net*TIMS STUDENT USER GUIDE

Telecommunications Instructional Modeling System for Multiuser Internet Delivered Hardware Experiments



Emona net*TIMS Student User Guide

Issue Number: 2.7

Published by:

Emona Instruments Pty Ltd,
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Camperdown NSW 2050
AUSTRALIA.

web: www.emona-tims.com

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Printed in Australia

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overview

*1.0 Overview of Emona TIMS and the net*TIMS System*

Emona TIMS System – important background information

TIMS is laboratory hardware equipment used by students and professors to carry out experiments in telecommunications theory and concepts. The name "TIMS" stands for "Telecommunications Instructional Modeling System".

TIMS implements the block diagrams found in telecommunications text books. Experiments are implemented by patching together functional building blocks, called “TIMS modules”, according to telecommunications block diagrams. Figure 1.1, below, shows a student implementing a simple modulation scheme using three plug-in modules and one fixed module.



Figure 1.1: TIMS-301 System Unit

Note that each module has knobs and switches: these are used by the student to vary parameters such as frequency, phase, amplitude and timing. These parameters must be adjusted so that the experimental results relate back to the theory and mathematical calculations.

Practically any telecommunications coding or modulation scheme can be patched together with TIMS. TIMS is a true mathematical modeling system as it implements the actual mathematical equations using real electrical signals NOT SIMULATION.

The only difference between a TIMS experiment and “real-world equipment” is that TIMS scales-down the carrier and sampling frequencies to make it easier for students to view and understand the signals they are viewing.

Emona net*TIMS – TIMS Experiments via LAN & Internet

net*TIMS allows students to carry out real TIMS hardware experiments "at a distance". Net*TIMS maintains the **TIMS block diagram approach** for implementing telecommunications theory and concepts using real hardware building blocks – “TIMS modules”.

net*TIMS experiments function identically to the standard TIMS-301C experiments.

In net*TIMS, experiment control and manipulation is the same as with standard TIMS-301C: students are able to vary parameters such as frequency, phase, amplitude and timing so that the experimental results relate back to the theoretical and mathematical calculations.

The key difference between standard TIMS-301C and net*TIMS, is that in net*TIMS each module’s knobs and switches are adjusted via a graphical display on the user’s computer screen.

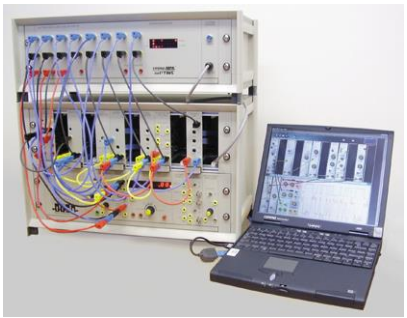


Figure 1.2: net*TIMS System & a laptop logged-on to the experiment

It is important to note that in net*TIMS, students actually **manipulate real hardware and view real electrical signals**. They are able to control the TIMS experiment from across a LAN or the Internet via an experiment control panel/screen displayed in their browser.

Figure 1.2 shows a net*TIMS System and experiment as it could be set-up at the College campus. The display on the computer is the same display a student would see via their browser, from home or another lab.

The net*TIMS screen layout viewed by the student closely resembles an actual hardware TIMS System in both appearance and operation in order to maintain the hands-on feel of TIMS as much as possible.

*1.1 Familiarization with net*TIMS Hardware*

The following section will help you identify the important component parts of the net*TIMS System.

