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*Unclassified*
Medical Simulation Research Branch

Ms. Beth Pettitt, Branch Chief - BSME, MBA, M&S PhD Student, SPRDE Level III, PM Level III, S&T Level III

Mr. Jack Norfleet, Chief Engineer - BSEE, MBA, M&S PhD student, SPRDE Level III, PM Level II, S&T Level III, completed EMT Training

Dr. Tere Sotomayor - S&T Manager, BSIE, MS Operations Research, PhD in M&S, SPRDE Level III, S&T Level III

Dr. Christine Allen - S&T Manager, BS, MS M&S, PhD in M&S

Mr. Matthew Challberg (previous student)

Ms. Sandy Dickinson - S&T Manager, BSCS, S&T Level III, completed EMT Training

Mr. Bill Pike - S&T Manager, BS Sys Science, MS CpE, MS M&S, Doctoral candidate in M&S PhD program, SPRDE Level III, IT Level III, S&T Level III, Navy Reserve CDR

Mr. Matthew Hackett - S&T Manager, BSCE, MSBioMed Engr, M&S PhD student
Medical Simulation Research Areas

- Patient simulators
- Severe trauma simulations
- Animatronics
- Haptics-based training suite
- Live animal replacement technologies
- Olfactory simulations
- Serious games
- Virtual environments and patients
- Card Games
- Exercise and environment control with After Action Reviews
- Student performance measurement
- Holograms
- SBIR efforts
PURPOSE:
Tactical Combat Casualty Care (TC3) Sim/ vMedic is a game based simulation where trainees are immersed in a realistic virtual scenario and must demonstrate both their Soldier and technical medical skills.

BACKGROUND/OBJECTIVE:

TECHNICAL CHALLENGES:
• Changes to tactics, techniques and procedures
• Keeping software up to date

PLANNED ACCOMPLISHMENTS:
• Re-brand vMedic back to TC3 Sim.
• TTA signed for transition to TCM gaming.
• New research for a TC3 Sim for a natural user interface using Kinect
PURPOSE:
- Creation of medically accurate virtual patients with advanced interaction capabilities
- Train Combat Medics on the proper procedures for sick call

OBJECTIVE:
- Integration of the Sgt. Star platform with medically relevant content
- Creation of animations and speech patterns consistent with a real patient
- Design and conduct experiments determining the effectiveness of virtual patients in supplementing medical curriculum

TECHNICAL CHALLENGES:
Identifying/creating appropriate and meaningful medical dialog/content

ACCOMPLISHMENTS:
- Implemented 3 scenarios: PTSD, spousal abuse, and bacterial meningitis
- Installed initial prototype
- Development of Kinect interface for patient interaction
- Incorporated physiology model
Merging Virtual Patients and Virtual Worlds

PURPOSE:
Merge the rapidly progressing virtual patient and virtual worlds technology areas

OBJECTIVE:
• Integration of advanced virtual patient into a virtual world
• Creation of medically accurate scenarios within the virtual world
• Design and conduct experiments determining the effectiveness of virtual patients within virtual worlds

TECHNICAL CHALLENGES:
• Identifying/creating appropriate and meaningful medical content
• Creating appropriate levels of fidelity within virtual world in order to not overburden computer
• Delivery mechanism via web requires certificate of networthiness

PLANNED ACCOMPLISHMENTS:
• Complete hemorrhage control unit by 1st year
• Complete medical content by 3rd quarter
• Development of scenario with SME by 2nd quarter
• Development of additional physiology components by end of 2nd quarter
PURPOSE: Create an immersive Fused Reality (FR) training solution to prepare medical personnel to practice loading and unloading patients in a realistic virtual world that provides feedback.

OBJECTIVE:
- Exposure to the new Heavy Armored Ground Ambulance (HAGA)
- Patient care scenarios rehearsed prior to deployment
- M4 weapon trainer for Soldier skills

TECHNICAL CHALLENGES:
- Head and hand tracking allows the user to explore the environment using a camera and the Kinect technology.
- Physical accuracy with scripting for the Virtual casualty examination system.

PLANNED ACCOMPLISHMENTS:
- Showcase at I/ITSEC 2012
- Identify transition partners
- Identify dollars for SBIR Phase III (Phase II 10/2/13)
PURPOSE: Determine current capabilities and potential applications of 3-d hologram technology, supplementing medical curriculum and improving AARs

OBJECTIVE:
- Install DARPA prototype table-top 3-d dynamic display at the STTC
- Develop and port anatomical models
- Design and conduct experiments determining the effectiveness of hologram technology for use in AARs or as a medical training aid

TECHNICAL CHALLENGES:
Obtaining/Creating 3D anatomical models with the “right” level of fidelity for the different training applications

PLANNED ACCOMPLISHMENTS:
- Investigate LIDAR based 3-d AAR by 4Q
- Develop anatomical models based on University of Minnesota human tissue data by 4Q
- Development of all software viewing software for dynamic holographic display
PURPOSE:
Develop a high fidelity upper body injury treatment training system using state-of-the-art special effects technologies to support stress inoculation training.

