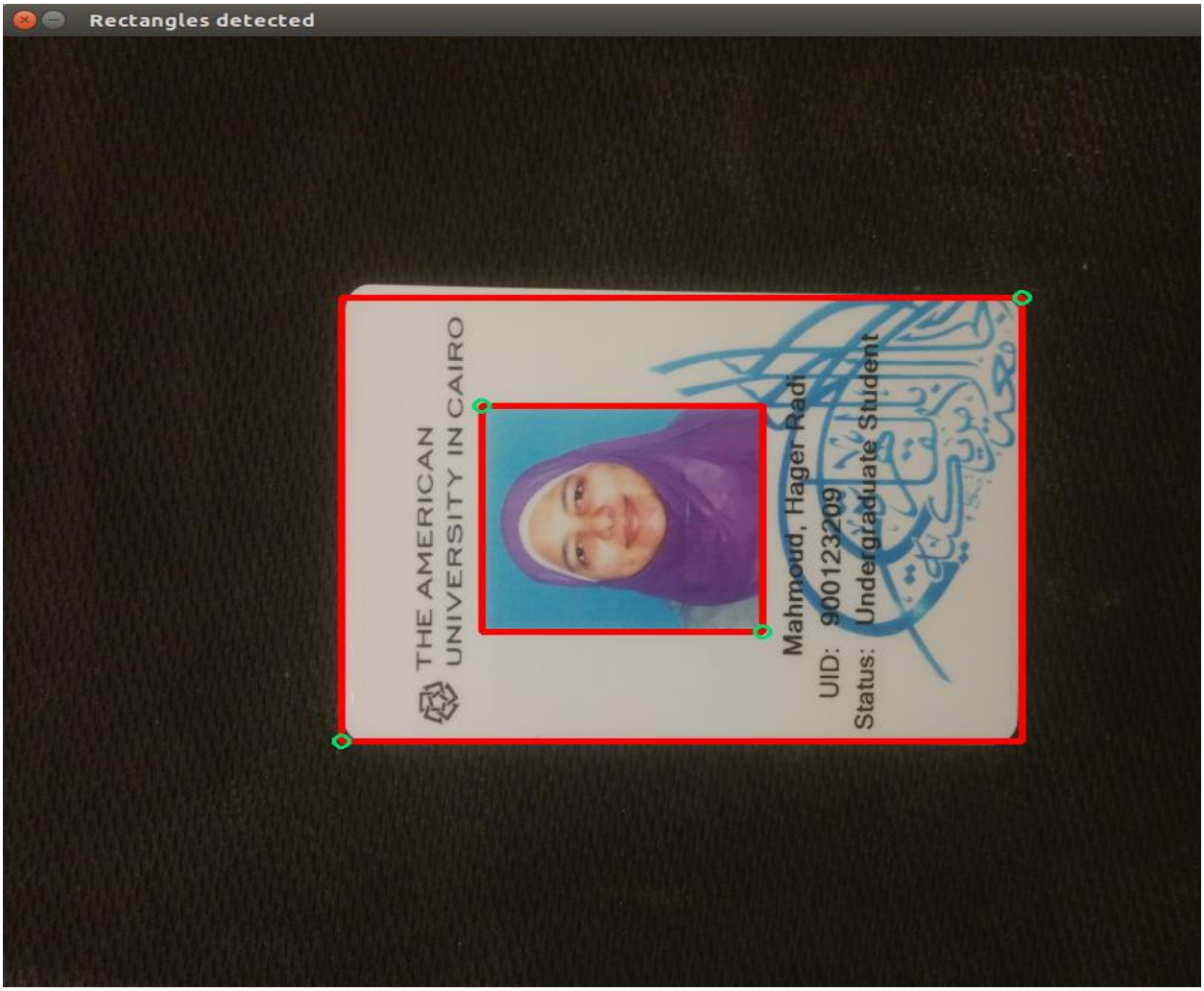
Mahmoud, Hager Radi
UID: 900123209
Status: Undergraduate Student

