miniSim™ Introduction, Network and Support Information

April 3, 2025

Introduction

The miniSim™ driving simulator is ideally suited to applied R&D, academic, and clinical research. Backed by decades of development at the University of Iowa's Driving Safety Research Institute (DSRI)*, the miniSim is both sophisticated and affordable.

Overview Examples

The powerful scenario control and data acquisition capabilities give you the flexibility you require, and all the data from every run at your fingertips. The miniSim is a result of over 20 years of research and development and is in use daily by our researchers and staff.

The software is the same for all versions and also supports vehicle automation applications, custom cab designs, and user-developed subsystems.

DSRI technology is used by DSRI staff daily to fulfill scientific research contracts on our NADS-1, NADS-2, and miniSim simulators, ensuring that you get the most up-to-date capabilities.

A common code base and tools are used across all our simulators, so a scenario developed on the miniSim will run on other miniSim systems, or NADS-1/NADS-2 and vice-versa.

Figure 1: The miniSim™ Driving Simulator with Partial Cab, and Operator Display.

The Four Tools:

1. ***Tile Mosaic Tool (TMT)*** for assembling a road network from a library of over 350 road/landscape segments called 'tiles'. You use the TMT to connect them and export a complete road network to the ISAT and miniSim. DSRI can create new tiles or modify existing ones to meet your specific needs.
2. ***Interactive Scenario Authoring Tool (ISAT)*** for building scenarios on the road network. ISAT is GUI-driven and does not require scripting. Has edit, rehearse, and playback modes.
3. ***miniSim Core*** runs the scenario on the assembled database and provides both real-time measures and a comprehensive data acquisition file in a secure binary format for post-processing.
4. ***nDaqTools*** are interfaces for MATLAB used to control the data reduction process, including the definition of the measures used.Text output is also available for Python users.

Software functions Include:

- ***Adaptive Cruise Control (ACC) and Lane Following*** systems are commonly used to emulate level 2 automation and hand-off of control. ACC parameters are adjustable including full-range speed control.
- ***Lane Keeping Assist (LKA) and Lane Deviation Warning (LDW)*** systems are built-in, and parameters are adjustable. The LKA system provides torque cues through the steering loader.
- ***Multi-Player*** capability is supported. Link 2-3 miniSim systems together so multiple drivers can interact in the same environment.
- ***AutoDriver*** is an automated driving capability incorporated into the vehicle dynamics subsystem to take over operation of the steer, gas and brake controls to autonomously follow a route through the world. The characteristics of the 12 available behaviors (lane change, turns, etc.) are controlled through a set of parameter files and a command vocabulary that may be given through the following mechanisms:
    - Scenario action (triggered by scenario event)
    - Manual action (button press)
    - External input via UDP
- ***Accessories*** used by the miniSim such as Motion, Video Capture, Eye Tracking, etc. may have specific miniSim subsystems to interface with them.
- ***Web Socket and UDP*** interfaces allow integration with external systems and displays, such as Haptic Seats, touchscreens, etc.
- ***Analog and Digital I/O*** is used to integrate driver controls and also trigger or synchronize external devices such as alerts or physiological data collection systems (D-Lab, Biopac, EEG, etc).
- ***User-Defined Subsystems*** are user-written programs that run within the miniSim real-time environment and have read (and write**) access to the shared memory space.

*Formerly the *National Advanced Driving Simulator* (NADS)

**To specific cell variables only

Accessories:

- ***Motion Base*** provides roll, pitch, and heave onset cues for improved immersion and vehicle control. Can easily be added to any miniSim without an increase in height or footprint.
- ***Infotainment*** systems emulate OEM-style infotainment interfaces while providing data acquisition and operator control.
- ***VidCap*** video recording system captures 4 channels of HD digital video synchronized with the simulation
- ***Springfield Road Network*** has 230 miles of roads covering 285 sq. miles! Complete and ready to use with initial settings for traffic, signal timing, and signs
- ***Haptic Seat*** 6 programmable transducers in the seat pan, and can be extended to 12.

Services:

Prompt, in-depth software support and updates are included with the support fee.

Our team can also provide the following services. Contact us for details!

