An Attempted Crowd and Floor Management System

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***Abstract*— This research article represents a system which enhances crowd handling and floor management techniques created with the assistance of Closed-Circuit Television (CCTV) and proximity beacons (BLE). With an aid of a desktop application crowd at a particular event/party will be observed with the use of CCTV cameras, which contains a video surveillance system. Video processing will also be used to keep track of a specific number of people roaming around an area and to make sure that no one enters any restricted areas. The visitors who arrive into a particular event will have a mobile application, which would guide them to navigate throughout an entire area and make sure that they do not visit any restricted areas. Bluetooth low energy (BLE) Proximity beacons will be used send signals throughout the generated map containing stalls Via Bluetooth; it also indicates the restricted areas on the map with the aid of the mobile application. This system will be beneficial for both organizers and visitors, organizers will finally find it easy to keep track of people and the visitors will be able to visit the areas they wish to without any difficulty.**

Keywords: crowd handling, floor management, CCTV, video processing, video surveillance, Bluetooth, BLE proximity iBeacons.

I. INTRODUCTION

A problem arises when organizers of an event try to reduce the congestion within an area. Inside a massive event, there could be several shops where people would like to go to, for example, a food corner, book stalls, etc. When people get congested it's really hard to keep control of them, sometimes the visitors will find it difficult to find the desired places they want to go to as the area can be vast in size. Too much of congestion can be a nuisance from the organizer's point of view. Tracking visitors will be hard, as people will tend to move along the area without even knowing where they are actually at. A particular crowd will find it difficult to reach their destination with a lot of congestion around them; they are going to have a hard time with this issue, with disputes like this people will not be motivated to come to an event, which could be a major problem for the organizers. "BunchMarker" is implemented to solve the above mentioned issues. BunchMarker is going to be about a crowd handling and floor planning system, which contains both desktop and mobile applications respectively. An event organizer can use BunchMarker as a desktop application to keep track of a number of people who visits the particular event. It could also be used to make sure that no one enters restricted areas. Visitors can use BunchMarker to search for the desired place they want to be at. This paper explains the implementation details of BunchMarker, four algorithms were implemented in order to make this system as a whole.

II. BACKGROUND

To carry out the research successfully, understanding previous researches and systems were essential. This chapter strives to understand the research gap to develop our system, for that following research covering the floor management, navigation methods, video surveillance, and restricted area indications areas.

Sze Lok Au and Jesse Sheng Jin have introduced Video surveillance system with object tracking and retrieval with the usage of video surveillance and video image processing by using pan-tilt-zoom cameras (PTZ) [1]. The system main task is to automatically control the PTZ cameras, it tracks the desired events and captures the video surveillance and then features will later be analyzed. A large number of CCTV cameras are used to set up to perform security surveillance as well. As an advantage of this research can see PTZ cameras can be very accurate as they can take close up images ranging from the desired distance.

Wen-Hsiung Hsieh has developed Adaptive CCTV camera system using adaptive Closed Circuit Television cameras (CCTV cameras) which include an optical sensing unit (OSU) [2]. This invention also uses an image processing unit which is connected to a microprocessor with at least one control unit along with a memory unit. An optical lens set that projects optical signals to the image sensing unit is also, and is connected to the image processing unit to enable optical parameters adjusting the

microprocessor to automatically generate the information towards pre-defined operating parameters. This invention could be very advantageous as it provides storing and real-time automatic adjustment of pre-specified operating parameters to achieve stable image capture functionalities and effectiveness under different environments such as daytime, evening, night, etc.

K.Pellegrims and R. Remmerie have presented Method of a system for hierarchical human/crowd behavior detection, see [3]. This is about an invention for the computer automated method to selectively pinpoint and specify human behavior in a crowd. This method includes allowing video data and also includes a sensor and audio data as well. Video data is being processed to extract ordered human and crowd features. Human detection is done by using unique hybrid human detector algorithm, which includes an adaptive boosting neural network. Crowd features are detected using textual analysis techniques. The sensor data includes at least one of a GPS location, weather, date, and time data. This invention helps the user by pinpointing any desired move in a specific human being in a crowd.