Step 4


Rectangles detected
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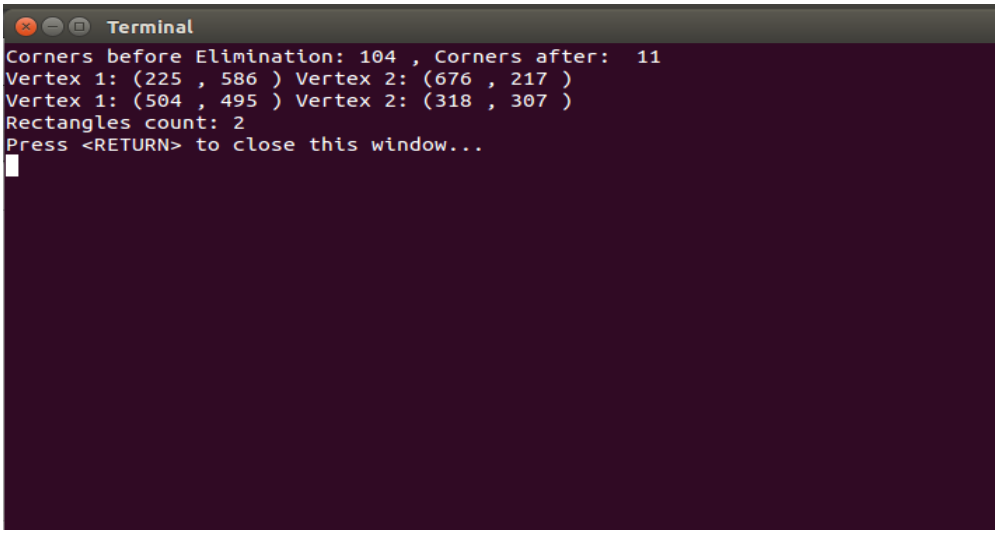
Mahmoud, Hager Radi
UID: 900123209
Status: Undergraduate Student

Step 5


Terminal
Corners before Elimination: 104 , Corners after: 11
Vertex 1: (225 , 586) Vertex 2: (676 , 217)