- Custom scenario development
- Custom environments and models
- Turn-key experiments
- Hardware Upgrades
- Simulator design and development
- Refresher Training
- Consulting

Figure 2: High-Resolution Rendering of Typical Scene

NADS miniSim™ Software and PC

The **NADS Software** supplied with the miniSim™ simulator may consist of:

- miniSim™ real-time driving simulation software
- ISAT™ scenario authoring tool for creating/modifying scenarios
- TMT™ virtual environment authoring tool with >350 sample tiles
- nDaqTools™ and data browser for MATLAB® to assist in Data Reduction
- AutoDriver™ vehicle automation tools
- VidCap™ Video Capture Software
- Infotainment System
- Springfield Road Network

The typical miniSim PC hardware specification* is as follows:

- Rackmount or Tower Case
- Windows 10 64 bit Pro
- Intel Core i9 3.5GHz 10-Core Processor
- 2 SSD RAID (500 Gb ea, 500 Gb usable)
- 32 Gb DDR3 SDRAM
- NVIDIA **A4000** and **T1000** Quadro GPUs

This hardware supports the following number of video channels and resolutions at **60Hz**:

- Instrument Panel: 16:9 LCD, up to 1920x1080, (1280x800, 1600x900 typical)
- Front: Left, Center, Right, Rear displays/projectors: 1920 x 1080
- One Auxiliary Video Output: up to 1920x1080 (1280x800, 1600x900 typical)
- Operator Display: 1920x1080

**Note: Hardware specs may change at any time due to hardware changes or availability.*

Software Control and Keylok™

Two key miniSim applications are controlled via a USB security device called a Keylok. This device has a programmable expiration date, for which DSRI provides renewals at the time of payment of the software support and maintenance fee.

miniSim and Tile Mosaic Tool (TMT) applications

Two applications require a valid Keylok to operate:

- miniSim™ real-time driving simulation software
- TMT™ virtual environment authoring tool with 350+ sample tiles

The miniSim and TMT applications are pre-installed on the simulator PC. The TMT is used to assemble road networks (or 'road map') of your design. It is best run on the same machine where the miniSim installation is present, as the export process generates many files that are to be accessed by the miniSim when it runs a scenario.

Two Keyloks are supplied

Integrated Scenario Authoring Tool (ISAT) and nDAQTools

These applications do not require a Keylok to operate.

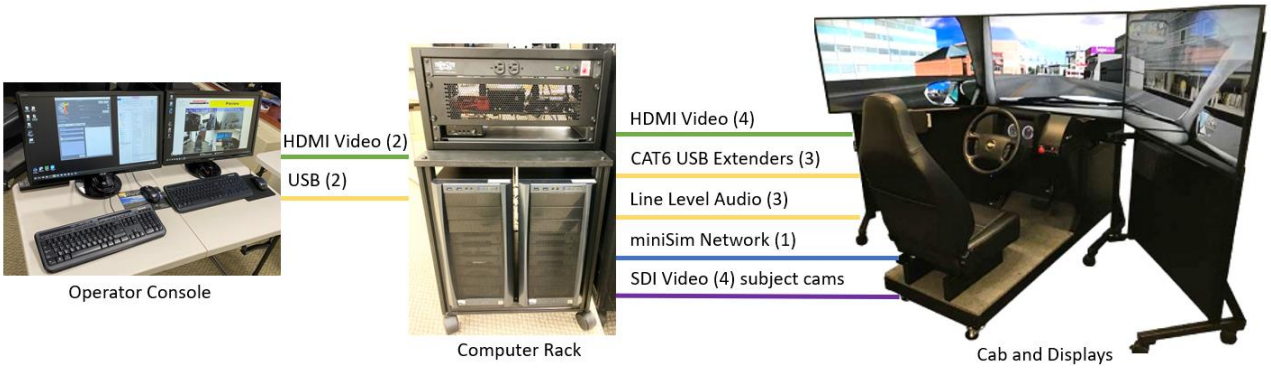
You may install ISAT on any Windows desktop or laptop so that you can ***Create***, ***Rehearse*** and ***Replay*** scenarios anywhere. A single file created by the TMT is opened by ISAT to represent the map during scenario authoring.

