Vision and Embedded System based Military Robot Path Planning

Sandeep Bhat
Srinivas Institute of Technology
Mangaluru, India

M. Meenakshi, PhD
Professor &Head
Department of I. T.
Dr.AIT, Bengaluru, India

ABSTRACT
Robots are playing an important role in the military application. Most of the work in the military is dangerous for human being. In a war field or rescue operation a soldier needs to take his own way to reach the destination. Most of the ways are dangerous for a soldier. Hence robot replaces the soldier and path planning is depending on the image processing and microcontroller based embedded system.

General Terms
Embedded System,MATLAB, Military and Robot

Keywords
Path Plan,SAD, Robot

1. INTRODUCTION
Presently a day's need of the robot is expanding as a result of robot's effectiveness at work. The independent robot meets expectations without human intervention. Zones like military, ATM stalls, and atomic reactors so on are utilizing robots [1]. To pick-up surgical tools from a tray and place the tools into different trays according to the types of the surgical tools a robotic system using a Baxter research humanoid robot. To identify the location of the tools in a tray vision-based robot manipulation system is used. [2]. Real-time gesture recognition is mandatory for gesture based human-robot natural interaction. Gesture is recognized using rule-based approach whenever the three skin-like regions at a particular image frame match with the predefined gesture [3].

The wireless camera fixed on the robot will capture the image in front of its viewing range and the object tracking is realized by SAD algorithm [4]. Sum of Absolute Difference (SAD) algorithm is used for the implementation of the proposed image processing algorithms. It works on the principal of image subtraction. The developed algorithm is validated in real time by Change-based moving object detection method [5].

Path planning of Robot is one of the challenging fields in the area of Robotics research. An intelligent system is considered to be a device/robot having an antenna connected with the sensor-detector system [6]. Model-based programming solves the complexity of programming embedded systems, interaction between sensors, actuators, and control processors [7]. In this work image processing using MATLAB [8] and the robot is implemented by 8051 microcontroller [9] for the desired path arrangement.

2. BLOCK DIAGRAM AND ITS EXPLANATION
The block diagram of vision and embedded based military robot is as shown in the figure 1.

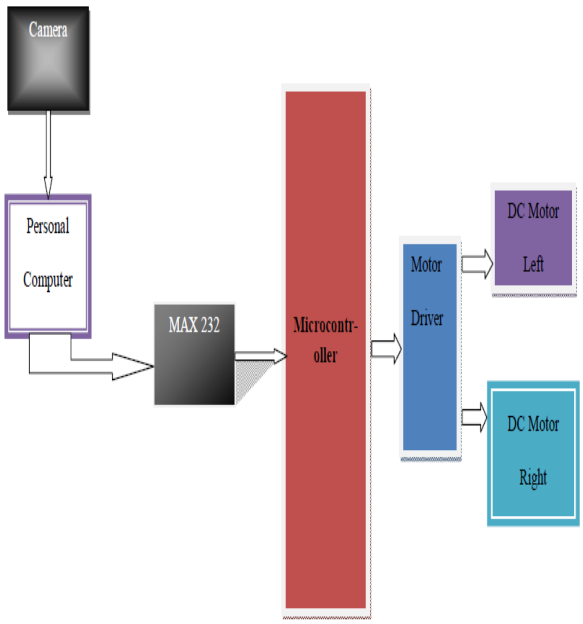

Figure 1: Block Diagram of the Military Robot

The camera captures the image of the proposed path of the robot and later handover to computer for processing. Based on the image substraction method,the present and previous images will be compared. Depending on the difference value of the pixels, i.e.,nonzero or zero object on the moving path will be identified. This path information will be sent to the 8051 microcontroller through MAX 232 level shifter. The microcontroller decodes the data and send the command to the DC motors (robot) accordingly.

3. WORKING PRINCIPLE
The working principle of the military robot is as shown in the figure 2. Camera captures the video (converts to image). Convert the colour image to binary image for the further processes. Determine the difference between the current image and previous image. After the comparison process if the difference is non-zero a new object (obstacle) is identified. Using the MATLAB software finds the position of the object based on the pixel position method and hence the proper path for the robot also established.