Vertex 1: (504 , 495) Vertex 2: (318 , 307)
Rectangles count: 2
Press <RETURN> to close this window...

Third, Three Rectangles:


Edges Detected!
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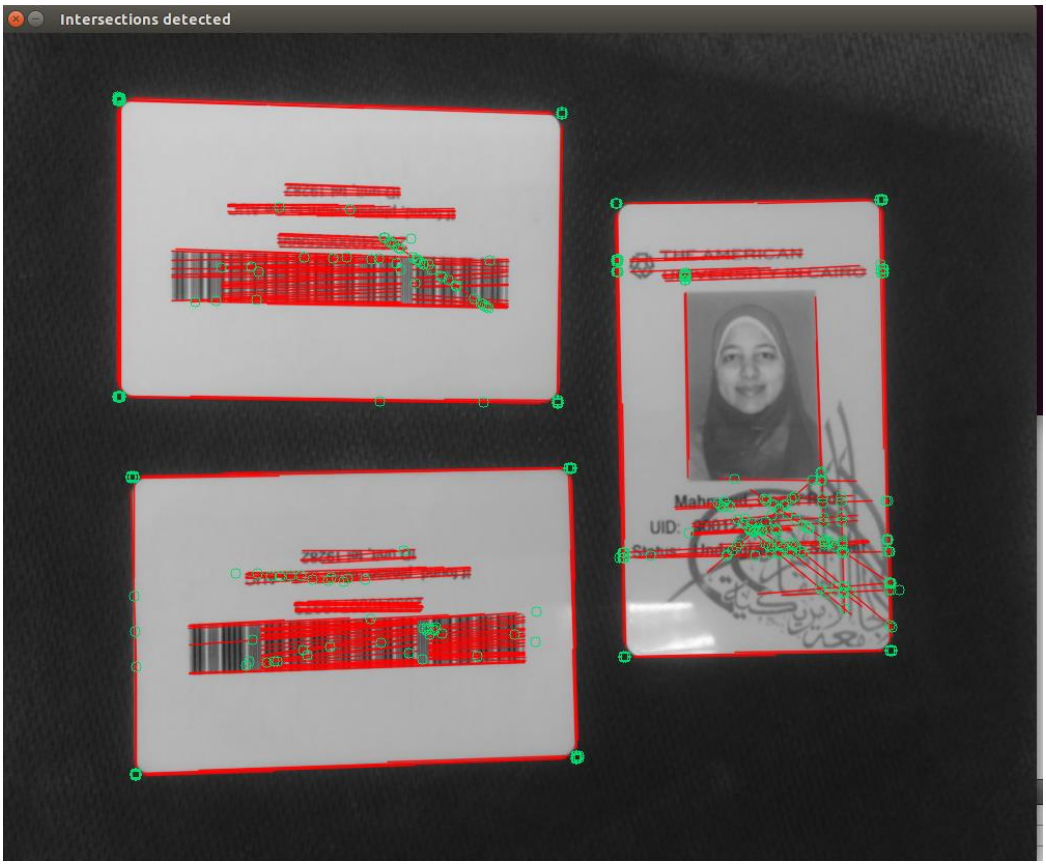
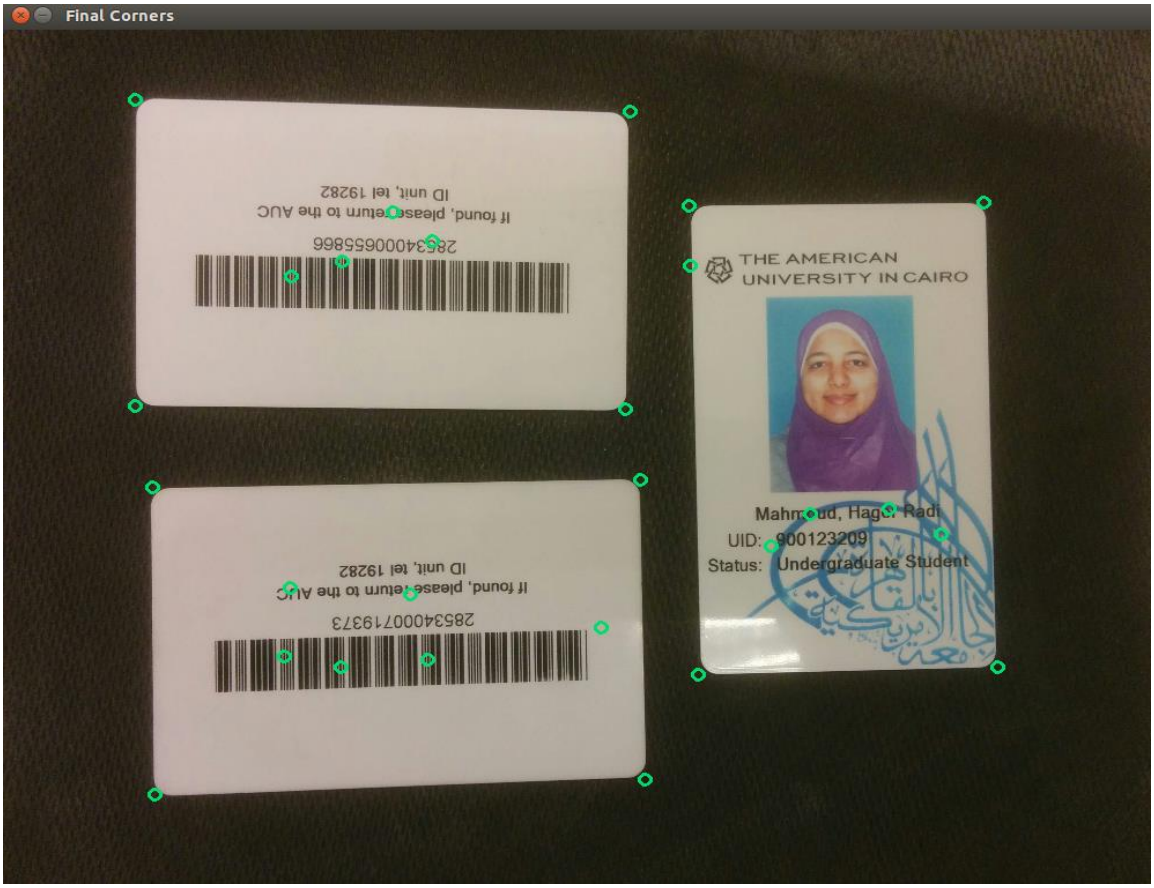
Step 1