OBJECTIVE:
Realistic lifesaving training: This effort will provide stress inoculation training such that Warfighter’s will be physically and emotionally prepared to deal with severe wounds. It supports training on the three preventable causes of death in the battlefield and will provide initial pain management capabilities.

TECHNICAL CHALLENGES:
Implementation of realistic facial expressions for pain and upper body movement with technology that is rugged and cost effective.

PLANNED ACCOMPLISHMENTS:
• High Fidelity Upper prototype development
• Experiments to assess reaction and usability in a field environment
• Publish results and findings from this research
**PURPOSE:**
Create a training solution to prepare medical personnel and units to perform collective tasks to free and care for trapped casualties.

**OBJECTIVE:**
- Develop a ruggedized vehicle inclusive of cut points
- Automate scenario-based training and expand metric suite capabilities
- Assess medical and extrication components

**TECHNICAL CHALLENGES:**
Develop the appropriate training scenarios and evaluation criteria.

**PLANNED ACCOMPLISHMENTS:**
- Iteratively test new vehicle (cut points, automation, medical scenarios, and AAR)
- Transition to AF Pararescue Jumpers (PJs)
- Publish results

Technical POC: Dr. Christine Allen
PURPOSE:
Research whether malodors negatively affect human performance, and if medics can adapt to the odors they will face on the battlefield while retaining the ability to detect alarm odors.

OBJECTIVE:
Research literature to determine what components of human performance has been negatively affected by malodors. Perform experiments to determine if olfactory adaptation can alleviate performance issues. In later years, add odor alarms (e.g., smoke, fuel).

TECHNICAL CHALLENGES:
Limited prior experimentation aimed solely at psychomotor skills. Odor and olfaction research not as established as other senses.

PLANNED ACCOMPLISHMENTS:
• Determine one or more performance issues tied to malodors
• Design and perform experiment to determine olfactory adaptation’s role in alleviating malodor affect
• Document results of this research through peer-reviewed journals
**PURPOSE:**
Create portable and largely operator independent exercise control and after action review capability

**OBJECTIVE:**
- Automate control of special effects, manikins, cameras, and data collection
- Sensor fusion
- Create AAR combining LiDAR feed, video feed, and student performance metrics

**TECHNICAL CHALLENGES:**
- Sensor fusion requires integration of various technologies, challenging to automate

**PLANNED ACCOMPLISHMENTS:**
- MSTC transition
- LiDAR feasibility and effectiveness studies
- Mobile capability
- Publish results

* Technical POC: Mr. Jack Norfleet
Transition…

User Tests

Usability Studies

TEE/Human Performance

Program of Record

6.1

6.2

6.3

6.4

Transition

Variable Pathologies
Holograms
Virtual Patients

Mixed Reality Modular Technologies
• Upper Airway
• Sensors
• Pain Mapping
• Bloods/Fluids
• Olfactory Effectiveness
• Live Tissue

Animatronics Student Performance Measurement

Patient simulators
Severe Trauma
Serious Games
Olfactory Delivery

User Tests
Usability Studies

* Classification *

SFC Paul Ray Smith Simulation & Training Technology Center

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
Modular Medical Simulations (FY13 and Beyond)

A menu of items to choose from to build a custom simulation of the proper fidelity for the training objectives.

- Simulated Pain Mapping/Pain response
- High Fidelity Upper Airway
- Simulated Bodily Fluids
- Simulated Blood-Coagulation, consistency, color, behavior
- Simulated Trauma
- Variable Physiology - Easily modify body type, size, weight
- 3D Anatomy/Patient Visualization
- Sensors
- Smell, Olfactory Simulation
- Bionic Mannequin/Live Tissue

Simulated Trauma:
- Simulated Blood-
  - Coagulation,
  - consistency,
  - color,
  - behavior

High Fidelity Upper Airway

Simulated Bodily Fluids

Simulated Pain Mapping/Pain response

Variable Physiology - Easily modify body type, size, weight

3D Anatomy/Patient Visualization

Sensors

Smell, Olfactory Simulation

Bionic Mannequin/Live Tissue

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

* Classification *
Interactions:
- How can we track and detect fine movement and absolute position in 3D?
- Natural language processing
- Unobtrusive eye and gaze tracking
- Trainee movement in virtual space
- Haptics

Human Performance Measurements:
- Objective
- Comparative
- Automated
- Sensing inside and outside the simulated body

General Advice

Proposals and SBIRs:
- Ask the POC questions and understand the problem
- Don’t apply your pet technology unless it fits
- Bring in interdisciplinary help
- Use your imagination to innovate
The Soldier's Creed

I am an American Soldier.
I am a Warrior and a member of a team.
I serve the people of the United States and live the Army Values.

*I will always place the mission first.*
*I will never accept defeat.*
*I will never quit.*
*I will never leave a fallen comrade.*

I am disciplined, physically and mentally tough, trained and proficient in my warrior tasks and drills. I always maintain my arms, my equipment and myself.
I am an expert and I am a professional.
I stand ready to deploy, engage, and destroy the enemies of the United States of America in close combat.
I am a guardian of freedom and the American way of life.
I am an American Soldier.