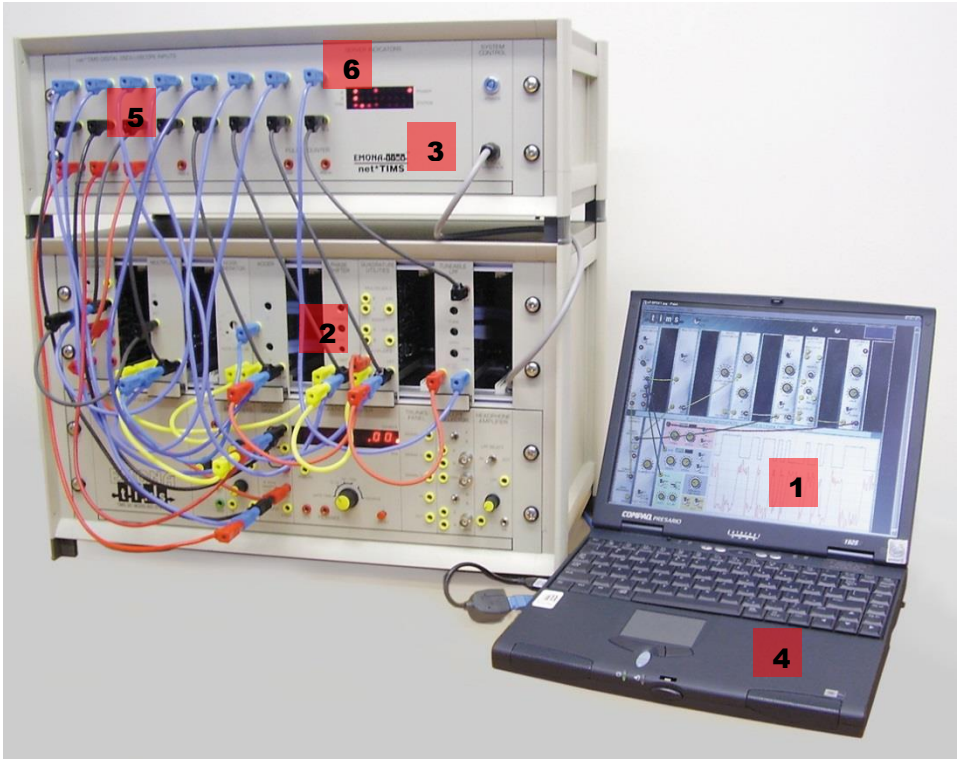


Figure 1.3: Basic net*TIMS experiment set-up

1. net*TIMS EXPERIMENT SCREEN: the graphical user interface which is a full screen representation of the patched plug-in and fixed modules, along with a real scope with spectrum (FFT) function.

An example of a BPSK experiment (modulation, demodulation & noisy channel) on net*TIMS is shown below:



Figure 1.4: net*TIMS experiment screen

2. net*TIMS MODULES: TIMS plug-in modules which have been **net*TIMS-enabled**. This means that their knobs (potentiometers) and switches have been replaced with equivalent remote-controllable electronic devices and an interface daughter board added to control the communications interface with the net*TIMS SERVER.

3. net*TIMS SERVER: a web server unit which 'serves' the net*TIMS EXPERIMENT SCREENs to each user 'client' software, as well as housing the digital scope and multiplexer interface unit used to capture the actual signals for display. This unit also controls student access, monitoring and administration functions.

4. net*TIMS CLIENT: the application software used by a student on their personal computer to view the net*TIMS EXPERIMENT SCREEN and interact with the net*TIMS SERVER and net*TIMS experiment. This software is run in a **web browser window, such a Chrome,** on the user's personal computer.

No installation of software is required. The user/student needs only to enter the IP address of the net*TIMS Systems into the web browser. The user/student logs into the experiment via a username and password (user/visitor for the Emona demo systems).

The net*TIMS CLIENT application automatically runs in the browser and handles all control, display and FFT functions on the user's local computer, with no burden on the net*TIMS SERVER.

5. net*TIMS server SCOPE INPUTS: provides a total of 20 oscilloscope inputs for the net*TIMS experiment, including:

8 x channel A inputs – labeled A-1 to A-8;
8 x channel B inputs – labeled B-1 to B-8;
4 x trigger channel inputs – labeled TRIG-1 to TRIG-4.

