**Omega Vest Testing Plan**

**TEST CASE 1: Computer System/Application**

**Description:** We have a developed a proper prototype for the Omega Player. It plays video, audio, connects to the microcontroller, and sends signals to the microcontroller. In addition, we have a version that allows to debugging and proper functionality. Using our debugging tools, we can measure how long the signals take to be sent, how much disk usage the program has, and the frame rate.

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|  | **Requirement** | **Pass/ Fail Criteria** |
| **(SYS01)** | The SYSTEM shall operate on Windows computers. | Pass if the SYSTEM works on Windows computers (XP, Vista, 7, and 8) for both architectures (x86 and x64) that have the video codecs installed. |
| **(SYS02)** |  The SYSTEM shall have Graphical user interface that can play video and audio.  | Pass if the system can play all major video formats (AVI, MOV, WMV, MPEG, etc) |
| **(SYS03)** |  The SYSTEM shall be capable of playing video files at the adequate frame rate of each video format. | Pass if the following conditions are met:* MOV video files are played between 25 and 30 frames per second.
* WMV video files are played at 30 frames per second.
* AVI video files are played between 24 and 30 frames per second.
* MPEG and other video files are played between 28 and 30 frames per second.
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| **(SYS04)** | The SYSTEM shall be able to connect to detect multiple microprocessors and connect to them.  | Pass if the system can list all the different Arduino microcontrollers connected to the computer and identify which communication port each one is using. |
| **(SYS05)** |  The SYSTEM shall be able to send six signals to a microcontroller with minimum delay. | Pass if the program takes 50 milliseconds or less to send the signals. |
| **(SYS06)** | The SYSTEM shall be able to run in new computers as well as in less sophisticated computers | Pass if the program’s disk usage is less than 15 Megabytes, which is less than web browser. |
| **(SYS07)** | The SYSTEM shall be able to read and parse CSV files with the encoded instructions. | Pass if the following conditions are met:* Program does not exit while trying to open the CSV files.
* Program parses the CSV files as required by the signals sent to the microcontroller.
* Program does not attempt to send signals to the microcontroller if no CSV file is found.
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| **(SYS08)** | The SYSTEM shall be able to play, pause, forward, and reverse the video. | Pass if the right signals are sent to the microcontroller in 50 milliseconds or less. If paused, it should turn the output devices off to save power. |

**TEST CASE 2: Microprocessor Interface and Serial Communication**

**Description:** When a video is playing, the computer application sends messages in terms of strings. These messages are sent to the microcontroller via the USB interface. The memory on the microcontroller contains code that reads the messages and controls the digital pins of the microcontroller depending on what message is being sent. The digital pins are outputs that have ‘H” value 3.3V or ‘L’ value 0V.

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|  | **Requirement** | **Pass/ Fail Criteria** |
| **(SYS09)** | The SYSTEM shall correctly initialize each pins of the microcontroller for the different modules of the vest (motors and servos) in order to avoid errors while the video is being played.  | Pass if the system can run without error upon initialization of pins and variables, fails if under any circumstance the system stops working and causes inconvenience to users. |
| **(SYS10)** | The SYSTEM shall boot up and initialize all relevant pins and variables within 5 seconds. | Pass if the first run of the microcontroller can set all pins and variables within 5 seconds, fail if the system does not setup within 5 seconds. |
| **(SYS11)** |  The SYSTEM microcontroller subsystem is hard-coded by the creators of the Omega Vest. This means that code on the flash memory of the microcontroller is unchangeable by the user and can only be modified by the Omega Vest team. | Pass if 80% of non-engineering users are unable to modify the code on the flash memory of the microcontroller, fail if 80% of non-engineering users are able to modify and hack the system. |
| **(SYS12)** |  The SYSTEM shall be capable of receiving and handling multiple messages that will control the digital pins of the microcontroller with minimal delay (optimally <50 milliseconds). | Pass if the system can receive all concurrent string messages and correctly control all relevant digital pins within 50 milliseconds, fails if the system is not capable of handling all messages and controlling the pins within 50 milliseconds. |
| **(SYS13)** | The SYSTEM shall be capable of adding additionally pins for future upgrades of the Omega Vest (up 13 pins in total for the Arduino Uno microcontroller). | Pass if the system can handle up to 13 digital outputs for future upgrades of the Omega Vest, fails if system is unable to do so. |