Kenneth Fallon has developed Voice remote command and control of a mapping security system [4]. Its enables the use of human speech to remotely access, interrogate, control and obtain real time information from security devices in a facility or location. The user is able to view the mobile display device and command the system using the human voice. The system supports detecting and tracking security intrusions, controlling the security devices at the location, requesting changes to the display, obtaining status information of the system or any device and communicating to others that may be accessing the system jointly.

Jugal Kishor Gupta & S K Gupta have introduced size Design and analysis of crowed estimation techniques, this is fitted to surveillance systems using Closed Circuit Television (CCTV) where specific objects and their behavior can be supervised through a long period of time, see[5]. A technique to estimate crowd densities is based on two measures removed from the input image of the area under surveillance. The first measure is the number of front picture elements calculated by deducting the input image from a position image containing no people. The second measure is the number of advantage picture elements of the image computed by an edge recognition followed by a diminishing operation. This cannot be applied in areas with high density crowds.

Xinyu wu has presented Crowd density estimation using texture analysis and learning [6]. This presents an automatic method to detect abnormal crowd density by using texture analysis and learning. By using the perspective projection model, a series of multi-resolution image cells are generated to make better density estimation in the crowded scene. The cell size is normalized to obtain a uniform representation of texture features. In order to diminish the instability of texture feature measurements, a technique of searching the extreme in the Harris-Laplacian space is also applied.

L. Sen and Pengcheng have introduced Navigation method and system based on a cell phone [7]. This research presents, domestic and international navigation products there are two common ways, one is autonomous using this mode of GPS receivers, and equipped with electronic maps and navigation engine), the user simply Enter or select the destination name, the device computing the best path, and displayed on an electronic map, for reference. From this users can calculate the best path, easy to find the path, efficient and its real time. As a function, they used Achieve static navigation and dynamic navigation.

III. METHODOLOGY

BunchMarker was implemented under the prototype methodology. The prototype acts as an early approximation of the system built until the final product is derived.

The first reason to choose this model is because the project requirements are not known in detail ahead of time. The project team has presented two prototype versions while developing the project.

a. Planning

This is the initial phase of building the system, and this phase was used to identify which type of platform should be used to create stalls and perform a navigation demo on(The system was implemented on square surfaces).

b. Requirement Gathering and Analysis

Information from the organizers and visitors perspective was identified through this phase, there are several research questions which needed to be answered for identifying the objectives of this particular system.

To find out a way to overcome the difficulties faced by the event organizers when trying to keep track of the visitors. To implement a method to guide the visitors to their desired places within the given area. Set up a method to dynamically create the floor plan of the venue and view graphically to take pre decisions about the floor plan. Choose the most applicable and practical ways to gather real time data for the system outcomes.

This software mainly eyes on event organizers and people who attend them. The major objective of this system is to help organizers, and the visitors to make decisions on their different perspectives

based on the event and venue. This is going to save a lot of time of the organizers and the visitors as well in the activities which they do in large crowd gathering event. This could be achieved by implementing a desktop application for the organizers and mobile application for the visitors.

The first prototype version of this system specfies the floor plan generation with the use of the desktop application and a face recognition system, the mobile application contains the registration and login platform for the visitors.

The second prototype presented with the integrated two components which are face count and dynamic floor plan. Mobile application contains that navigation system and customized message sending to the different users according to the user identification.

c. Design

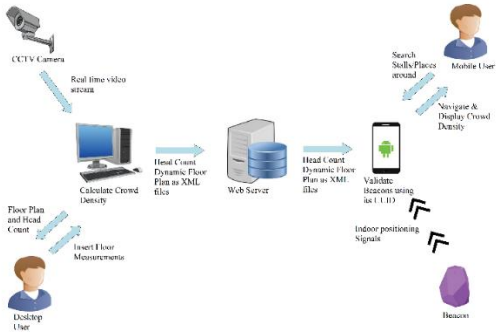

Figure 1. High-Level Architecture Diagram

Organizer is the main system handler. Organizer inserts measurements of the floor they are going to arrange. CCTV camera connected to the desktop PC and by video processing takes the face count. All those data passed to the database and retrieve by the mobile application. Mobile phone retrieves signals from beacons and navigate the user to the desired stall.

d. Implementation

There are four main unique algorithms implemented towards this system.

Dynamic floor map creation: System takes the measurements of each stall and building. Calculate appropriate floor plan and draw using the pen tool.

