

Introducing an Image Processing Base Idea for Outdoor Children Caring

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Abstract—In this paper application of artificial intelligence for baby and children caring is studied. Then a new idea for injury prevention and safety announcement is presented by using digital image processing. The paper presents the structure of the proposed system. The system determines the possibility of the dangers for children and babies in yards, gardens and swimming pools or etc. In the presented idea, multi camera System is used and receiver videos are processed to find the hazardous areas then the entrance of children and babies in the determined hazardous areas are analyzed. In this condition the system does the programmed action capture, produce alarm or tone or send message.

Keywords—Baby and children Care and Nursing, Intelligent Control Systems for Nursing, Electronic Care and Nursing, Dangers and safety for children and babies, Motion detection, Expert danger alarm systems.

I. INTRODUCTION

INJURY prevention is the best method for safety promotion in any societies or places. Dangers in around are the main worries of parents for their children and babies. Parents use vision and sound controls to evaluate their children activities to determine danger possibilities and make safety prevention tasks. In most cases they avoid them from dangers which may threaten their children. The aim of this paper is introducing new intelligent system for babies and children caring in yard by using digital image processing. There are some conventional method of caring and danger preventing without any placation of intelligent systems most of them are focused on training, risk elimination or applying of preventive notes and issues or designing on safe considerations. Commonly we use visual and sound controls to evaluate the children and babies activities in the yard to determine dangers around of them. Parents use three works for danger preventing. They are:

- 1- Removing the dangerous equipments around them.
- 2- Preventing the babies from get closing to dangerous equipment or actions by continues caring.
- 3- Training.

One of the best methods for this purpose is to alarm them when they are closing and entering near dangerous equipment or dangerous positions. Statistical Studies show that the main warring subjects for children and babies are:

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- 1- Pool
- 2- Garden tools
- 3- Animals
- 4- Falling down
- 5- Improper use of the equipments in around.
- 6- Height
- 7- Barriers
- 8- Steps

These are the main accidents for children and babies. However most families consider this dangers but the statistics shows these are the most occurred events for the children and babies when they are in the yard.

There are several publications of home accident and injuring statistics and analysis [2], some security systems are suggested to use of CCTV for remote caring purpose; in this method only a small TV or monitor shows the baby's situation and actions [2]. But they need continuous caring because in these systems we can see only the children and babies by CCTV remotely and there isn't any intelligence or automated caring facility. Most of prior arts are focused on the statistics, classifications, safety rules and issues and behavior analysis.

II. IDEA

A. Main Idea

It is very interesting to make a new artificial system which can make the cares that we do them by our eyes or our ears. It can be used to inform parents or nurses. Main desire problem in this paper is to introducing computer base safety operator software to see the children and babies motions and detect the danger events in around of them, then when the babies or children entered in the dangerous area; the software produce desired actions to inform parents form the probability of danger which threatened their children [1], [2].

The method is based on application of multi webcams and using digital image processing techniques to finding baby and child motions in desired places such as gardens and comparing positions to dangers positions to producing appropriate alarm for notification automatically. In the implemented system the received video is made to safe and dangerous zones and the child or baby position is obtained by digital image processing and alarm notifications are generated if the baby or child is entered in a danger zone.

Therefore this method detects children motions

automatically and when the children or babies entering to a danger area or zone then it produce user recorded or default alarm sounds and messages to inform them and their parents especially their mother when she is in kitchen. Application of image processing in baby caring is very interesting for small families to decreasing danger probability and increasing caring level. In this implementation a recorded video is used for test the method. The method is implemented in MATLAB software and the results are presented in this paper.

B. Main Considerations

Idea implementation needs four basic considerations as followed.

- 1- How we can extract the babies and motions in the yard?
- 2- How we can determine the probability of danger in any area of the yard for children?
- 3- What is the best area zoning method?
- 4- What is the efficiency percent of the introduced method?

In next parts of the paper solutions for next considerations are presented and the benefits of the idea are counted.

C. Benefits

- 1- Increasing the safety for children and babies in yard.
- 2- Decreasing the accidents and events for the children and babies.
- 3- Increasing the parent remote caring precision and helping them for babies caring.
- 4- Use of intelligent mechanism for baby caring application.

III. SOLUTION

The solution method is implemented by using up to four webcam which is connected to a quad video mixer or USB quad junction bus, to make available videos from yard environments and desired places in the yard that should be processed. Then we developed software to get these video information and separate them; then the software removes background and unmovable objects in each videos; then make a rectangular zoning for every videos by some adjustable parameters (such as number of rectangular zones in any videos, sensitivity, children clothes color and...) Then the software prompts to user to define dangerous zone and the probability of the danger by a GUI interface. After that if user presses the run bottom the software start to detect following items [3].

- 1- Children or babies existence in zones.
- 2- Children or babies motions.
- 3- Children and babies entering in dangerous zones.
- 4- Assigning danger probability

These features is implemented by digital image processing, the algorithm and the software Block diagram for 12*16 zoned video are presented in Fig. 1. We can increase the precision in baby and children detection algorithm by predefining colors of the baby clothes but we assume that

only the baby is the moving object in the controlled areas. In this algorithm at first we use RGB to gray scale block to convert the videos to decrease the data volume after that we separate the information of each zone by defined zones and then the SAD algorithm is used to detect motions in each zone.