6. net*TIMS server "SERVER INDICATORS": SERVER INDICATORS is an array of LED displays which provide real-time indication of user activity and system diagnostics

BASIC SPECIFICATIONS

POWER SUPPLY

Input 90 to 264V AC, 47Hz to 63Hz. 15VA

Fuse 700mA (T) 250V slow blow fuse

PHYSICAL

Case Dimensions 300(W) x 530(D) x 190(H) mm

System Weight 2.4kg

2.0 Accessing a net*TIMS Experiment

*2.1 ACCESS THE net*TIMS SERVER HOME PAGE*

- Launch your web browser (Chrome, Edge or Firefox).
- Go to the website or IP address you have been given by your professor or lab staff. You will see the netTIMS home page, similar to that shown below:

- The home page displayed below in figure 2.1 comes directly from the on-line net*TIMS Server.

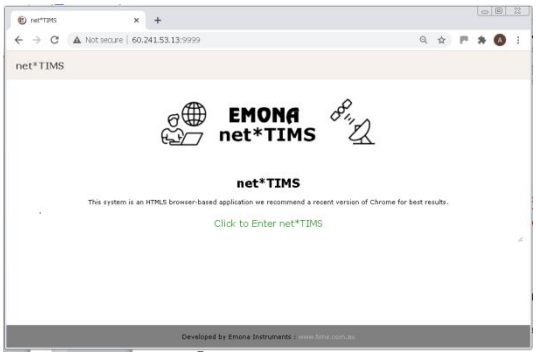


Figure 2.1: net*TIMS web home page

2.1 START EXPERIMENT PAGE

The next window provides an introduction to the using the Remote Lab system. Click the START EXPERIMENT button to log onto the net*TIMS experiment client which runs as html5 in your browser.

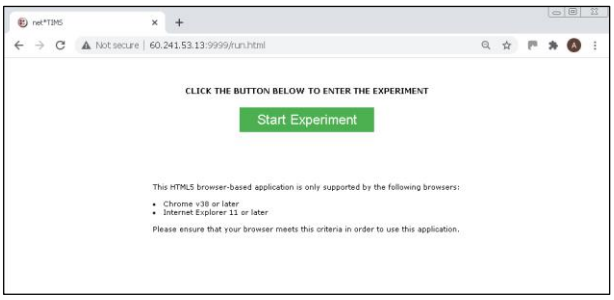


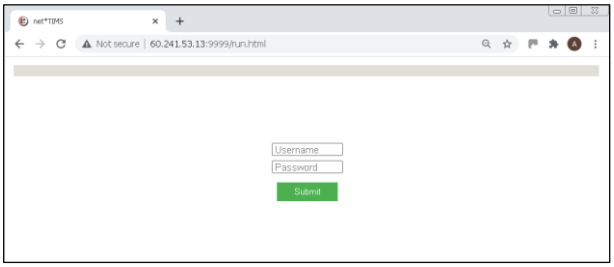
Figure 2.2: Introduction to the net*TIMS System information page

*2.2 LOGGING ONTO THE net*TIMS EXPERIMENT*

An experiment has been uploaded into the net*TIMS Server for the purposes of this demonstration.

The professor has the flexibility to create practically any TIMS experiment on the net*TIMS System that can be implemented on the TIMS-301C Standard System.

Next, the net*TIMS CLIENT will ask for user name and password. Use the default user name and password. See figure 2.4 below:



Enter the **user name** and **password** you have been assigned.

The experiment will now be displayed. The following is an example of a net*TIMS EXPERIMENT display on a computer:



NOTE: IT IS IMPORTANT TO REALIZE THAT THESE EXPERIMENTS WILL NOT FUNCTION UNLESS THE ACTUAL HARDWARE MODULES HAVE BEEN PLUGGED INTO THE net*TIMS RACK and PATCHED TOGETHER, EXACTLY AS DISPLAYED ON THE USER'S SCREEN.

net*TIMS IS REAL HARDWARE AND IS NOT A SIMULATION.