**TEST CASE 3: Power Distribution System and Power Source**

**Description:** The power system for the Omega Vest will contain an AC-DC adapter and a voltage divider to efficiently distribute the correct amount of voltage and current to each subsystem of the Omega Vest.

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|  | **Requirement** | **Pass/ Fail Criteria** |
| **(SYS14)** | The SYSTEM shall transform 120VAC @ 60Hz to 6VDC with max current of 2A. | Pass if the AC-DC adapter outputs a DC voltage of 6V with maximum current of 2A, fails if unable to do so. |
| **(SYS15)** | The SYSTEM shall contain a voltage divider to step down 6VDC to 3VDC for certain modules of the Omega Vest. | Pass if voltage divider correctly halves the voltage from 6V to 3V with current limits in mind, fails if unable to do so. |
| **(SYS16)** | The SYSTEM shall correctly distribute voltage/current to each components of the Omega Vest.  | Pass if laboratory measurements match the voltage/current ratings of individual components. |
| **(SYS17)** |  The SYSTEM is efficiently designed to avoid dissipation of unnecessary power. | Pass if power measurements do not exceed nominal power dissipation for each subsystem. |

**TEST CASE 4: Vibration Motors**

**Description:** The network of vibration motors is triggered by digital signals from the Omega Player and Arduino microcontroller.

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|  | **Requirement** | **Pass/ Fail Criteria** |
| **(SYS18)** | A single motor within the SYSTEM must be simulated and operate correctly. | Passes if simulations are within expectations and operation matches simulation, fails if otherwise. |
| **(SYS19)** | Multiple motors within the SYSTEM must be simulated and operate correctly. | Passes if simulations are within expectations and operation matches simulation, fails if otherwise. |
| **(SYS20)** |  The SYSTEM must operate within voltage and current load limits. | Passes if system functions, fails if system does not function. |
| **(SYS21)** |  The SYSTEM must only vibrate when a signal is directly received. | Passes if correct set of motors vibrate when signal is received, fails if wrong set vibrates or vibrate without signal. |
| **(SYS22)**  | The SYSTEM must cease vibration when signal is terminated. | Passes if motors stop vibration when signal is stopped, fails if motors continue after signal has stopped or stop prior to end of signal. |

**TEST CASE 5: Pneumatic Compression System**

**Description:** This system will contain an air tank that will send compressed air to the user. When this system is triggered, a servo will open the air valve to a specified degree to allow the air to flow from the tank to the user, and then close the air valve to cut off the airflow.

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|  | **Requirement** | **Pass/ Fail Criteria** |
| **(SYS23)** |  The SYSTEM shall contain an air tank that can be refilled by an air pump. | Pass if the air pump can distribute air to the air tank and detach from the tank without completely depleting all air from the tank. Fail if any air is depleted after removing air pump. |
| **(SYS24)** | The SYSTEM shall contain an air valve that connects the air pump and air tank. | Pass if the air pump and air tank can be attached to the air value, and the air pump can still distribute air to the air tank. Fail if any air is depleted while air is being distributed to the air tank, or after removing the air tank. |
| **(SYS25)** | The SYSTEM’s air valve shall be able to open and close to disperse air from the air tank to the output port. | Pass if the air value can open and close to disperse air from the air tank to the output port. Fail if air does not disperse from the output port. |
| **(SYS26)** |  The SYSTEM shall contain a servo that turns to the correct angle to open and close the output port. | Pass if the servo does not open and close the output port at the correct angle. |
| **(SYS27)** |  The SYSTEM must trigger the servo to open the output port so that air can be dispersed to the user. | Pass if the servo is triggered at the correct time and the servo opens the output port. Fail if the signal does not trigger the servo. |
| **(SYS28)** |  The SYSTEM must trigger the servo to close the output port. | Pass if the servo is triggered at the correct time and the servo closes the output port. Fail if the signal does not trigger the servo. |