The nDAQTools application runs within a MATLAB™ environment (not supplied) and is used to calculate measures from the time-history data recorded by the miniSim. This also can be done on any Windows PC with MATLAB installed. Some miniSim users have found that Python can be used instead of MATLAB, and have created an open source Python library called unDAQTools available on Github. The unDAQTools library is not supported by DSRI, but we do supply a utility to convert the miniSim data files to text.

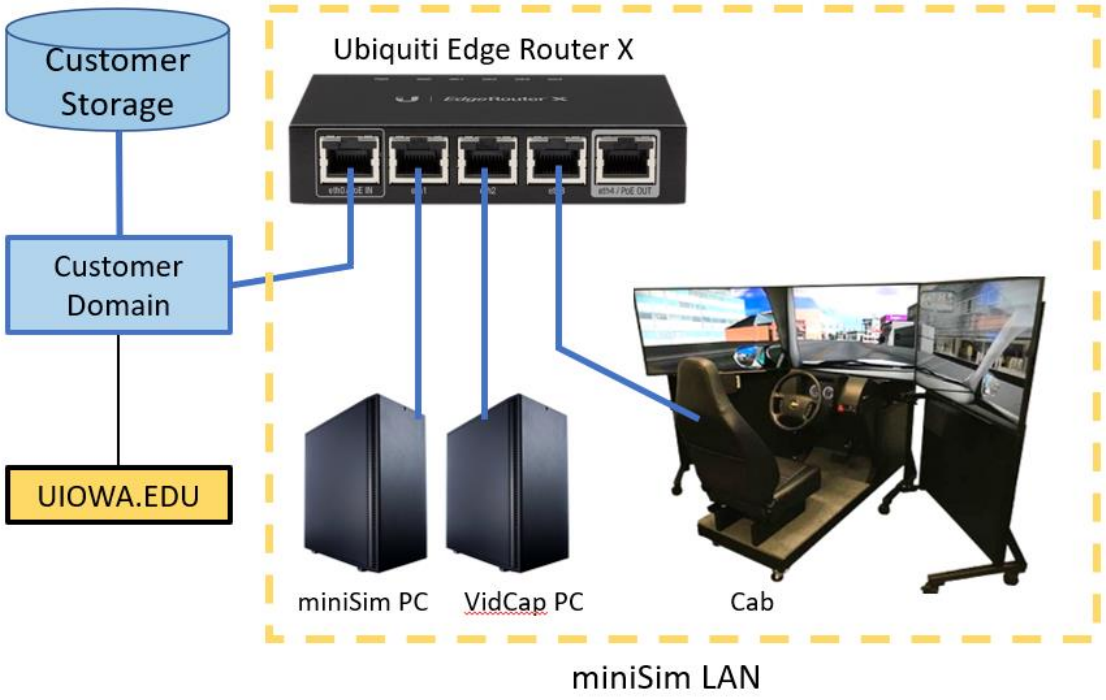
Networking Topics

Quarter and Simplified Cabs

here are 3 primary parts of the driving simulator installation: Computer Rack, Cab and Displays. The cab, displays and cameras all have cables that are routed to the Computer Rack. These include Video, Audio, USB etc.