Figure 2.3: example net*TIMS EXPERIMENT display

3.0 RUNNING THE net*TIMS EXPERIMENT

3.1 CONTROLLING SWITCHES AND POTENTIOMETERS

Users who are familiar with using the TutorTIMS simulation software, will find that net*TIMS experiments function in exactly the same manner.

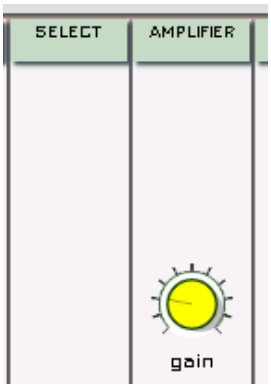
SWITCHES



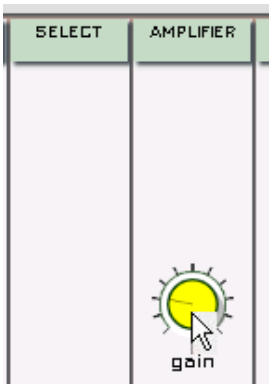
To control both toggle SWITCHES and drop-down menu SWITCHES, hover the mouse pointer over the switch and click the LEFT mouse button.

POTENTIOMETERS and POTENTIOMETER CONTROL

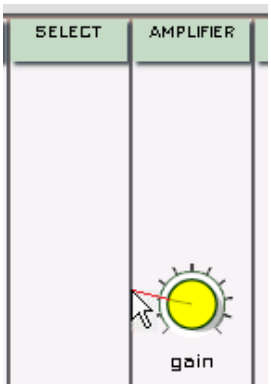
Hover the mouse pointer over the potentiometer. Then, hold down the left mouse button and drag it around the potentiometer knob. The potentiometer marker will rotate as the mouse pointer is moved.



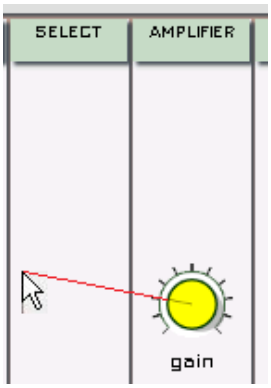
POTENTIOMETER/ KNOB to be varied.



SELECT with LEFT MOUSE CLICK. **DO NOT RELEASE**.



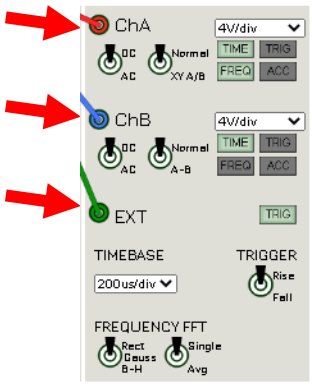
COARSE control: hold down the LEFT mouse button and DRAG short distance from KNOB.



FINE control: hold down the LEFT mouse button and DRAG much further from KNOB.

3.2 CONTROLLING the IN-BUILT INSTRUMENTS

SCOPE INPUTS



OSCILLOSCOPE DISPLAY

net*TIMS provides a 2 channel oscilloscope with an input bandwidth waveform capture depth which far exceeds the operational requirements of any net*TIMS experiment. Actual bandwidth is 50MHz however this will never be required in a net*TIMS experiment.

Each oscilloscope input can view up to 8 output signals across the experiment. The viewing points are set by the professor or lab staff when they build the experiment.

To select a SCOPE INPUT
click on the scope input terminal "**ChA**", "**ChB**" or "**TRIG**" and the available viewing points in the experiment will be displayed with a number from 1 up to 8 (or 1 up to 4 for "TRIG".)

SPECTRUM DISPLAY

Note that the scope also offers spectrum (FFT) display by clicking on the "**FREQ**" button. This signal is generated locally on the user's PC from the real signal captured and displayed.