**TEST CASE 6: Pneumatic Scent System**

**Description:** The Pneumatic Scent System is to be attached to the left side of the Omega vest SYSTEM. When the video that is played on the Omega player hits a certain pre-programmed point in time, the Arduino, which is also programmed, will turn on a servo that depresses the nozzle of the aerosol scent canister, thus releasing pneumatic scent that then travels through a 6mm in diameter short air hose, that is then dispersed near the Omega vest user’s face.

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|   | **Requirement** | **Pass/ Fail Criteria** |
| **(SYS29)**  | The servo must be able to rotate with the given signal coming from the Arduino device. | If the servo rotates, this is counted as a pass. If the servo fails to rotate, then it considered a failure. |
| **(SYS30)**  | The servo must provide enough rotational force to depress the nozzle of the aerosol scent can so that scent can be dispersed. | This will be considered a pass if the nozzle of the aerosol can is depressed enough so that the aerosol scent is released from the can. If the selected servo does not have enough power to depress the nozzle of the aerosol can so that scent is released, then it is considered a fail. |
| **(SYS31)**  | The scent that is released from the aerosol scent must have enough pneumatic force to travel through the length of the air tube to the Omega vest wearer. | If 50% of the outputted aerosol scent vapor is released from the end of the air tube, then it will be considered a success. It is expected that some percentage of the scent vapor will collide with the walls of the air tube, thus said collided vapors will not make it to the end of the exit of the air tube. |
| **(SYS32)**  | Upon exiting the air tube, the aerosol scent needs to be directed in such a fashion that it does not hit the user directly, but at the same time, it cannot be directed at an angle too far from the Omega vest user.  | The requirement will be passed, if the sample user is satisfied with the direction of the dispersed scent. The requirement will fail if the test subject is not satisfied with the direction of the outputted aerosol scent. |

**TEST CASE 7: Packaging**

**Description:** The packaging of the SYSTEM involves housing individual electrical components using 3D software and 3D printing. All of the different aspects of the SYSTEM are enclosed safely into the Omega Vest.

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|  | **Requirement** | **Pass/ Fail Criteria** |
| **(SYS33)** |  The SYSTEM shall safely house the entire pneumatic compression system. | Pass if the system is completely housed. Fail if any aspect of the system is not housed or is a hazard. |
| **(SYS34)** | The SYSTEM shall safely house the entire pneumatic scent system.  | Pass if the system is completely housed. Fail if any aspect of the system is not housed or is a hazard. |
| **(SYS35)** |  The SYSTEM shall safely house all of the vibration motors. | Pass if all of the vibration motors are completely housed. Fail if any aspect of the vibration motors is not housed or is a hazard. |
| **(SYS36)** |  The SYSTEM shall safely house the power distribution system. | Pass if the system is completely housed. Fail if any aspect of the system is not housed or is a hazard. |
| **(SYS37)** | The SYSTEM shall safely house the microcontroller and all of its aspects. | Pass if the microcontroller and all of its aspects are completely housed. Fail if any aspect of the microcontroller is not housed or is a hazard. |
| **(SYS38)** |  The SYSTEM shall safely enclose the housing of the pneumatic compression system, pneumatic scent system, vibration motors, power distribution system, and the microcontroller inside the Omega Vest. | Pass if all aspects of the SYSTEM are enclosed in the Omega Vest. Fail if any aspect of the SYSTEM is not housed or is a hazard. |