**Stargate** - A Virtual Reality Interface for  
Real-Time Patient Monitoring and Medication Management

**Background**

The task of monitoring patients and managing their medications has become increasingly daunting owing to factors including nursing shortages, increased patient acuity, growing use of technology and complex medication protocols. The patient bedside has become a complex and often confusing space with a wide variety of equipment clustered around the patient. Making sense of this environment and providing effective care is often confounded by the disparity of user interfaces provided by each medical device.

While great strides have been made in the use of expert systems, fuzzy logic and other AI tools in diagnosis, no technology is likely to replace the perception of a trained and experienced clinician. In fact studies comparing the prognostic accuracy of nurses having only visual and haptic information vs. those given only numeric and tabular data for the same set of patients show that the former’s ability to judge patient outcome is substantially better than the latter.

**Project Vision**

Advances in computer technology such as artificial intelligence (AI) and virtual reality (VR) are now making possible training tools, e.g. virtual patients (VP) of extraordinary realism and accuracy. These simulations employ sophisticated models of organ systems and are able to present a patient and caregiver(s) in settings such as a virtual operating theater, ICU, ED room or similar environment. As with aircraft simulators, these tools provide training experiences which are not likely to arise except in rare emergency occasions.

A guiding principle for the clinic will be to explore and develop the intersection of VR, model and statistic based methods with human pattern recognition and perceptive abilities in order to obtain the optimum information transfer. If the unmatched abilities of the human mind could be optimally interfaced with machine abilities such as sensors and databases then the optimum in safe and effective patient care might be achieved.

**Project Strategy**

Inspired by the outstanding work of the 2005-2006 Mudd Clinic on a video-game based VR – “Video Game Interface for Power Grid Management,” we envision the development of a conceptually similar solution for Patient Monitoring and Medication Management (PM³). The solution would be further informed by the work cited in literature as well as others the team would investigate including field trips to working hospital bedsides to conduct orthographic analysis of the bedside ecology.

A central theme of the work will be exploration and development of the most natural means to communicate vital medical information between caregiver and computerized data.
sources and sinks. For example, a virtual patient (VP) icon might change skin color in response to elevated temperature. Appropriate use of “amplification” could be employed to expose and emphasize exceptional conditions such as hypoxia which would cause the VP’s skin to turn a dramatic blue and the skin become transparent revealing immobile lungs. Similarly interactions such as requests for data, initiation of orders and recording of observations might be facilitated graphically, e.g. nurse could touch VP’s heart to see EKG waveform, touch IV icon to open order and so on.

**Deliverables**

1. A plan for surveying and analyzing the information and transactional needs of typical ICU and ED environments.
3. A written high-level plan for approaching design of an optimized VR interface.
4. A set of specifications describing capabilities of the system.
5. A set of mock up slides depicting potential system operation.
6. A review of the proposed design by Cardinal Health.
7. A revised specification based on feedback from item 6.
8. A working prototype system employing synthesized or actual data able to conduct at a minimum the following classes of functions within a selected field of treatment such as post-surgical recovery, procedural sedation, oncology etc.:
   a. Depict Alarm/Alert conditions
   b. Recall past and present patient states including vital signs, lab values, fluid balance, etc.
   c. Depict current and past medications given
   d. Depict medications scheduled
   e. Depict interactions between medication delivered and patient response
   f. Depict ordering of medication