A REAL TIME INFRARED SCENE SIMULATOR

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ABSTRACT

A real time simulator for infrared scenes is required to evaluate the performances of recognition and tracking of information processing machine in seeker. A real time simulator for infrared scenes composed of two Intel i860 processors is described in the paper. We first describe the hardware architecture of our system, then we give out schematic diagram illustrating how to compute the image sequences of infrared scenes based on our hardware system. Finally, experimental results indicate that the simulator can meet the needs of application in practice.

Key words Scene simulator, Infrared seeker, Infrared scene generator, Parallel processing

1. INTRODUCTION

The infrared imagery guidance technology has become a major development direction in the study of precise guidance in the world. Since the seeker is the kernel equipment of the precise guidance system, it is indispensable to test and evaluate its performance.

To test the seeker information processing machine, it is the most effective way to acquire the infrared (IR) image information of spatial moving targets and scenes under the real environments and then to evaluate the performance of recognition and tracking, but this will consume a lot of manpower and material resources. Moreover the real environment is always changing, so it is impossible to have experiments under all the environments. If some specifications of the seeker information processing machine are not meet the demands, it is possible that sometimes the performance in one actual experiment is very good, but it could not meet the demands in another actual experiment because of the change of the
environments. Therefore before the actual experiments with real targets and scenes, varieties of complex IR scene simulating images, which can be changed as fast as possible, are generated by using the IR scene simulator, and then they are used to test the performance of the seeker quantitatively and qualitatively instead of using the real targets and scenes. To do so, one can not only examine the performance of the processing machine comprehensively, but also obtain the basis for the test in real scenes. Hence the simulator of IR scenes is very useful in practice.

It needs a lot of graphical computations to simulate the motions of the targets and the changes of the scenes, so it is difficult to fulfill the task by using general-purpose computers. To solve this problem, IR scene image sequences can be generated by using general-purpose computers and be sent to the IR seeker processing machine in a certain format, and then the performance of IR seeker processing machine is tested by using these data. Simple as the method is, it has two disadvantages. In the first place, the demands for real-time and interactive processing can not be met, since it will take a lot of time to generate many image sequences. Moreover since the image sequences are generated beforehand, the trajectories and postures of the targets can not be changed flexibly in its motion. In the second place, the noise of generated image sequences can not vary at random, as a result the performance of the information processing machine can not be tested completely. Hence the IR scene simulator must be used to test the performance of seeker information processing machine effectively. A real-time IR scene simulator is constructed by using two Intel i860 processors which are high speed RISC processors. Up to 25 frames of IR scene image sequences can be generated per second. The resolution of the images is 256 × 256 × 8 bit per frame.

2. SYSTEM ARCHITECTURE

It needs a large quantity of floating-point and graphical operations to generate real-time IR scenes. Therefore high speed processing must be adopted. Many kinds of special-purpose graphical processors, e.g. HU63484 family and TMS340 family, are available so far and they can accelerate the image generating speed, but in our system most of the real-time calculations are concentrated on graphical transformation not on the generation of graphs. A lot of matrix multiplication (floating-point multiplication and addition) and hidden processing are needed to fulfill the graphical transformation. As a general-purpose microprocessor, i860 not only has computation and control functions which other types of processors have,