Maximum FFT frequency display is 25MHz, however this will never be required in a net*TIMS experiment.

Toggle switches select one of 3 windowing functions, Rectangular/Gaussian/Blackman-Harris.

ACCUMULATE/PERSISTENCE DISPLAY

Accumulate mode, "**ACC**" is also available for viewing eye diagrams.

REFRESH BUTTON

The oscilloscope waveforms update when and only when any switch or knob is adjusted or **ACC** mode is selected. Otherwise the previous display is held.

It may be useful to reconfirm a displayed waveform. The REFRESH button may be clicked at any time to update the oscilloscope display.

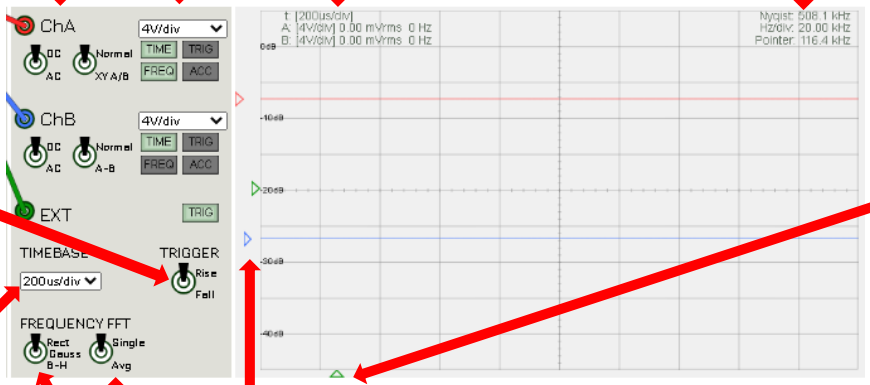
3.3 Oscilloscope control and measuring functions

ChA & **ChB** inputs;
AC/DC input coupling;
EXTernal trigger input

Ch**A**, & Ch**B** V/div attenuator setting;
TIME and **FREQ** (SPECTRUM) display selection
Normal, XY (A/B), **A-B** display modes
TRIGGER source: **ChA**, **ChB** or **EXT**ernal.

t : Timebase setting,
ChA & ChB : Vrms and frequency measurement

FFT : spectrum display details.
Display is active when **FREQ** button is selected.



TRIGGER edge selection.

TRIGGER HORIZONTAL position (**green**) : click and drag left/right.

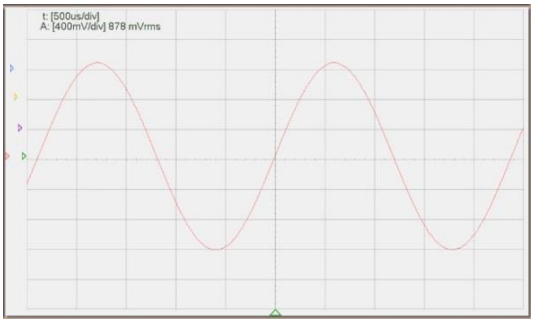
TIMEBASE selection, drop down menu

Position control for
ChA (**red**) and ChB (**blue**): click and drag up/down.
TRIGGER LEVEL (**green**) setting of the trigger level: drag up/down.

FFT controls:
Single shot display, or
Avg (average) spectrum display.

Windowing function:
Rectangular Window
Gaussian Window
B-H (Blackman-Harris) Window