Crowd density calculation Takes video surveillance via CCTV and takes people count by video processing. Calculate crowd density depends on face count and area of each stall.

Restricted area indication: Using indoor positioning of beacons mobile application tracks the position of the user and if the user entered restricted area application gives a notification.

Indoor navigation: User searches stall by stall name. The application retrieves signals from

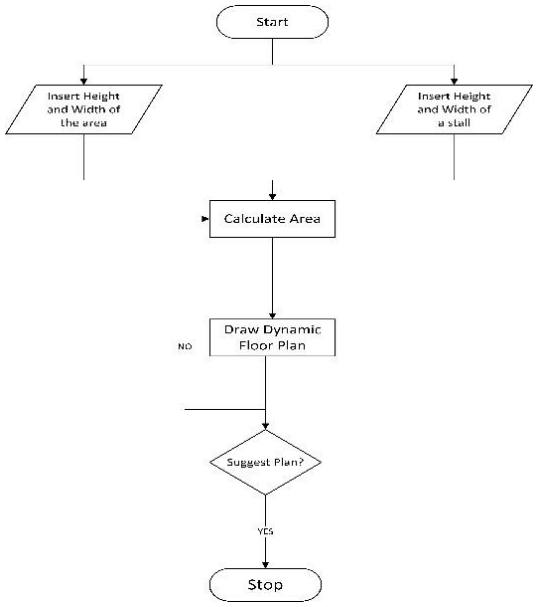

Figure 2. Dynamic Floor plan (Flow Chart)

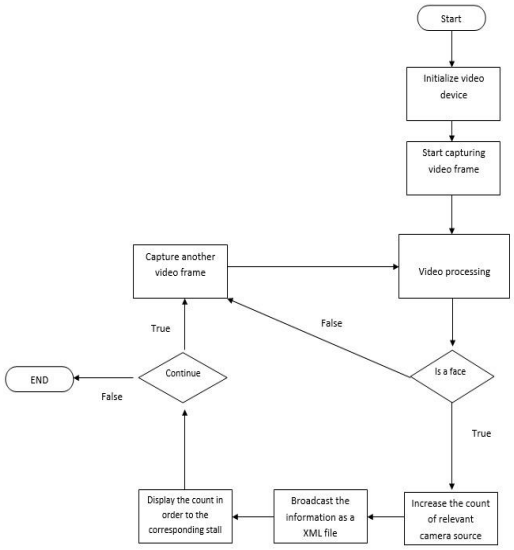

Figure 3. Crowd density calculation (Flow Chart)

beacons and validate according to the UUID of the beacon and navigate.

e. Testing

In order to clarify whether BunchMarker meets all end user requirements and find out each data processing and validation happening accurately, the research group had to perform several testing methods. Several test cases were derived from checking whether the data inserted fall under acceptable bounadries if the dekstop application is taken into consideration a test case was derived to verify whether the user can login to the desktop application with valid credentials, the same test

case was derived from the mobile application as well.

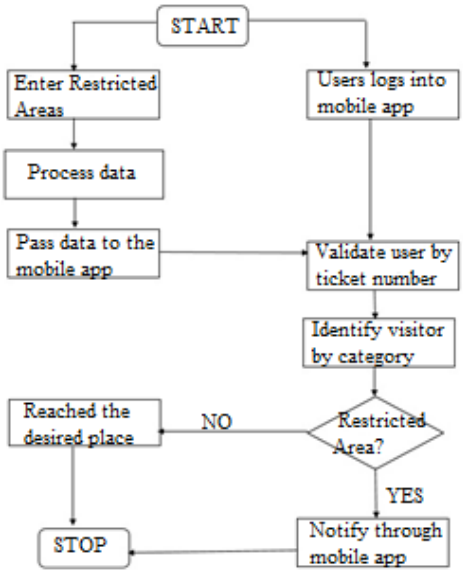

Figure 4. Restricted Area Indication (Flow Chart)