Lines detected

Step 2



Step 3


Final Corners
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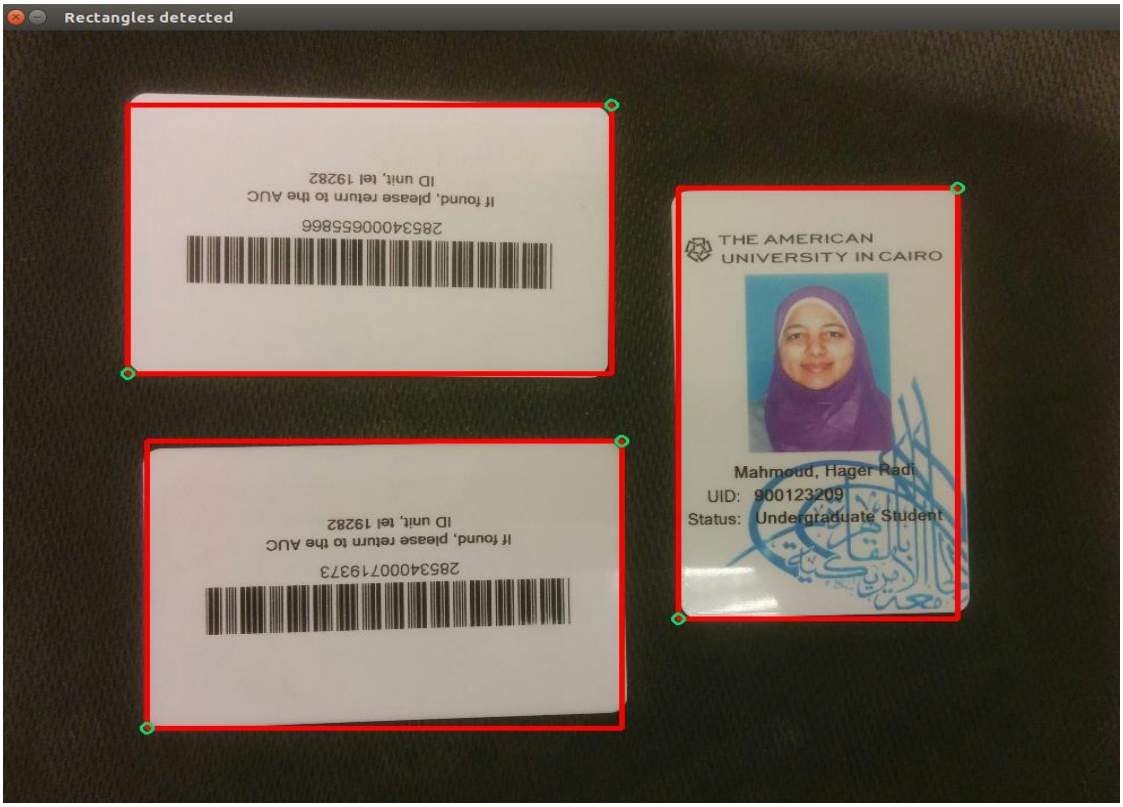
Status: Undergraduate Student

