Mobile Robot Movements Using Image Processing for Home Surveillance

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Abstract— This paper proposes a classic approach to implement the use of moving robots using the principles of Image processing. The mobile robot is controlled from a distance by a human operator through a GUI(Graphical User Interface). In this, it includes the simulation of the sensors to predict the actions of the robot. In this proposed paper, we aim to design a robot that will be used under a Video Surveillance Vicinity. The robot and thus the surrounding area will be under surveillance. Any changes in the robot's movements can be viewed via the camera mounted on the robot. Also, any intrusion attacks or occurrences will be received to the human operator through SMS Alerts or Internet Based Services on the Android phones. Technique such as Color Segmentation is implemented. The GUI (Graphical User Interface) that is made in the software will receive the live images from the camera.

Keywords—Surveillance, Color Segmentation, RGB models and sensors.

I. INTRODUCTION

In the advanced era of technology, there is a rapid growth in the usage of new and new techniques for the betterment of humans. The use of a robot in the human environment is one of this. With the growing amount of technologies, there is more demand for security and safety. Thus, there is a need to develop one such entity to provide that. In this proposed paper, we design a mobile robot using the fundamentals of Image Processing. The mobile robot refers to a moving robot which is designed to work in the video surveillance areas.

The birth of robots was seen during the early developing age. The field of growing technology had witnessed the requirement of robots in certain applications. Several scientists collaborated to make the use of robots function in the developing technology. Following was the study work done during the early times. Nicholas Roy, Wolfram Burgard, Dieter Fox, Sebastian Thrun[1] worked together on "Mobile Robot Navigation with uncertainity in certain Dynamic environments. Dynamic environments refer to the environments which are harmful to human interaction. Their approach included generation of trajectories that involved the information content and density of the people in the specific environment. Nicholas Roy, Sebastian Thrun[2] proposed a statistical method for calibrating the odometry of mobile robots. Odometry refers to the measurement of distance travelled by the mobile robot. The algorithm proposed in this approach makes use of the robot's sensors to automatically calibrate (mark or calculate with the standard readings) the robot as it operates in the environment. However, there were certain demerits of this approach such as wear and tear, absence of human intervention and change in the physics of the mobile robots. J.Schulte, C.Rosenberg, S.Thrun[3] researched on Human Robot Intervention or properly known as Human Robot Interaction. This approach aimed at designing an interactive robot which had a motorized face, an architecture that described the moods of the robot and a systematic method for learning how to interact with the people. Therefore, the past decades have seen the origin of robots and various drawbacks of the same. In the recent times, there is more focus on the security and other factors associated with it. The proposed paper is implemented for the purpose of Home Surveillance. That means the robot used here will be moving in the in-door environment.

II. RELATED WORK

As mentioned above, we have seen the rise of robots in the past decades. We shall see the related work regarding surveillance using mobile robots.

A. A Surveillance System based on Audio and Video Sensory Agents co-operating with a Mobile Robot[4]

This paper presents a Surveillance system that makes use of audio and video sensors to show and track the presence of an intruder in an off-limit area. The system in this approach is composed of a mobile agent and various static agents. The mobile agent is like a vision agent consisting of an omnidirectional vision system and a mobile robot. The static agents are like acoustic agents consisting of self-steerable microphone arrays. In this respective approach, an intelligent surveillance system is built that makes use of both mobile(moving) and fixed(static) surveillance agents.

B. An autonomous Mobile Robotic System for Surveillance of Indoor Environments[5]

In this proposed approach, an autonomous mobile robot for surveillance of indoor environments is used. This system is designed in such a way that it is capable of handling tasks and other issues autonomously. This approach successfully

addresses a number of basic problems related to environment mapping, localisation and autonomous navigation, scene processing(to detect removed objects) and people detection.

III.   ALGORITHMS

Following are the algorithms to be implemented:

A.   Blurring

A Gaussian blur is also known as Gaussian smoothing which is the result of blurring an image by a Gaussian function.

The use of Blurring usually makes the image unfocused. In the area of signal processing, blurring is obtained by convolving the image with a low pass filter. The amount of blurring is increased by incrementing the pixel radius. Fig. 1 and Fig. 2 represent the original image and the image obtained after blurring respectively.

Fig. 1 Original image to show the effect of blurring

Fig. 2 Blurred image obtained by blurring algorithm

B.   Grayscaling

A Grayscale digital image is an image in which the values of each pixel is a single sample value. This implies that it carries only the intensity information. Images of this type are also known as black and white which are usually composed exclusively of shades of gray which vary from black to white. Fig. 3 represents the image that is obtained after grayscaling.

Fig. 3 An image that is obtained by doing grayscaling

C. Thresholding

Thresholding is the simplest method of image segmentation. From a grayscale image, thresholding can be used to create binary images. Fig. 4 represents the image that is obtained after thresholding.

Fig. 4 An image that is obtained by doing thresholding

IV. IMPLEMENTATION

The above algorithms will be implemented for the different types of images. The system implementation will include the interfacing between the software and hardware components. IC 8591 is used along with MAX 232 and other hardware components. The robot will be designed on which the camera will be mounted. The robot will be moving that is it will be mobile in the indoor environment and capture the images of the surrounding to the GUI created at the user side. Any intrusion in the process will be detected by the sensors and the notification will be sent to the Android phone via SMS alerts or internet based services.

V. CONCLUSIONS

This paper actually is a survey paper which discusses the algorithms to be implemented for the working of the project. The mentioned algorithms are for obtaining the images in the respective form. Various mathematical notations are used to compute the value of the function. This paper mainly focuses on the algorithms to be implemented and the actual implementation of the project.

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