previously matched with $R(x, y)$ with cost $C(x - \beta + d_{\text{max}}, x, y)$. Based on the uniqueness constraint, we conclude that at least one of the two matches is incorrect and only the match with minimum cost is retained. Thus, if the point $L(x - \alpha + d_{\text{max}}, y)$ has less matching cost than $L(x - \beta + d_{\text{max}}, y)$, uniqueness check will reject the previous match and accept the new one. This implies that, the proposed approach allows for recovering from previous errors as long as better matches are found during the search. The procedure is shown in Fig 17. Each new arriving left point $L(x, y)$ belonging to the interval $[R(x - d_{\text{max}}, y), \ldots, R(x, y)]$ of the potential matching points in the right image. During the Implementation stage, we only need to set up $d_{\text{max}}$ registers to keep track of the best match and corresponding matching cost for right image points in the range of interval. The match newly created finally, the median filtering is applied to the disparity data. The median operation applies a 3 3 filter on the disparity image. It can enhance the disparity results by cleaning up spurious isolated matches which almost are false ones. Median filtering is also implemented based on the window processing architecture and similar scan line buffers are used to construct filter window as stereo matching module. For such small kernel, the element in the middle position can be identified through pipeline sorting and swapping operations which only consumes limited system resources [45].

5 Experimental results and Discussion

The application of our hardware-based stereo vision system is mainly focus on robot navigation. This task requires the system continuing providing accurate information about the environment.