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The Real-Time Alert System for Prayers at Smart Masjid

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Abstract

Smart Masjid with embedded technologies is the key factor for the prayers to correctly pray without having mistakes. The technologies inside or outside the Masjid might be greatly helpful for the prayers. Arrange and monitor people in a crowded environment inside masjid is a critical task. The authors have proposed the solution of arranging the rows during pray in the Masjid. It is necessary to fill rows start from the first row behind the Imam. Most counting techniques depend on detecting individuals to count their numbers. Counting and arrangement become inefficient when it is required in real-time and when the crowd is dense. I am proposing a technique for monitoring and estimating the density of the crowd in real-time using infrared technology. The intelligent systems will be designed based on the number of people section wise. The mosque will be divided into sections and each section will be allocated an Infra-Red Camera. Each section will be programmed to contain a limited number of people. There will be an LED display allocated to each section. With the people coming into that section, the display will start becoming less GREEN. In other words, the intensity of the GREEN LED display will become weaker. As the section is filled, the display will turn red. This way, people could see the section from quite a distance and can easily decide whether to move forward or not. As soon as the people enter the mosque, they will have an overview of each section and can decide to go to suitable places to get settled easily into the rows. The pre-programmed thermal camera will recognize people based on their body temperature. The LED display will go less green as the system receives more thermograms. After reaching the highest level of thermograms received, the LED display will automatically go RED. This would naturally stop people to enter that section.

Keywords: Counting Technique, Density of Crowed, Infrared Technology, Infrared Camera Thermograms, LED, Red Light.

1. INTRODUCTION

Masjid is regarded as a place of worship; it is a very popular word and commonly used by Muslims throughout the world. According to a report, the percentage of the World Muslim population concerning the total World population has increased steadily from 17% in 1950 to 26% by 2020 [1]. While the total European population increased from 548 million in 1950 to 744 million by 2020, the percentage of Muslims in Europe increased from 2% in 1950 to 6% by 2020. As of 2013, it was predicted that the world's Muslim population will grow twice as fast as non-Muslims over the next 20 years. By 2030, Muslims will make up more than a quarter of the global population [1].

It is quite clear that the World Muslim population is increasing at a dramatic rate. The increase in the Muslims around the world means the increase in the number of

pilgrims coming to the holy lands of Makkah and Madinah every year [2]. Several problems are faced by pilgrims due to the overcrowding of people in Masjid at the time of Hajj and Umrah in Saudi Arabia. We have focused on the problem of filling gaps inside Masjid to deliver an even distribution of people inside the mosque [3]. Figure 1 shows the masjid al Nabawi Madinah.

Figure 1. Masjid Al-Nabawi, Madinah

This study mainly focuses on limiting the over-crowding of the people in rows during prayers at Masjid and could be implemented anywhere else [4-5]. Because of the huge area of the mosque [6], it becomes very difficult for the people whether to go further to the next row or not. In most cases, people just don't care and step forward towards the front, resulting in overcrowding and hence inconvenience to the people [7-9]. We are proposing a novel system that could be used to limit the overcrowding of the people and create an even distribution of people inside the mosque.

There have been a lot of discussions about the approach that should be used to solve the problems. A lot of debate was carried out at the Faculty of Computer and Information Sciences about this issue. Various ideas were proposed including the use of microcontrollers, sensors, laser-cameras, etc. After some critical reviews put forward by some faculty members, we came up with a solution that was accepted as an appropriate approach towards the solution to the problem [10-13]. We are proposing Infra-Red technology to be used in this project as the best suitable tool to solve the problem.

2. METHODS

2.1 Working Of The Infra-Red Camera

Most Infrared Security System will be able to capture clear images during the day – which is exactly what we want. The overall effectiveness of a camera is marred if you are not also fully protected at night-time. Night-time security is vital to have because criminals will often choose to act under the cover of darkness [14].

Therefore infrared CCTV is a great all-round surveillance choice – it gets good picture coverage no matter the time of day or night.

As CCTV becomes more commonly used, the systems become more sophisticated, infrared CCTV for example, is now an affordable way of protecting a low-light area. Infrared closed-circuit television cameras make this a reality, effectively monitoring the darkness for your surveillance system [15]. This technology has been used for the surveillance purpose so far, but here we are using it for a whole new concept.

2.2 Thermal Imaging

The process used by infrared CCTV cameras for night-vision is known as thermal imaging. People and objects constantly emit a level of heat referred to as thermal energy. Thermal energy resides in the electromagnetic spectrum which in turn occupies the top of the infrared light spectrum [16]. Thermal energy is invisible to the naked eye because it is emitted from a source, as opposed to being reflected by light. Infrared CCTV cameras use thermal imaging to capture various levels of thermal energy and convert it to a light-based image that is visible to the human eye [17]. This process of revealing the invisible occurs over several steps:

i. Infrared Lens - The specially designed lens of an infrared camera is used to focus the levels of invisible infrared radiation within its view [18].
ii. Thermogram - Infrared detectors review the radiation focused by the lens and proceed to create a temperature map known as a "thermogram." The completed thermogram is then translated into a series of electric impulses [19].
iii. Signal-Processing - Once converted into electric impulses, the thermogram is sent to a chip on the camera or server known as the signal-processing unit. This unit rebuilds the electric impulses as usable data [20].
iv. Display - Once translated, the user data is sent to the display, where it appears as a graphic rendition of the contrasting heat emissions that were originally captured [21], [22]. These images exist in the visible spectrum, allowing the human eye to see the subject via its thermal energy.