OSCILLOSCOPE DISPLAY

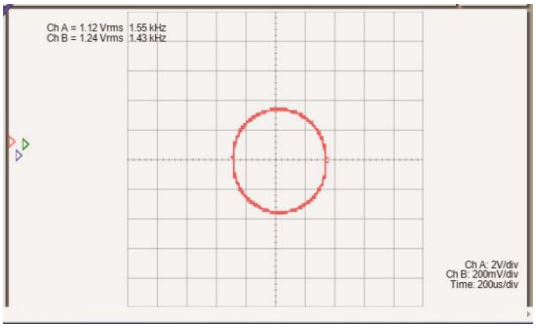


With **on-screen TRMS VOLTAGE measurement** of the displayed waveform

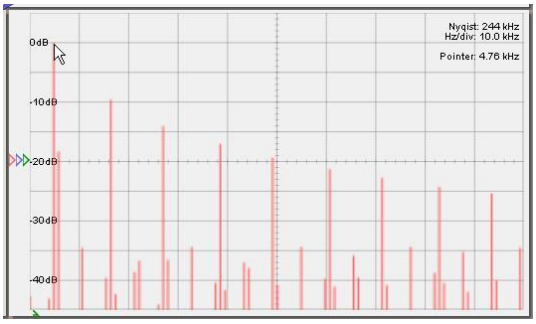


With on-screen **CURSOR** measurement giving **VOLTAGE** and **TIME**.

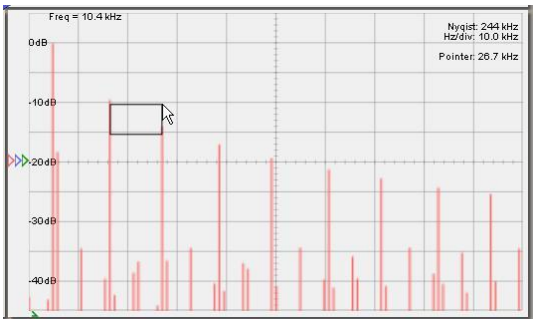
XY DISPLAY



SPECTRUM DISPLAY



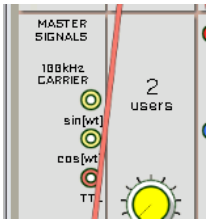
With on-screen FREQUENCY display of **mouse pointer position**.



With on-screen **CURSOR** measurement of **FREQUENCY**.

3.4 Simultaneous Multiple Users

net*TIMS is a multi-user system, which shares the hardware with **MORE THAN 30 USERS** simultaneously, serving each user independently. Number of current users currently logged-on is displayed for your information. See below “2 users” is displayed.



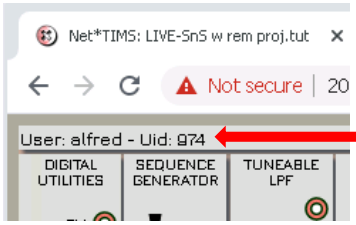
3.5 WATCH MODE – COLLABORATIVE LEARNING MODE

WATCH mode enables individual students, working remotely from each other, to view the client screen of another net*TIMS user in real time. This viewing is known as “watching” the other’s experiment screen. This enables collaboration and tutoring at a distance as a student may “watch” the experiment screen of a professor, or students can watch a screen of another student for group collaboration.

WATCH mode implements a “one actor, many viewers” topology and there is no limit to the number of viewers of the one actor, for example, the professor or lead student.

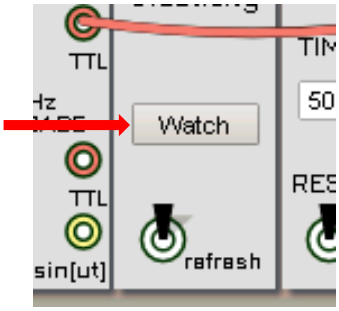
This collaboration can be enhanced with real time audio discussion, carried out via other internet -based audio services such as the many messaging and chat services available (not part of net*TIMS).

How to activate:
Each net*TIMS client session has a unique and randomly assigned user identification number, **“Uid”** displayed in the top right corner of the client screen.

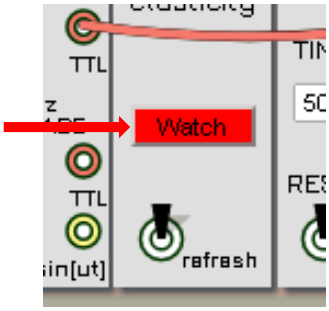


Example of a “**Uid**”: 974

Click on the **Watch** button to activate. The button will turn red when active.