Step 4


Rectangles detected
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UID: 900123209
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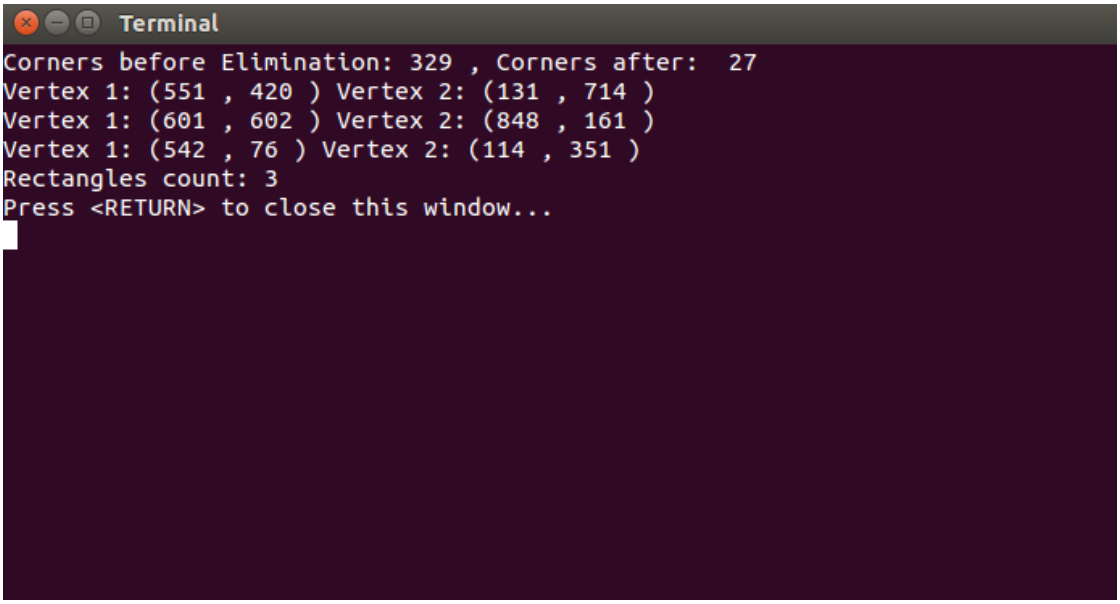
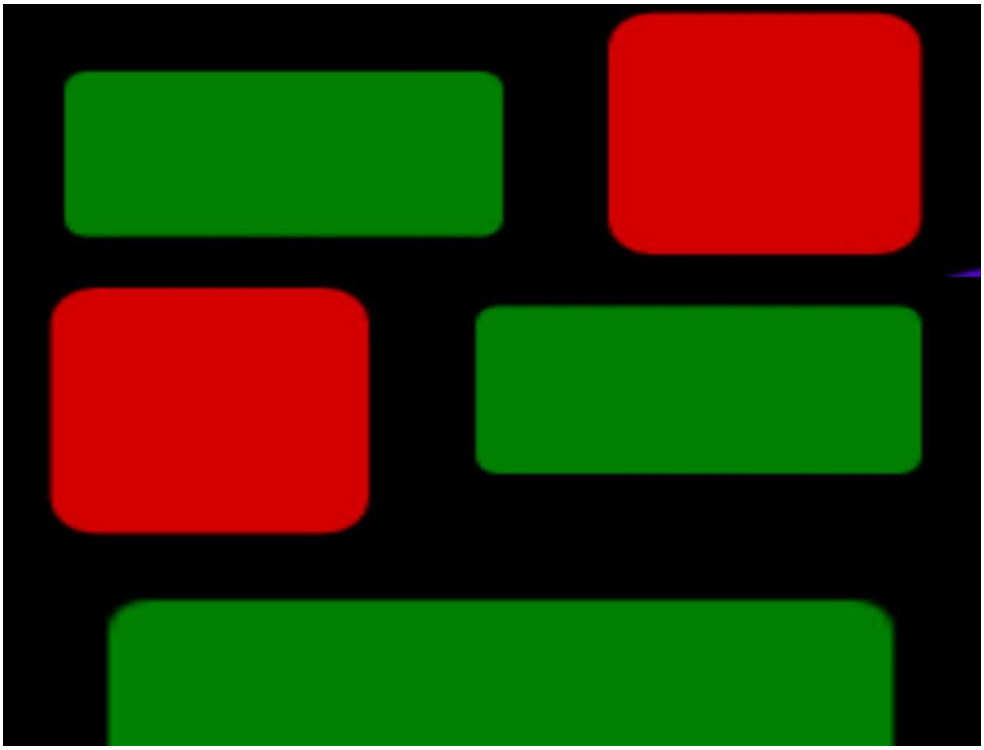
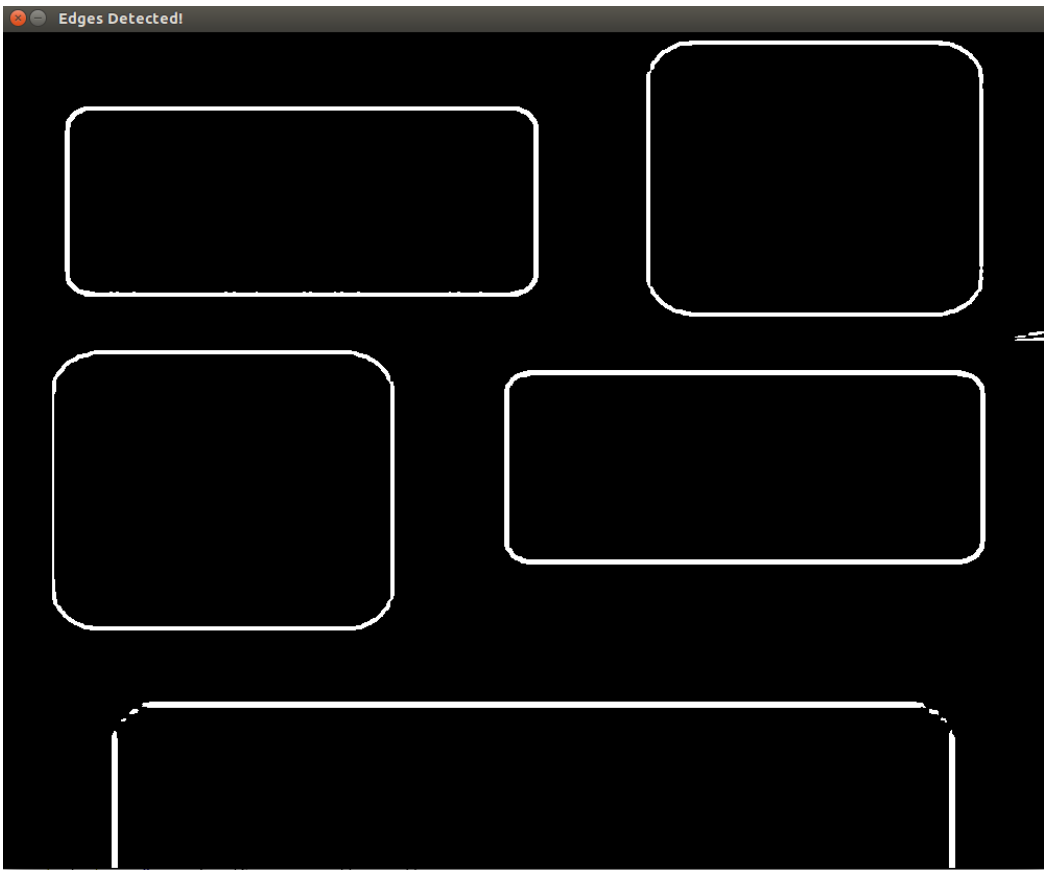
Step 5



P.S: My photo in the ID was not detected as a rectangle because the edge at the top of the photo was not a perfect line, hence it was not detected in hough lines. (due to a lighting problem when taking the image)