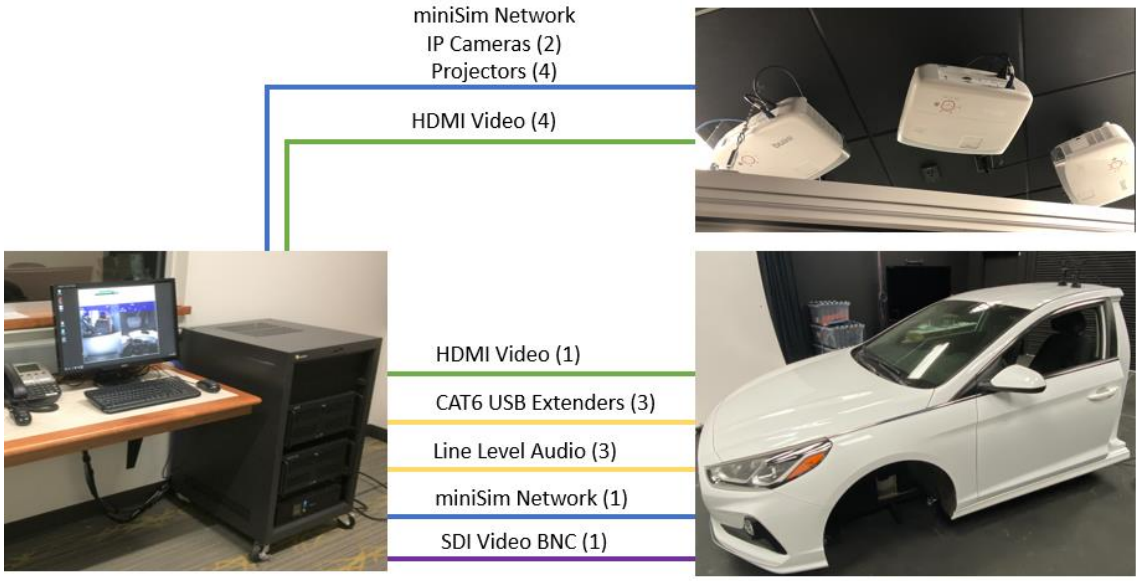


The miniSim Network Diagram is as follows:

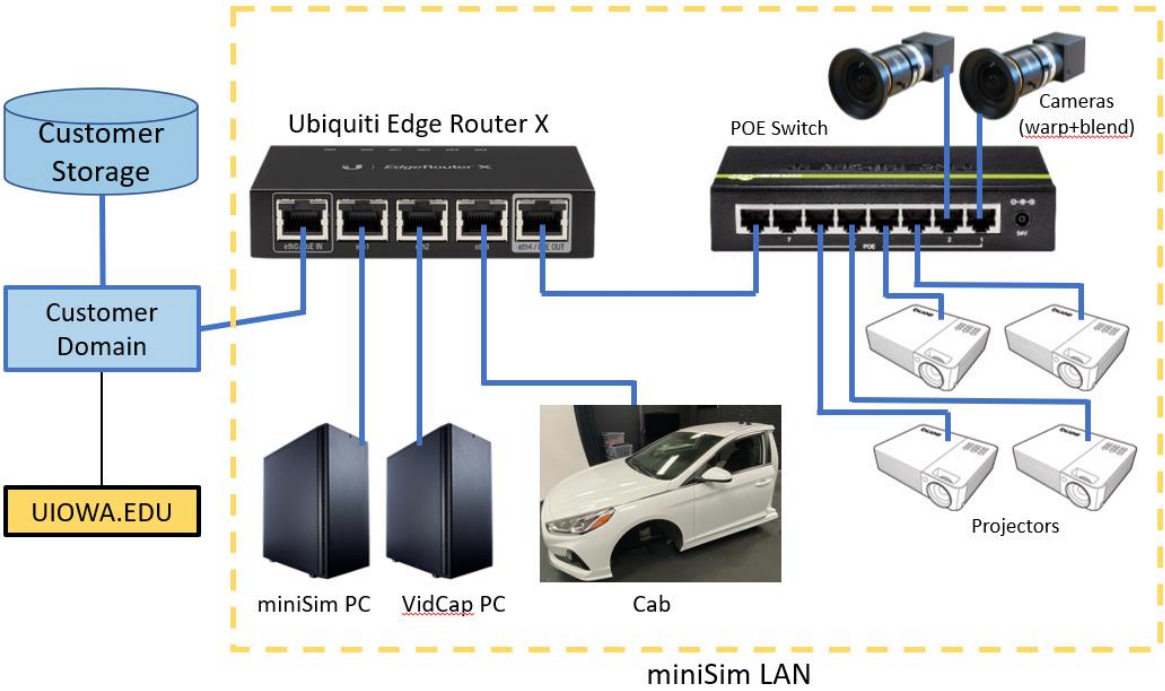


Half Cab System

There are 3 primary parts of the driving simulator installation: Computer Rack, Cab, and Projectors and Cameras. The cab, projectors and cameras all have cables that are routed to the Computer Rack. These include Video, CAT6, Audio, USB etc.



The miniSim Network Diagram is as follows:



Router Configuration

The miniSim and VidCap PCs require reserved IP addresses. A router is **supplied** to create a miniSim-only LAN. The router is configured to give a specific IP address to each PC and camera (by MAC address). We highly recommend that we do this for improved security and system robustness. **We are pleased to provide the router admin login information to local Admin**.