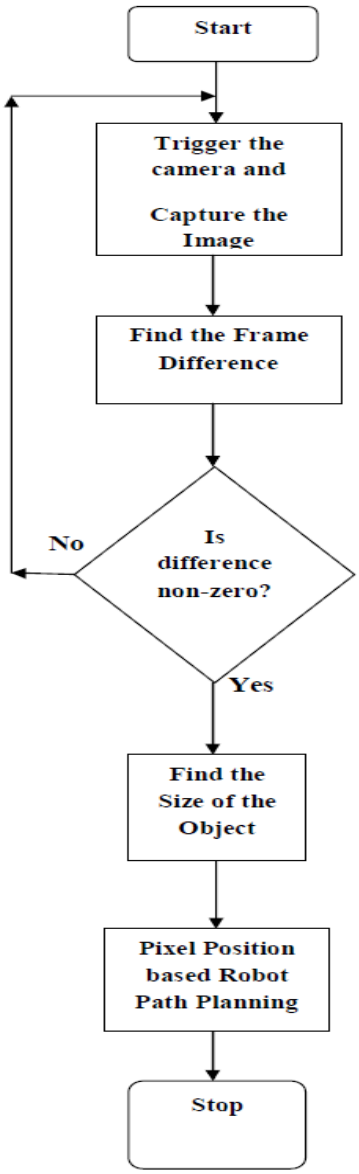

Figure 2: Flow Chart of the Working Principle

4. RESULTS AND DISCUSSION

To track the object through the path of the robot, the object position should be determined. Applying the SAD algorithm[6] for the current image as shown in the figure 3 and the previous image shown in figure 4,the result of differing image with labeled is as shown in the figure 5.

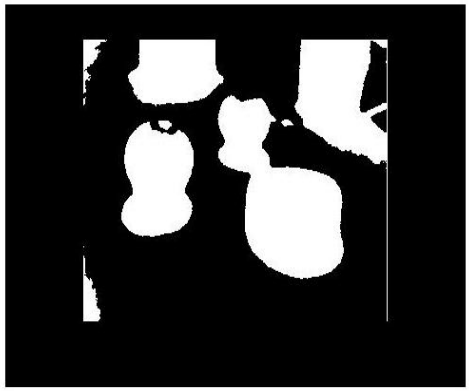

Figure 3: First Image to be compared

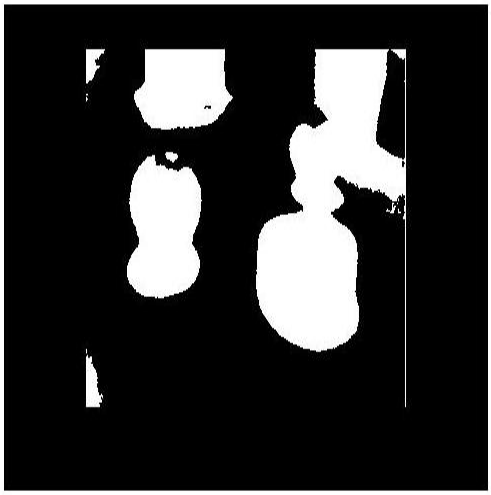

Figure 4: Second Image to be compared

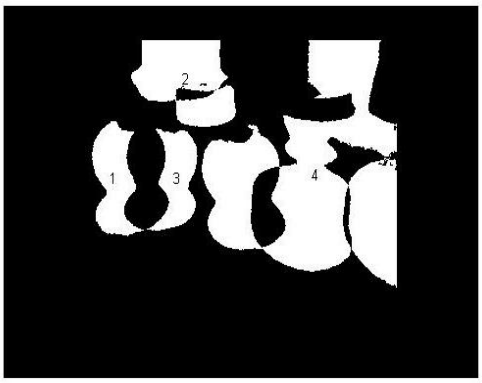

Figure 5: Differing Image

The final prototype of the military robot is about to move right as illustrated in the figure 6.

Figure 6: Prototype of Military Robot

5. CONCLUSION

The moving object in the path of the robot is determined applying the SAD algorithm. The robot takes its path by avoiding the object position to reach the target. The path planning is depending on the image processing and microcontroller based embedded system.

6. ACKNOWLEDGMENTS

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