successfully implements virtual reality using 3D graphics and input devices suitable for movement in 3D space.

2.1 *The Inspection Process*

When the simulation is started, trainees are presented with a 3D model of a vehicle. Using the input device provided with the software, the trainee walks around the vehicle and performs a visual inspection. The trainee looks for parts that appear damaged or require a detailed inspection regardless of condition. To perform the inspection, the user identifies an item of interest by selecting it with the mouse. This action causes a window (dialog box) to be displayed allowing the trainee to type in inspection information. This information would be a description of the process used to inspect that part. This information can then be used to determine if the trainee

- knows how to correctly identify parts of the vehicle that require inspection
- recognizes damaged parts
- knows the proper course of action to take in the case of a damaged part

Results are recorded by the simulator, and a report is produced upon completion of the inspection. These results can then be reviewed by a qualified trainer for evaluation purposes. Additional information recorded by the simulator includes the total time taken to perform an inspection, position in the scene where the trainee inspects an object and the number of attempts made to inspect each part.

2.2 *Value-Added Features*

During development of MVIS, several training professionals from the mining industry contributed ideas and suggestions for improvement. We have taken many of these suggestions and have either integrated them into our current implementation of MVIS or are planning to incorporate them in future versions.

2.2.1 *VR interaction*

The key to effective virtual reality is the ability to draw users into the simulation. By making the simulation as real as possible, users will get more out of their experiences in VR. One major area of VR that affects its effectiveness is the interface used for movement in 3D space. MVIS utilizes an input device more suitable for movement in 3D than traditional computer input devices. Traditional computer input devices (mouse, track balls, touch pads, and keyboard) are ineffective for moving in 3D space because these devices limit movement to two dimensions in a single action. For example, the arrow keys on a keyboard can only be used to move in a single direction. This is fine for walking, but how does the user look down or up while walking forward? In order to change the viewing direction, the user must either use a different key or a combination of keys. The same applies when using a mouse-type device (mouse, track ball, joy stick). These devices create a complicated user interface for 3D movement which can be confusing and discouraging. To alleviate this problem, we decided to take a different approach and use a 6-Degree-of-Freedom (6DOF) input device. As name implies, a 6DOF device allows for six types of movement: movement along the three axis (X, Y, Z) and rotation around these axis. Using this device, users can easily perform complex movements such as moving forward while scanning for obstacles on the ground or for those hanging from a ceiling. Moreover, all actions are performed using a single, intuitive, hand-held unit [6]. An example of a person using such a device with MVIS is shown in Figure 2.

Figure 2: An Inspection with a 6DOF Device (SpaceOrb [6]).

2.2.2 *Inspection dialog box*

The inspection dialog box in MVIS (shown in Figure 3) is a window that allows trainees to enter inspection information for a vehicle part. In the first implementation of MVIS, this dialog box presented the user with a list of actions they could perform on a part being inspected. Mining professionals suggested that the dialog box be changed to query trainees for a description of how they would inspect a part rather than prompting them for a decision based on a list of options. This change was made based on the following reasons:

1. Providing a list of options to choose from is equivalent to a taking a multiple-choice test. Therefore, an individual with good reasoning skills could deduce the correct action. This does not give the trainer an accurate measure of the trainee's knowledge.
2. Inspecting an individual part often involves a process rather than a single action. Multiple-choice tests are insufficient in these situations.

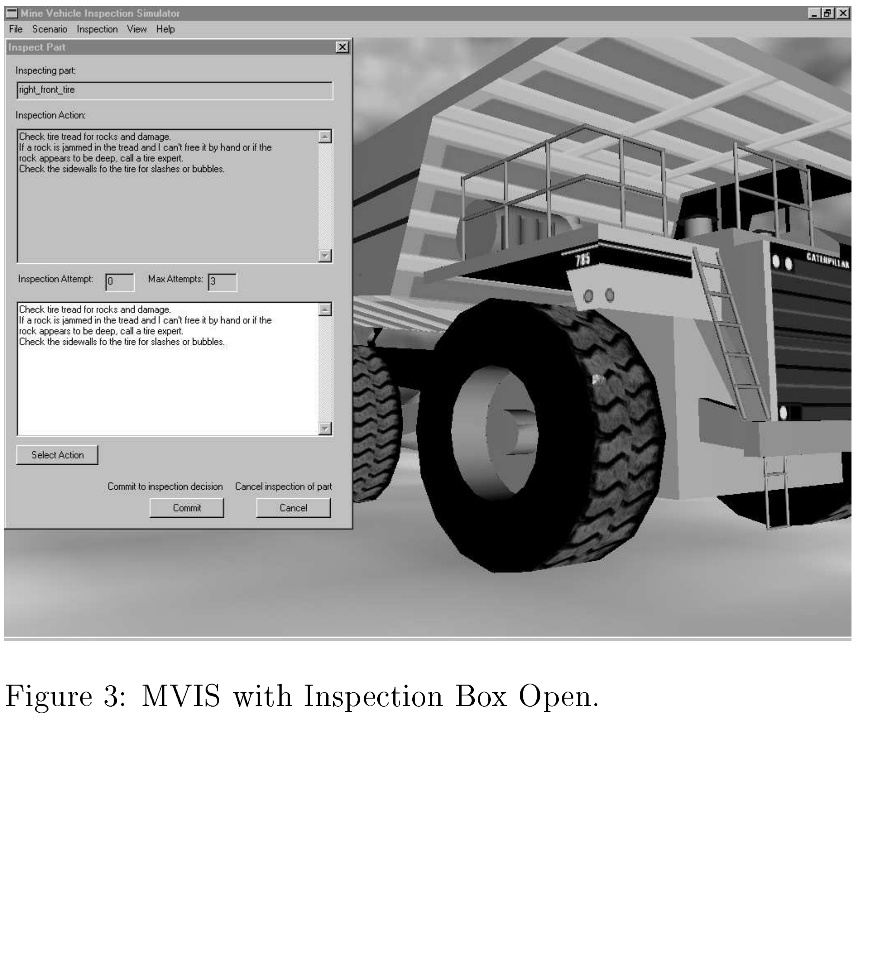

Figure 3: MVIS with Inspection Box Open.