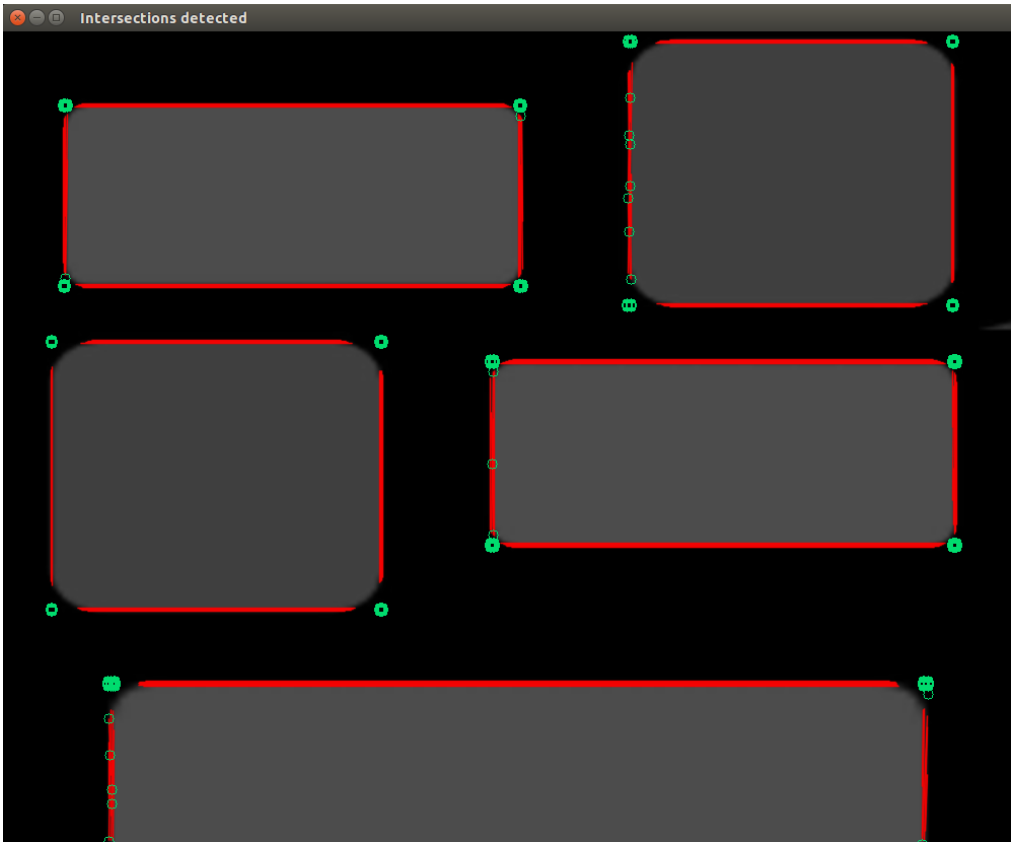
Fourth, 5 Rectangles:



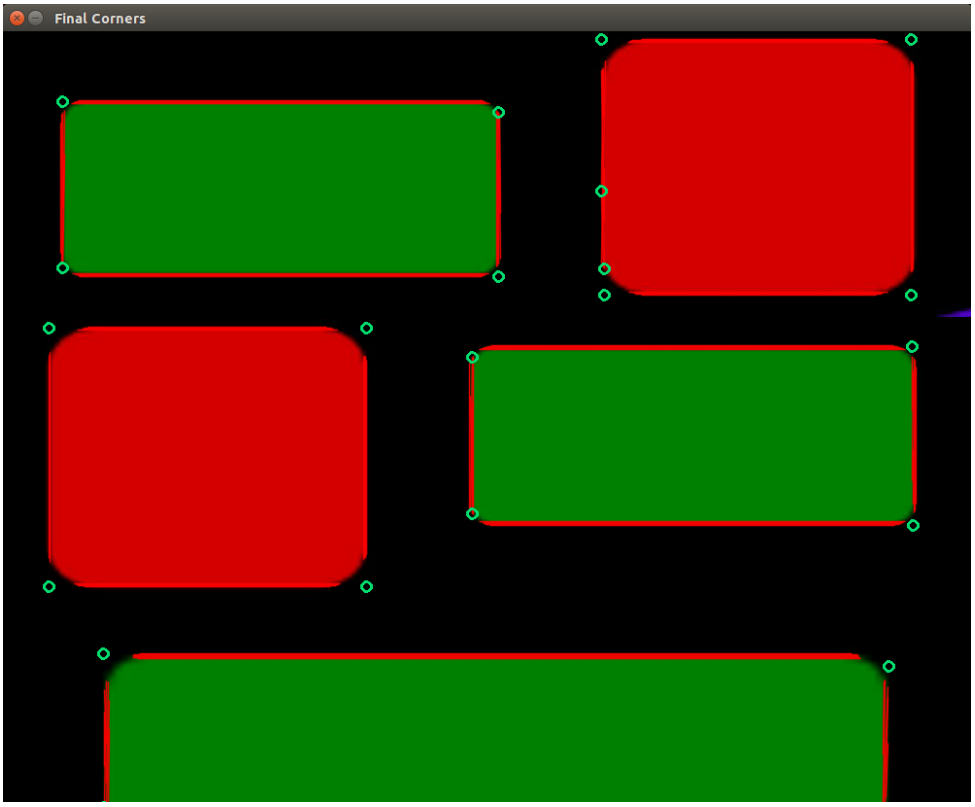


Step 1

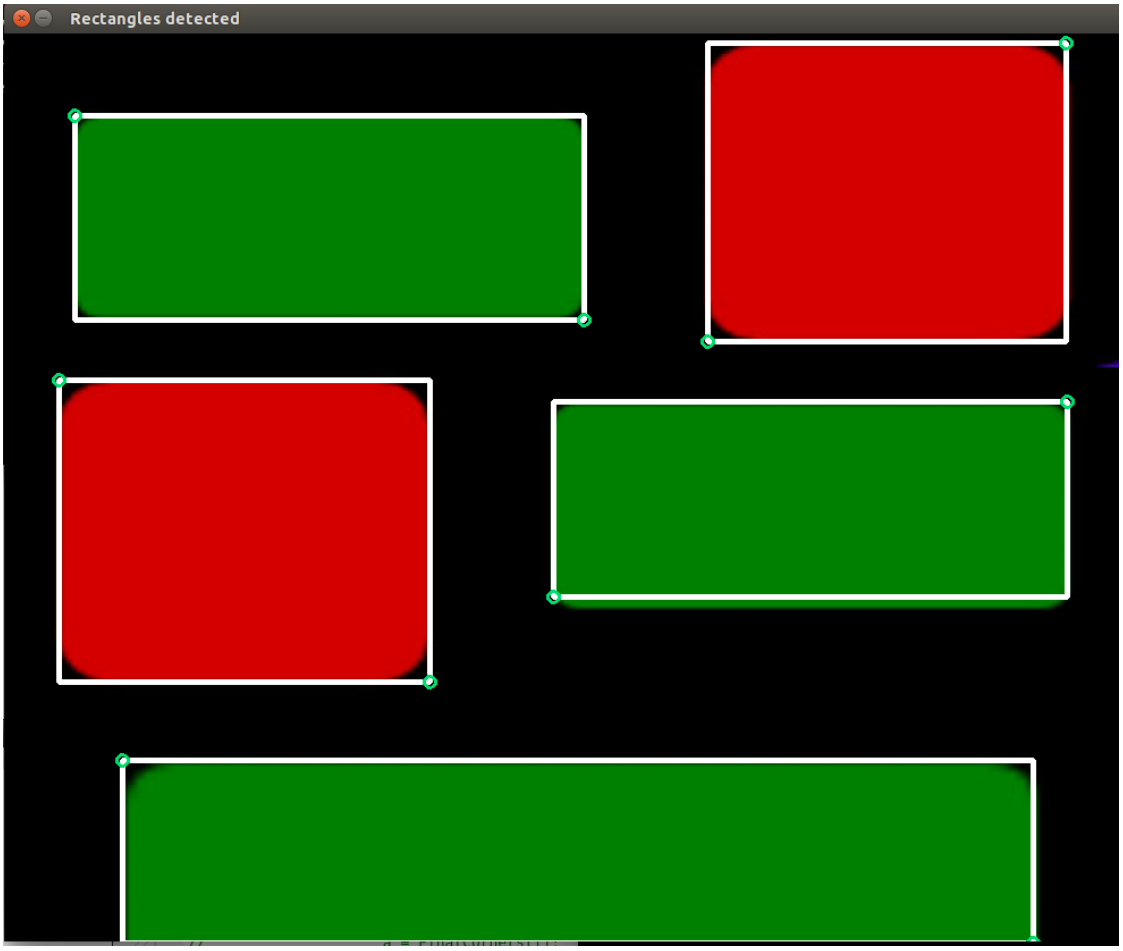
Step 2



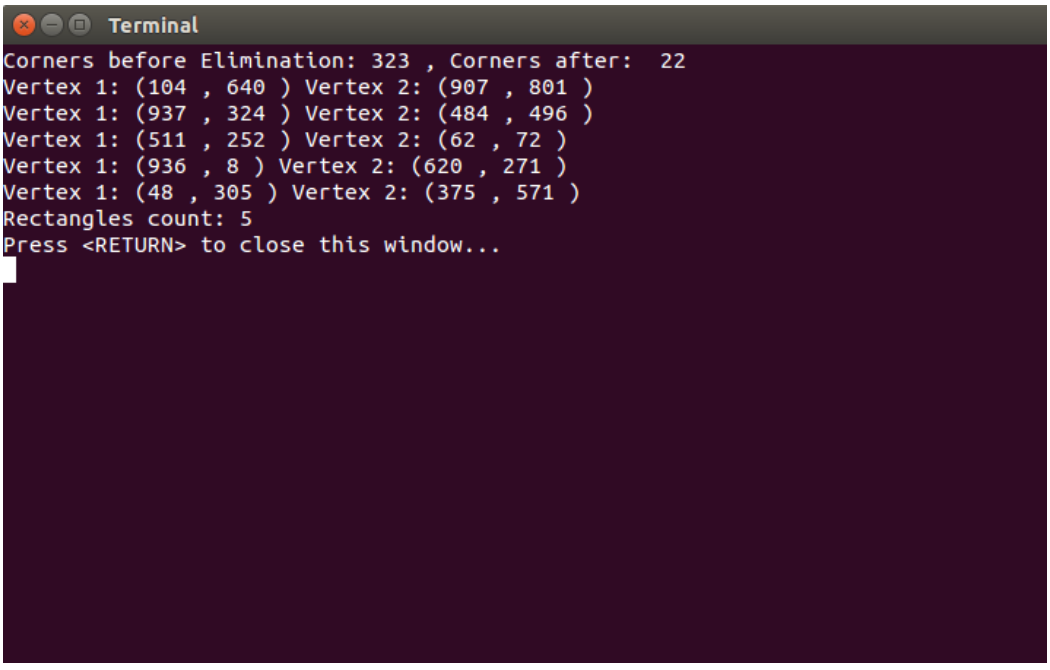
Step 3



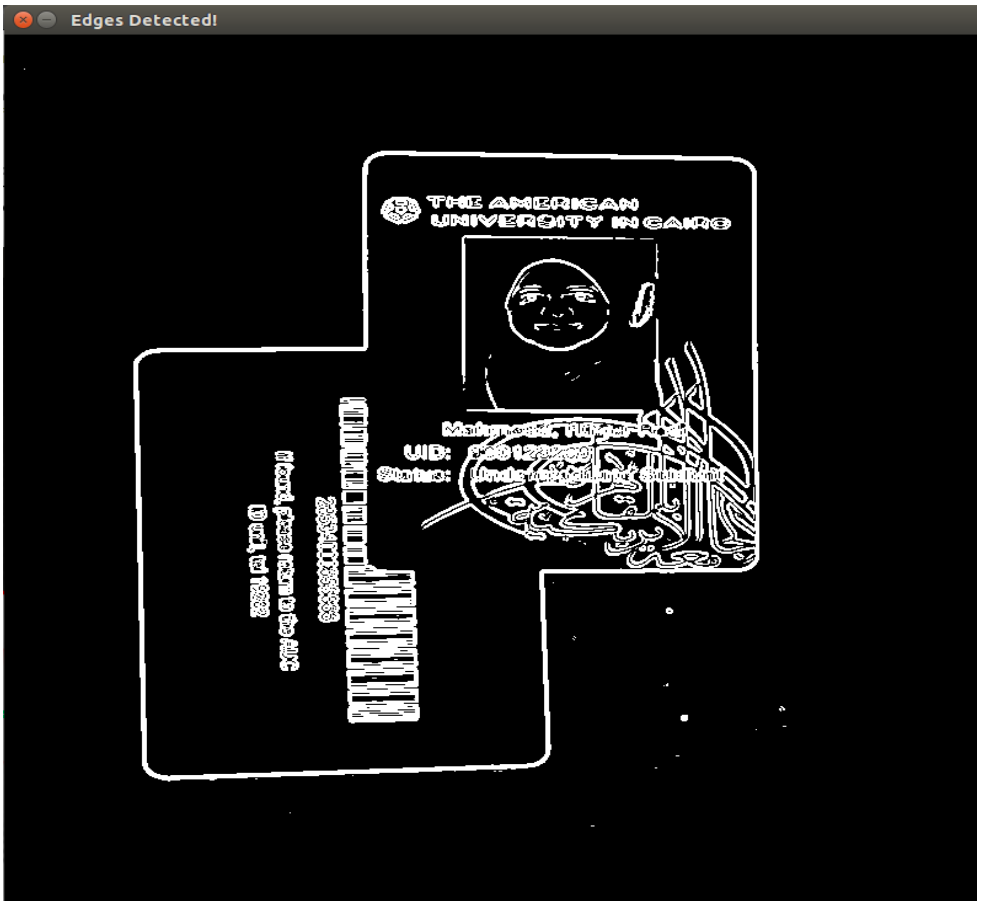
Step 4


Rectangles detected

Step 5


Terminal
Corners before Elimination: 323 , Corners after: 22
Vertex 1: (104 , 640) Vertex 2: (907 , 801)
Vertex 1: (937 , 324) Vertex 2: (484 , 496)
Vertex 1: (511 , 252) Vertex 2: (62 , 72)
Vertex 1: (936 , 8) Vertex 2: (620 , 271)
Vertex 1: (48 , 305) Vertex 2: (375 , 571)
Rectangles count: 5
Press <RETURN> to close this window...

Overlapped rectangles:


Edges Detected!
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UID:
Step 1


Lines detected
UID:
Step 2

Step 3

Step 4

The corners of the overlapped rectangles were defined but the program could not draw the rectangle itself as a whole.