We are using Ubiquiti Edge Router X or similar routers.

Research Data

The miniSim and Video Capture PCs are typically equipped with two SSHDs in mirrored configuration. These are intended to store experimental data locally before it can be copied to a more secure location.

Most miniSim users have access to their institution's cloud data storage services, and it is recommended that they transfer this data off the miniSim and VidCap PCs regularly to reduce the risk of loss.

DSRI is not responsible for data loss.

Researchers will need to reduce and analyze this data using tools such as MATLAB, Python, SAS etc. to extract the desired measures and perform statistical analyses. They should have access to the data storage systems from their workstations to perform this task. This is not typically done on the miniSim PC, to keep it available for development.

The miniSim neither needs or stores Personal Identifying Information (PII) or Personal Health Information (PHI).

The miniSim does not transmit any data to DSRI/Univ of Iowa.

Backup

The user is responsible for backups.

Users are responsible for maintaining the miniSim PC and backup of collected data. This includes Windows Updates, backups of the miniSim directories, data archive/storage, security, and PC repairs. Your on-site IT support can typically handle these areas easily. Most Universities offer cloud storage services at reasonable cost for long-term storage of research data (some sponsors may require this). This will enable a system to be quickly restored, or an experiment re-used.

DSRI keeps an image of the system before it ships and typically retains these for 1 year. We use Acronis for creating these images. DSRI can also repair/reload your PC for a reasonable fee.

Firewall Settings

The local area network between the two PCs requires certain firewall settings on the miniSim and VidCap PCs. See the Firewall Rules on our Support page.

miniSim

Standard ports

Port	Type	Description
2554	TCP	PSManager (all data is received)
2555	TCP	PSDict (talking to the dictionary)
2556	TCP	PSManager (subscribers talk to PSManager)
9000	TCP	SimopServer
10123	TCP	FTP from Simop to LocalCoordinator

Vidcap

Standard ports

Port	Type	Description
2554	TCP	PSManager (all data is received)
2555	TCP	PSDict (talking to the dictionary)
2556	TCP	PSManager (subscribers talk to PSManager)
9000	TCP	SimopServer
10123	TCP	FTP from Simop to LocalCoordinator
64009	UDP	PSManager (UDP)

Internet Access

We recommend ***disconnecting*** the system from the internet (WAN) during data collection.
This will eliminate the possibility that updates will be downloaded and applied while the miniSim is running, which may affect the smoothness of the graphics rendering. This can be done physically by unplugging the network cable, or by disabling the connection in Windows.

The miniSim software *does not* require an internet connection to operate, but it is highly desirable for several reasons!

- **Windows updates**. The miniSim PC runs Windows 11 64-bit Pro. Windows will check for and download updates automatically when online. Windows Defender antivirus and Windows Firewall are used. We recommend that users update their system and virus definitions regularly but be aware that updates to drivers may affect system operation. Contact us for assistance if this happens.

- **User support and software updates**. Internet access is **highly** desirable for user support. Remote Support is described in detail below. Most users will connect their miniSim to the internet only when they need remote support.

- **Data backup.** The use of network or cloud storage is recommended. The miniSim uses a dual-disk RAID (mirrored) for redundancy, but backup and archiving of experimental data is the user's responsibility. Most Universities provide cloud data storage at reasonable cost. Some users have local network attached storage (NAS) on their laboratory network.

- **Data analysis.** Most researchers conduct data analysis on their workstation or laptop to keep the miniSim available for use by others. Use of shared network drives, a NAS, or cloud storage makes the process of moving and archiving data files much easier.

Support and Maintenance

The DSRI Software are delivered and supported by DSRI in exchange for a yearly Software Support and Maintenance Fee ("Annual Fee"). The Annual Fee is required for use of the software and for support, updates, bug-fixes, and new releases.

DSRI will invoice for the support and maintenance fee upon contract execution, and annually thereafter on the date on which the system was delivered and initial user training completed ('renewal date'). Upon receipt of this payment, DSRI will update the user's USB keys (Keylok) for another year.