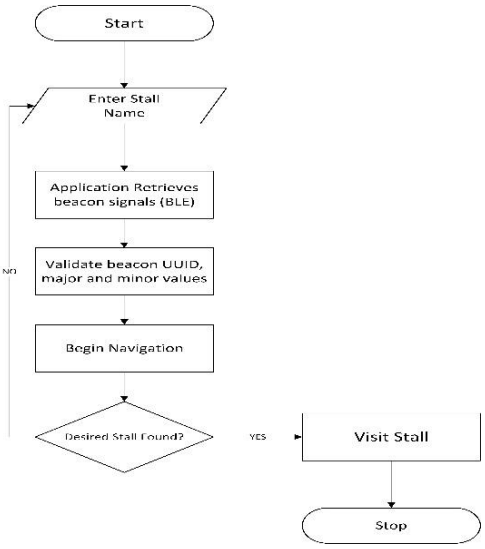

Figure 5. Indoor Navigation (Flow Chart)

IV. RESULTS & DISCUSSION

f. Evidence

Figure 6. Enter Floor Measurements (Interface)

Logged user is privileged to insert floor measurements through a form and data will save in the database.

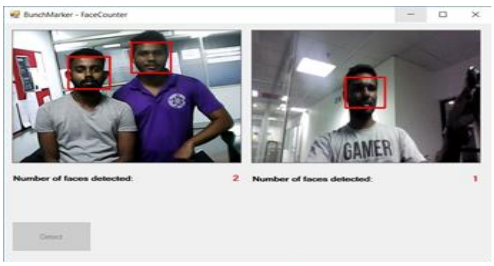

Figure 7. Face Recognition (Interface)

Through several cameras, the system takes people count of the each stall by video processing.

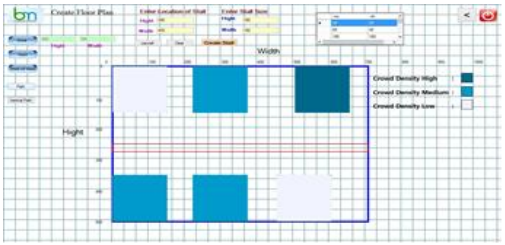

Figure 8. Crowd Density Indication

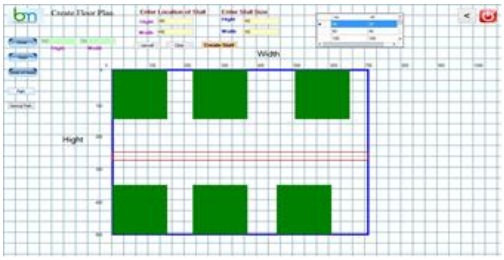

Figure 9. Dynamic Floor Plan (Interface)

In created floor arrangement crowd density Indicates using different colors according to different crowd density.

Created floor plan, calculated using user entered values.

g. Discussion

BunchMarker system developed only considering indoor events such as exhibitions. The system couldn't handle outdoor large crowd gathering events. Calculate the face count may not be possible in large crowds via video processing. The accuracy of crowd density depends on the light available on the place and the angle of the camera. Under all these circumstances crowd density accuracy level will be about 70%. System generated floor plan sometimes may not be applicable according to the surroundings and atmosphere of the building that event is held. The system has no any function to detect those circumstances. To identify each visitor through the mobile application organizers has to issue a ticket

or token with a unique number related to visitor's belonged category, otherwise, the mobile application can not indicate restriction areas according to difference categories.

V. RECOMMENDATIONS

This paper recommends that event organizers should seek the advice of the landowner or venue manager concerning its capacity. There is also a need to clarify the responsibility of counting patrons, to ensure protective measures are effectively taken. Apply quality improvement techniques and tools (e.g.: participate in quality improvement collaborative groups).

VI. FUTURE WORKS AND CONCLUSION

About this system can proceed in future in ways mention below. When creating the floor plan group considered only square areas. It will be more convenient when creating the floor plan if research group build an advance algorithm that can measure and draw circle areas in it. The system takes the crowd density by counting the faces in the specific area through a camera. In our built system group had to use a separate camera rather than the existing CCTV cameras in building that event going to be held. In future, if could take the input video stream from the existing video surveillance in the building it will be more convenient and cost effective. The existing system takes a rough count of the people just to indicate the relative congestion in each. If can count the people using a motion detector, will be able to get an accurate count than face detection. For that System has to integrate with motion detector device. In addition to the navigating user to stalls, the application can show the details of the stall which were pre inserted to the database.

VII. ACKNOWLEDGEMENT

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