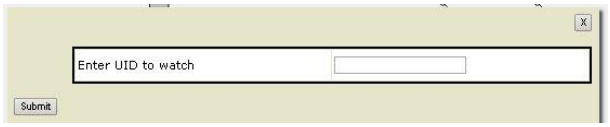


Watch mode **OFF**



Watch mode **ACTIVE**

As soon as the **Watch** button is clicked, a dialog box will open in which the viewer will enter the **Uid** of the session they wish to watch.



Watch dialogue open

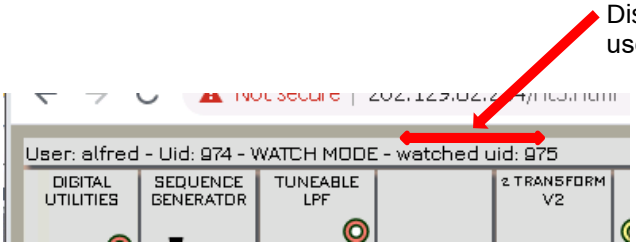


Watch dialogue with example **Uid** entered, 803

Users can communicate their **Uid** to each other via parallel messaging services (not part of netTIMS) in order to facilitate this.

The screen of the viewer will then be identical, and follow changes in real time, of the “**watched Uid**” screen.

The student in WATCH mode, i.e.: who is watching another user, is able to vary their own screen controls, however whenever the “watched” screen is refreshed, all viewers will be updated instantly to match the “watched” screen.

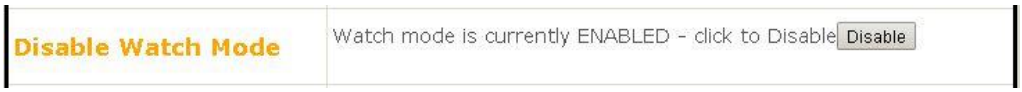


To exit WATCH mode, the user can toggle the **Watch** button, and they will have immediate control over their own session again.

The user being watched has no indication that they are being watched. This may be useful for supervising student progress by a supervisor.

The ADMIN page of the net*TIMS SERVER contains a list of all student users and their **Uid**, for identification and activity confirmation purposes.

WATCH mode can be enabled and disabled by an administrator via the net*TIMS ADMIN page, as shown below. When disabled, the **Watch** button will not appear on any user’s screen.

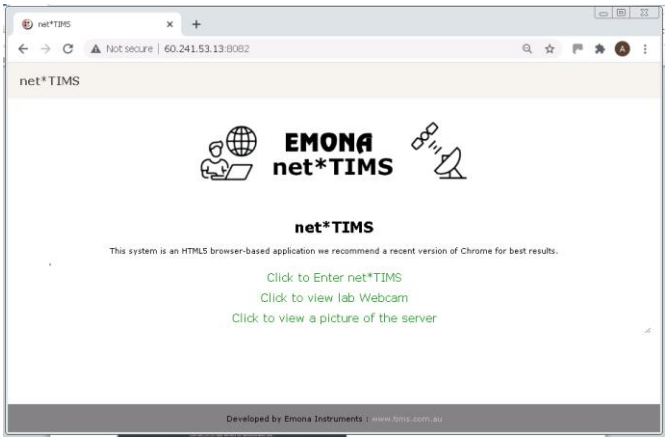


It may be useful to disable the mode so that students cannot collaborate by viewing each others experiment setup.