DSRI retains the right to adjust the Annual Fee and agrees to notify Recipient one (1) month prior to the automatic renewal date of fee adjustment. See miniSim Terms and Conditions for more details.

Support is available from 9am-5pm Central Time Mon-Fri, except for University Holidays†. Support is via email, phone, or remotely via the miniSim MyQuickSupport application. DSRI will acknowledge support requests within 24 hours. All users have access to training videos and materials on the miniSim website.

Hardware (cab, PCs, displays, etc.) is supplied as-is and without warranty, except for manufacturer's warranty if applicable. Support and repairs will be mutually agreed upon and provided on a non-profit basis.

†University Holidays are: New Year's Day, Martin Luther King Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday following Thanksgiving, Christmas Day, and an additional day near Christmas designated in the official University calendar.

Online Support Materials

Visit the miniSim Support Page for the most up to date support information, training videos, and manuals. Local copies of manuals are also provided on the miniSim PC.

How Do I Get Support?

The primary method is via email: miniSim-Support@uiowa.edu

We check this account at least once a day, and delegate requests to the appropriate team member. We acknowledge the requests within 24 hours (not including weekends and Holidays), and will resolve the issue quickly in the order they come in.

If you send email from your personal account, please state where you are located. We use this information to determine what system you have (PC specs, Software versions, etc) and keep track of support issues.

What is *not* support?

Support is not Training. During training the user is oriented to the system architecture, how the modules work together, system operation, tips on good practices, practice using system, etc. We provide training to all new users, and we expect that they pass-on this information to new students/researchers as they

enter the lab. We provide 'refresher' training remotely (web meeting) for a reasonable fee, and there is no restriction on the number of students. A few days of intensive training will make your team much more productive and confident in using the miniSim. Ask us for a quote!

Support is not Development. We encourage requests for new features; the DSRI team will evaluate feature requests for inclusion into a future software release. If specific new functionality or model is desired in a specific timeframe, please contact the miniSim team for a quote.

Backups

Users are responsible for maintaining the miniSim PC and backup of collected data. This includes Windows Updates, backups of the miniSim directories, data archive/storage, security, and PC repairs. Your on-site IT support can typically handle these areas easily. Most Universities offer cloud storage services at reasonable cost for long-term storage of research data (some sponsors may require this). This will enable a system to be quickly restored, or an experiment re-used.

Note that the miniSim PC is usually supplied with two hard drives in a mirrored array (RAID 1). This provides redundancy in the case of a failure, but this is not intended for long-term secure storage.

Hardware Repairs and Upgrades

The miniSim hardware (cab, PCs, displays, etc.) is supplied as-is and without warranty except for any manufacturer's warranty if applicable. Support and repairs will be defined by DSRI and provided on a non-profit basis.

We will aid in troubleshooting hardware problems and locating replacement parts. In most cases we can tell you what part to buy directly, as it will be more expensive for us to source them for you.

If necessary, we can provide a quote for miniSim-specific parts, or for a site visit to repair the system.

For hardware upgrades, we can provide you with a quote. Upgrades range from a complete PC, Cab upgrade, or adding options such as a Motion System or Infotainment. We will also migrate your existing experiments to the new PC and configure it for any other upgrades added.

Remote Access via TeamViewer

DSRI has chosen TeamViewer QuickSupport as a remote access tool for miniSim user support. This has the following benefits:

QuickSupport provides these benefits:

1. QuickSupport is a miniSim-branded executable (.exe) that the user runs *only* when they allow us access to the system. It is a single executable (TeamViewerQS.exe) that does not auto-launch at boot like the 'free' or 'Host' TeamViewer versions, thus we cannot log into unattended systems.

2. It allows our engineers to see ***all*** the displays to perform desktop and mosaic configuration, etc.

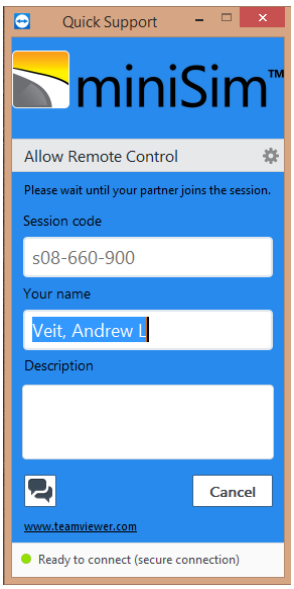
3. Only members of the DSRI miniSim support team can access the system when granted permission by the user at each occurrence (white list).

    a. Completely unattended support is ***not*** possible with QuickSupport.
    b. If you require unattended access by our support team, the TeamViewer 'Host' is used. This is also a white-list application, only allowing miniSim team members access.

