A Systematic Human Counting at Guest House using Sensing Device Technique

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ABSTRACT- The application of vision detector using sensing device techniques is important in systematic counting of people both indoors and outdoors. This technique is broadly used in auditorium, lecture theatre and public market.
In this paper, the technique uses a camera attached to an Android-based mobile phone which is then applied to capture images that are then transferred to a storage system via USB for image processing and counting. Also, a model for counting people indoors and outdoors is developed. Also, accurate human counting is observed.

Index Terms: Human counting, Sensing device, detection, Model

I INTRODUCTION

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The application of vision detector in human counting is an automatic counting of people. Likewise, sensing technique is an important method of counting people both indoors and outdoors. The displayed system has ability to detect and track many people using a disparity map, skin detector and face detector [1]. Crowd gatherings in mass as can be found in places like stadium or concerts has high tendency of creating a potential risks to audience[2]. It is important that administrator should be able to provide the data of people who are in a building or enclosed outdoor space. The information collected from the counting of people is important for surveillance and security, monitoring of high traffic areas, staff planning and safety, market effectiveness, crowd management, energy optimization and, fire management which users can explore. In this paper Computer vision and MATLAB/SIMULINK tool box are used for face detection and counting using android phone camera. The data will enable us to have statistical information on the people flow at different periods of time.

. II LITERATURE REVIEW

High density traffic flow of people is time consuming [3]. People counting systems can be classified into two categories; non-obstructive and obstructive. Non-obstructive systems like thermal sensors or infrared beams though they do not create obstacle on doorways, however they still have counting problem [4]. Also, examples obstructive people counting system are turnstiles and mat-type foot switches [5]. Turnstiles are costly, flexibly low with obstruction on the passing way which causes problem of undercounting [6], [7]. In this paper, our counting system is based on computer vision with Simulink tool box. Computer vision is an inter- related field which uses computer for videos or digital image processing [8]. From engineering perspective, it automates tasks that can be done by the human visual system . The security in Smart Cities can be improved through computer vision in the Internet of Things (IoT) scenarios [9]. They worked on computer vision module to analyse isolated picture and returns to the IoT platform to get their result. They tested module using different models for heads and shoulders. The accuracy for True Positives is 34.38% for 54 pictures. With model for detecting upper bodies, module obtained a 35.19% of accuracy. In foreground segmentation the feedback update-by-detection scheme balance stationary people segmentation and removing background noise but the head-shoulder model has a poor performance on detecting people with strange clothes and hats and there was clustering of points [10]. Automatically computer vision extracts, analyses and understands applicable information from a sequence of images or a single image. In view of this, section-2 discusses architecture of the human counting system, section-3 discusses findings and interpretations and section-4 provides experimental result and conclusion.

III METHODOLOGY

The systematic human counting proposed is based on the technique of human face detection which uses computer vision tool box and Simulink tool box. The images from android phone version 5.1 camera are processed on computer (RAM 4.00GB capacity; Processor; Intel (R) Celeron CPU 2.16 GHz) via USB connection for analysis. One important aspect to have a proper image for processing is lighting system. If there is poor illumination from lighting system, there will be will insufficient information from images for any machine vision application. After getting the image from camera, background of the image is estimated for segmentation. After performing segmentation of the images, the information is passed through a decision making algorithm for tracking and counting of the people. Automatically, a tracker is initialized for every foreground blob identified either as an individual or a group.

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Finally, the developed model is implemented on MATLAB/ SIMULINK.

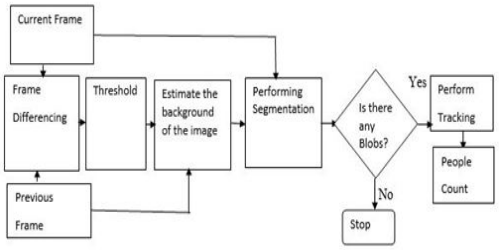

Figure1: Counting System Algorithm for Image Processing

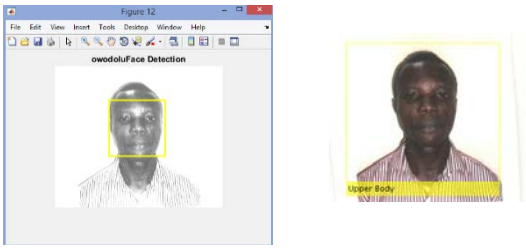

Figure 2: Face Detection with Viola Jones Cascade Detector for Single Image (Tested)

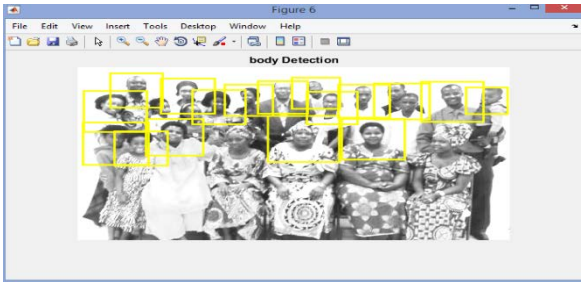

Figure 3: Detection of 18 People out of 22 with Upper-body using Viola Jones Cascade Detector