3. RESULTS AND DISCUSSION

The researchers themselves involved gathering most of the data for analysis. Various strategies are applied for gathering data such as questionnaires, assessment, and reporting. Analysis of the accuracy of the information requires implementation through the use of tools and concepts. It includes the importance of flexibility for collecting the data. This research has been carried out across interconnected operations such as data elimination, application method/analysis found, and completion.

The mosque will be divided into sections and each section will be allocated an Infra-Red Camera. Figure 3 shows the rows of peoples and infrared cameras.

Figure 2. Coloring displayed by LED

Figure 3. Example of three rows and four columns in the Masjid

Each section will be programmed to contain a limited number of people. There will be an LED display allocated to each section. Figure 2 shows the coloring produced by the LED.

With the people coming into that section, the display will start becoming less GREEN. In other words, the intensity of the GREEN LED display will become weaker. As the section is filled, the display will turn red. This way, people could see the section from quite a distance and can easily decide whether to move forward or not. As soon as the people enter the mosque, they will have an overview of each section and can decide to go to suitable places to get settled easily into the rows.

Algorithm-1 (count number of people in image)
Step 1: Read the Image
Step 2: Convert the Image to Grayscale
Step 3: Threshold the image
Step 4: Complement the image
Step 5: Find the Boundaries of the Objects
Program in Matlab

```
image1=imread('count.jpg');
imshow(image1) image1=rgb2gray(image1);
imshow(image1) image2=im2bw(image1, graythresh(image1));
imshow(image2) image2=~image2;
```

imshow(image2) t1 = bwboundaries(image2);
imshow(image2) text(10, 10, strcat('\color{green} Objects Found:', num2str (length(t1))))

Algorithm-2 (output algorithm)
Step-1: Find the total number of persons from algorithm 1 say n.
Step 2: if n<Max goes to step 3 otherwise go to step 4.
Step 3: GREEN light will ON and the RED light will OFF.
Step 4: RED light will ON and GREEN light will OFF.

Our pre-programmed thermal camera will recognize people based on their body temperature. Since the normal human body temperature is 38 C (98.6 F), this system would create a thermogram of a human being. The LED display will go less green as the system receives more thermograms. After reaching the highest level of thermograms received, the LED display will automatically go RED. This would naturally stop people to enter into that section. Figure 4 shows the real-time people counting and display the color green because space is available in the rows.

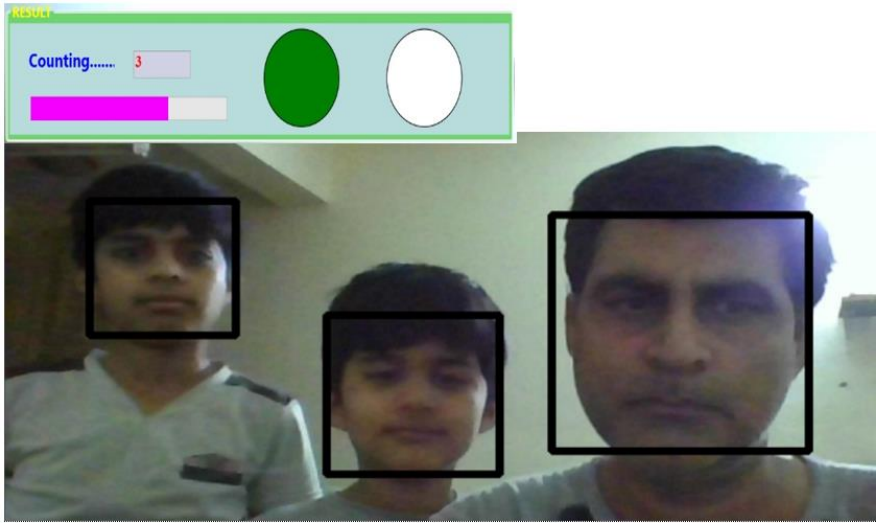

Figure 4. Real-Time people counting and shows color

The output of the research shows that green indicator because the number of people in a row is less than the maximum number. If the row is full then the red indicator will be on.

5. CONCLUSION

This study aims to find the solution to the space finding problem in the Masjid and continuous improvement of the ongoing research on Smart Masjid. The algorithm is implemented that reads the thermogram which is captured by an Infra-Red camera. Each thermogram is processed and the human images are defined making

it easy for the system to count the number of persons in each section and identify the space between two prayers. Based on the input data, the output algorithm responds. The output algorithm notifies whether there is any space left inside the section or not using an LED display. The prayers will know the available space inside the Masjid using the lighting system. Greenlight indicated "the space is available" and red light indicated "the space is not available". In the future, this study can be implemented in smart Masjids in whole the world.

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