4. Makes upgrades smoother. Beyond simple software patches consisting of a few files, applying updates and migrating a user's experiments from an old miniSim install to a new one may require assistance. An 8-chapter video that describes the migration process is available here.

5. Many users add additional devices to the miniSim, such as eye-tracking or infotainment systems. In these cases, remote access greatly simplifies configuring communication with the miniSim.

6. Unlike other remote access tools, we know that TeamViewer does not impact performance of the miniSim when it is not being used. Many enterprise solutions for remote support or monitoring run in the background at all times and can affect graphics rendering performance.



Software Security Risk Assessment Information

It is common for institutions to conduct software security reviews before acquiring a system. If you need further information, please contact us! Based on previous questions the following summary is provided for the miniSim software suite:

1. Is it a cloud service?
    a. No. Network access is not required for the system to run, and all system data and all acquired data are stored on the miniSim and Video Capture PC.
2. Is network access needed?
    a. Network access is used for providing support. TeamViewer Quick Support is used. This application is only run when needed. DSRI staff can request access, which then is granted by the user. Only DSRI staff with authorized user accounts can access remote machines using this method (whitelist).
3. What does it do?
    a. miniSim is a driver-in-the-loop simulator for academic and clinical research, and applied R&D applications.
4. How is it used?
    a. The miniSim system allows a user to conduct human factors and clinical research in a repeatable and safe driving environment. The user creates their own scenarios for their experiment, and when driven by a participant, records the driver's inputs and other scenario data. This data is reduced using Matlab (or similar tools) to extract the measures desired.
5. Is PII or PHI data used? Is Protected Health Information or other sensitive data being used, processed, maintained, or stored by this application?
    a. No PHI information is needed or used by the miniSim driving simulator.
    b. Users, however, must observe their institutional review board (IRB) requirements for human-subject experiments pertaining to personal identifying information (PII) and PHI.
6. Are any services hosted by the vendor?
    a. No. All the miniSim applications run on the supplied PCs. All data is recorded locally on those PCs. The user is responsible for data back-up to their local and/or cloud storage.
7. Can the system/application integrate with customer's Active Directory (e.g. LDAP, Kerberos, SSO)?
    a. Yes. The miniSim is configured by default to run under a local system account. It can be integrated with AD, but additional configuration would need to be done to assure functionality between the miniSim and associated systems (such as vidcap, etc).
8. Is there a unique account for every user and administrator?
    a. No. By default, the miniSim uses a single, local account. It can be configured to be a member of an Active Directory system, but any new user would have to be manually configured to assure functionality between the miniSim and associated systems.
9. Will there be generic or shared accounts?
    a. Yes. The default login is intended to be used as a generic/shared/service account.
10. Does the application password management meet the requirement of 8 min. characters, alpha-numeric, upper/lowercase, special characters?
    a. Yes. The default login uses a password that exceeds those requirements. The miniSim software application itself does not have user accounts or passwords.
11. Any Deprecated or unsupported technologies used?
    a. No. Any software dependencies are commercially available or are open-source projects.
12. Is there a source code escrow?