3.6 Webcam to view the netTIMS hardware

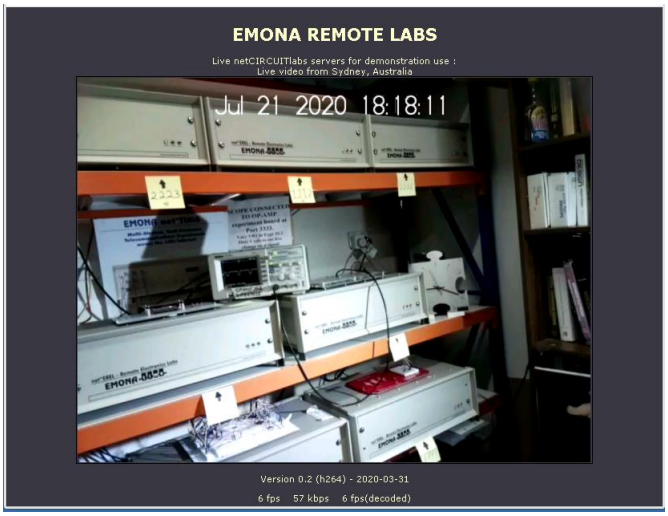
Students can view the netTIMS hardware they are controlling via live webcam images.

netTIMS supports two different webcams.

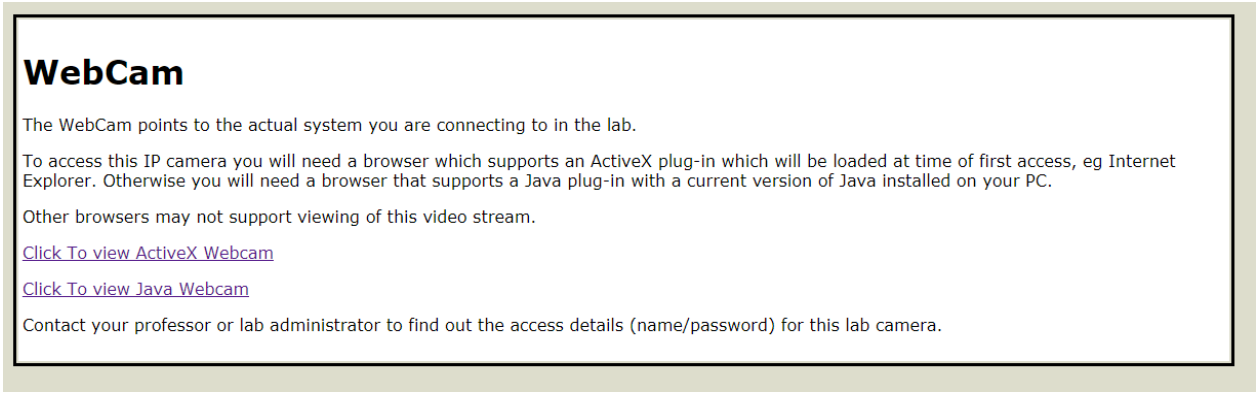


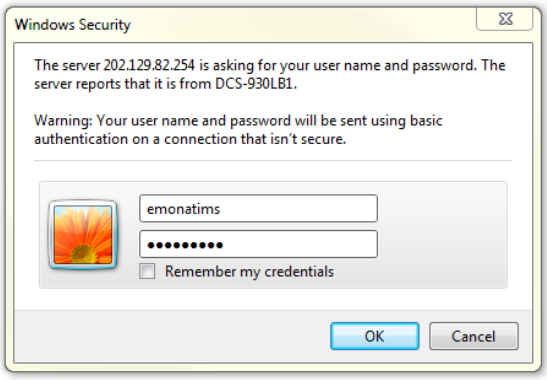
Left mouse click the "**Click to view lab Webcam**" hyperlink.

1. If the **RPi webcam** is installed, a live webcam image will immediately be displayed. Below is an example of an **RPi webcam** display:



2. If the **DLink webcam** is installed, the following window will appear:





DLink webcam log in window. If a username and password is required, contact your professor or lab staff for the required **user name** and **password**.



Example of the **DLink webcam** display.



Emona net*TIMS™ Telecommunications Instructional Modeling System for Internet Delivered Hardware Experiments.

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