SAD is sum of absolute difference method which computes the sum of difference color of every pixel from the last pictures or n frame last image. If the sum was greater than an adjustable threshold then it detects a motion (we compute the motion threshold by experimental tries.) Then the position of movable object is compared by the border of dangerous zones if it cross one of them or it was in danger areas then one following actions are done by the computer.

- 1- Playing the default alarm sound if it was selected. [4], [5]
- 2- Playing the recorded sound of the family members that was selected.
- 3- Saving the events to obtaining the moveable objects and entering in dangerous zones.

The following processes should be done as mentioned in Fig. 1.

1. Back ground cancellation
2. Noise cancellation
3. Edge detection
4. Object recognition
5. Position determination

For example the background canceller is a comparing function that cancels the information of unmovable Objects from the received frame and the noise canceller is a smoothing 16*16 median filter. And the edge detector is a SOBEL filter. Position determination is done by comparing the edge of moving objects by the Zone's borders equations.

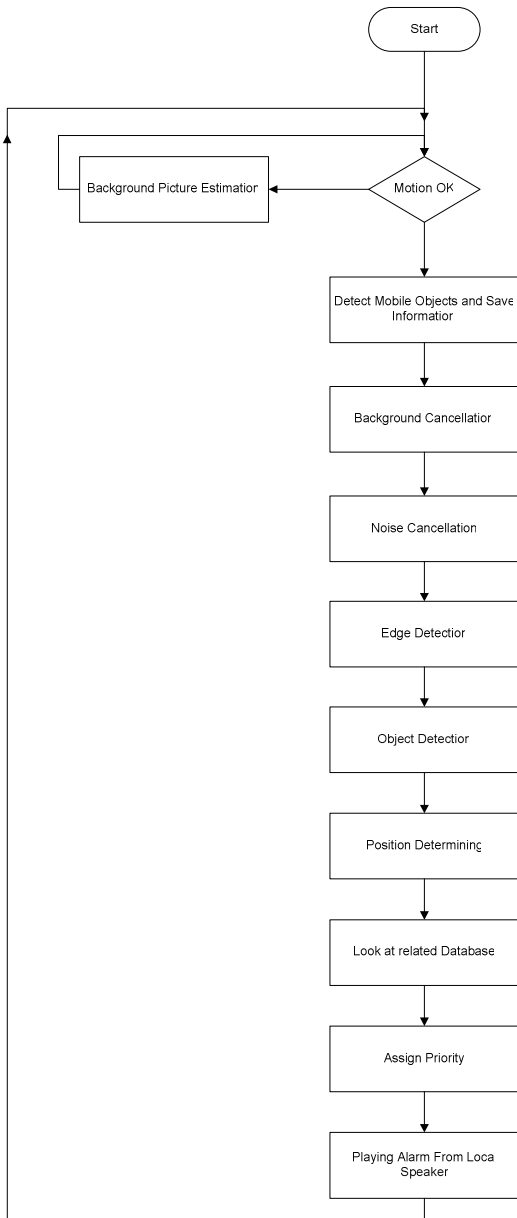


Fig. 1 Solution Algorithm

Simulation results that performed in Matlab simulink environment is presented in Figs. 2 and 3, figures represent base frame that is base of comparison consecutive frame that compared with base frame. In Addition edge detection block output in Fig. 3 is shown. Matrix in Fig. 4 shows final results [6].



Fig. 2 Children detection

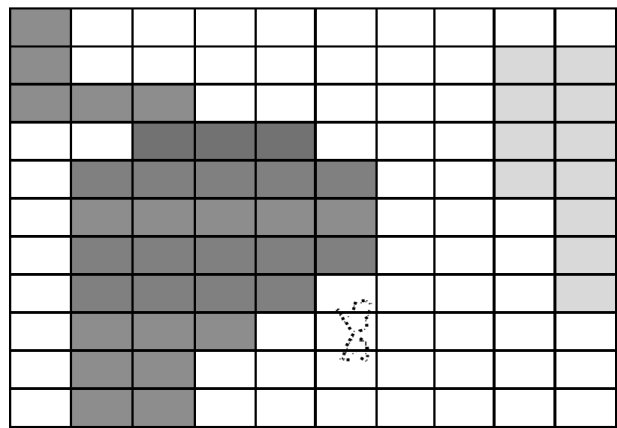


Fig. 3 Detection and zones

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	27	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	127	0	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	123	160	0	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fig. 4 Movement recognition pattern matrixes

IV. CONCLUSION

The result of this algorithm has dependence and sensitivity to enough light and resolution of camera and without enough light and good resolution of captured images we aren't able to get good result. Another effective notation that help us to get good results is replacing base frame with new one (Base frame refreshing) because of light changing along of day. Anyway this algorithm despite the simplicity is able to conduce to very good and precise results with low cost.

1 - An intelligent and automated electronic system in house caring is introduced and operation method is implemented.

2- The implemented method makes 72% efficiency for the results in our experimental software tests. The scenarios are made by computer video editing of a recorded film from a house and entering a mobile slow motion object on it, it is considered as a baby.

3- It is very interesting equipment for small families because ordinal caring needs at least a person for caring.

V. FUTURE WORKS

1. Automatic danger detection in house.
2. Using and merging expert systems and data bases for danger identification.
3. Reducing time of computations by processing optimization.
4. More statistical study of the system application and efficiency.
5. Use of multi camera sensor fusion to extract more efficiency and precision and extracting new identity.

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