    a. No. The code is managed by the University of Iowa, and is unlikely to be unavailable in the future.
13. All SaaS applications and applications hosted externally to customer containing non-public data must be protected by multi-factor authentication.
    a. No SaaS or other applications are hosted external to customer as a part of the miniSim.
14. Is there a mobile app?
    a. No.
15. Anti-Virus solution must be installed and running.
    a. Yes. Windows Security is used. This is a high performance system, it not recommended to utilize real-time virus scanning while the miniSim is being operated. Virus scans can be run manually during simulator down-time. This scheduling of scanning is the responsibility of the end-user.
16. If sensitive data is stored locally on the system, will the data be encrypted at rest & at motion?
    a. No. There is no sensitive data required to be stored on the system.
17. Will the sensitive data be properly purged or disposed of according to DoD or NIST800-88 standards at termination of contractual agreement?
    a. No. Sensitive data is not stored on the PCs. Customer will own the PCs, and can dispose of any data as needed.
    b. Length of study data storage is at least 3 years per OHRP (https://www.hhs.gov/ohrp/index.html) and may be longer if other contractual requirements apply (FDA, VA, etc.).
18. Will the system / application need to interface with any other applications or systems?
    a. The miniSim is not integrated with other systems within customer's domain or a 3rd party.
19. Explain Data Lifecycle
    a. The miniSim collects driving data (driver inputs, speed, lane position, etc). This is stored in a binary file format. The VideoCapture system records video directly to MP4 files.
    b. The researcher will move this experimental data to their internal cloud or other storage, accessible from user's workstations for analysis.
    c. Length of storage is at least 3 years per OHRP (https://www.hhs.gov/ohrp/index.html) and may be longer if other contractual requirements apply (FDA, VA, etc.).
20. Does the system/application have audit logging capability, and is it enabled?
    a. No, there is no audit log. There is a log created each time a scenario is run, but this is not intended for audit purposes.
21. Who is responsible for providing the hardware/software?
    a. The University of Iowa is responsible for providing the hardware and software.
22. Who is responsible for managing the system (vendor, department administrator, etc.)?
    a. Customer end-user or local admin would manage the PC (OS patching, updates, etc.)
23. Please specify all communication ports & system details including versions. If you are going to use insured protocols / ports, please provide detailed explanation.
    a. The miniSim and Video Capture PCs communicate with each other using ports as defined in the attached documents. They do not communicate with external PCs when in operation.
    b. Remote access to the PC via TeamViewer QuickSupport application is desirable for support purposes, but not required for operation. See section on remote access.
24. Is the deploying Application built on Open-Source Software platform Or Vendor support application?

    a. miniSim is a vendor-supported application.
25. How are security patches applied?
    a. Windows OS security patches are typically applied by the user or via automatic updates.
26. Vendor or any 3rd party need to have remote access?
    a. Yes. Network access is used for providing support. TeamViewer Quick Support is used. This application is only run when needed. DSRI staff can request access, which then is granted by the user. Only DSRI staff with authorized user accounts can access remote machines using this method (whitelist).
27. Will this system/application need to be accessible from the Internet?
    a. Yes. For user support and software and OS updates only.
28. Provide the vendor IP address or a Fully Qualified Domain Name.
    a. Domain is: **uiowa.edu**
29. Is customer data being transmitted outside of customer network?
    a. No.
    b. Customer may share data with DSRI for troubleshooting purposes.
30. Recovery Time Objective (RTO) defines the maximum amount of time that a system resource can remain unavailable before there is an unacceptable impact on other system resources, supported business processes, and/or the MTD. Determining the information system resource RTO is important for selecting appropriate technologies that are best suited for meeting the MTD.
    a. The miniSim was determined to be neither Tier 1 (Mission Critical), Tier 2 (Business Critical), nor Tier 3 (Necessary Business/Ops).
    b. It was determined the miniSim is Tier 4 – Administrative Services:
        - Non-Critical to accomplishing the mission of the organization.
        - Can be delayed until damaged site is restored and/or a new computer system is purchased.
        - Can be performed manually.
        - Minimal or no impact on patient care or safety.
31. Who is responsible for Disaster Recovery (DR) and Business Continuity (BC) of the system and application?
    a. The end-user is responsible. DSRI makes system images before shipment and will retain for at least 1 year. Customer/end-user will need to make periodic backups. UIOWA can assist with hardware failures and/or reloading the system for an additional fee. The end-user is responsible for scenario files they created, and all experimental data generated by the miniSim.
32. Who is responsible for the backup & restore?
    a. The customer/end-user
33. Where (location) is the backup stored? Will the backup be stored offshores? [Provide location]
    a. With the customer/end-user
34. In case of vendor hosted applications, vendor must provide an exit strategy, a high-level plan on how data will be identified, transferred safely without any service interruption. Please provide individual system level plan
    a. miniSim is not a vendor hosted application.