IV RESULTS AND DISCUSSION

The Guest House has a sitting capacity is 500 persons with different facilities for game and audio-visual display. The population is high on Saturdays due to ceremonies. The video and images were recorded on Saturday between 11 a.m-11.30am.The time of video clip was 4mins and it captured indoor and outdoor. The video or image was recorded in various locations at the Guest house. These are represented as Sample A, Sample B, Sample C, Sample D, Sample E, Sample F, Sample G and Sample H. The resolutions (pixel) are recorded. Sample A is the major location of the entertainment with the highest population of 22 people while Sample H has the lowest population of 4 people.

$$\% \text{ Counting Accuracy } \frac{\text{Processed Value}}{\text{Actual Counting Number}} x\ 100$$

Table 4.1: The Visitor Attendance and Counting Accuracy

ACTUAL COUNTING VALUE	RESOLUTION (PIXEL) IDENTITY	PROCESSED VALUE	DIFFERENCE BETWEEN ACTUAL AND PROCESSED (ERROR)	COUNTING ACCURACY (%)
22	293X521	18	4	81.8
18	279X435	17	1	94.4
14	267X367	9	5	64.3
19	288X398	18	1	94.7
15	273X320	13	2	86.7
7	173X263	5	2	71.4
5	194X428	5	0	100.0
4	196X316	3	1	75.0

The actual counting is by manual method. Likewise, the difference between the actual counting number of people and processed value gives the error as shown in the table above. In order to increase the accuracy, the background of the image is properly estimated to remove effect of occlusion.

Sample A, has the actual counting value of 22 people while the processed value from camera was 18 and error is 4. Percentage of counting accuracy calculated is 81.8%. Sample B, has the actual counting value of 18 people while the processed value from camera 17 and error is 1. Percentage of counting accuracy calculated is 94.4% respectively. Likewise, Sample C, has the actual counting value of 14 people while the processed value from camera 9 and error is 5. Percentage of counting accuracy calculated is 64.3% respectively. Sample D, has the actual counting value of 19 people while the processed value from camera 18 and error is 1. Percentage of counting accuracy calculated is 94.7% respectively. Sample E, has the actual counting value of 15 people while the processed value from camera 13and error is 2. Percentage of counting accuracy calculated is 86.7% respectively. Sample F, has the actual counting value of 7 people while the processed value from camera 5 people and error is 2. Percentage of counting accuracy calculated is 71.4% respectively. Sample G, has the actual counting value of 5 people while the processed value from camera 5 people and error is 0. Percentage of counting accuracy calculated is 100.0% respectively. Sample H, has the actual counting value of 4 people while the processed value from camera is 3 people and error is 1. Percentage of accuracy calculated is 75.0% respectively.

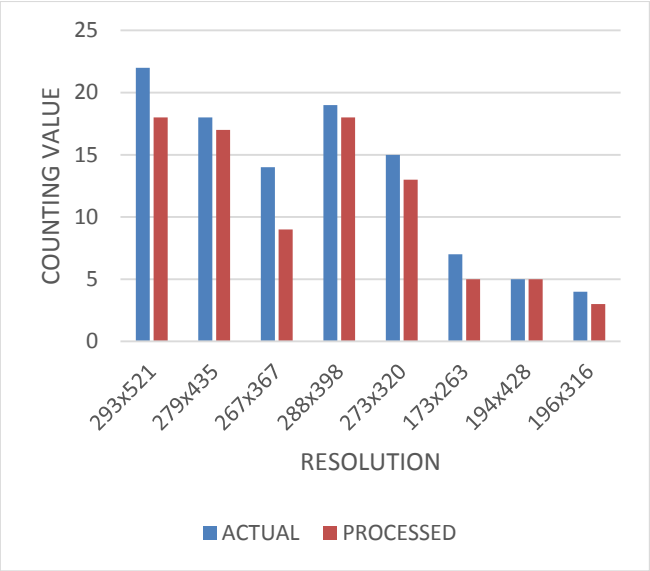

Figure 4: The Counting Value Variation and Image Resolution

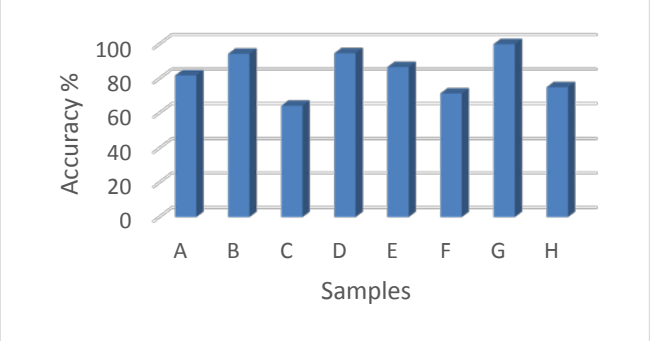

Figure 5: Percentage of Counting Accuracy of the Images The effect of occlusion affects the accuracy of the images. This is well controlled during background estimation

V CONCLUSION

The systematic human counting at Guest House using sensing device technique with computer vision and Simulink tool boxes experiment shows the result of Sample G with 5 people has the pixel of best quality with the accuracy of 100.0% under good illumination system. Likewise, people were more coordinated. Occlusion is one factor that causes error in other samples so a well illuminated environment is required. The paper reveals the systematic human counting technique in a guest house or place. MATLAB is the programming tool or interface on computer that is adaptable for counting implementation in image processing. This method is an alternative to old or manual counting system and it can be used in various places. Also it can be used for further research.

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