

Remote experimentation with robot connected via UMTS network

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To establish mobile learning environments we have adapted web-based remote laboratories to mobile devices like PDAs and smart phones. Our on-line lab experiment is a remotely controlled Pioneer 3 AT mobile robot [1].

A platform independent approach to realize web-based user interfaces on mobile devices is the use of asynchronous Javascript. With asynchronous Javascript an application behavior like Java applets or interactive Flash applications can be implemented. In combination with the exchange of XML based messages between client and server, these techniques are well known under the term 'AJAX'. Windows Mobile does not support an AJAX framework directly, but asynchronous HTTP requests are possible in Javascript.



Figure 1: Pioneer 3 AT connected to the UMTS network

UMTS networks in Germany provide each client with an restricted NAT (network address translation) IP address in a non routeable address range (usually 10.0.0.X). For client applications this is not a restriction, on the contrary it is an extra security feature. But for server applications a routeable and reachable address is mandatory. To overcome these restrictions a new SSH based tunnel to a machine which is reachable by a routeable IP address for the asynchronous HTTP requests and the video stream were added.

The Linux kernel of the robot has to be upgraded to version 2.6.18 to support the HUAWEI E169 UMTS USB stick. The dial in procedure was realized by the help of the 'wvdial' cosole tool. Another tool named 'usbmodeswitch' is required to switch the USB stick from initial 'usb storage' mode (a feature for plug and play Windows driver installation) to serial communication mode.

- [1] Andreas Bischoff. M-learning, mobile experimentation and telepresence with cell phones and pdas. International Journal of Interactive Mobile Technologies, 3(1):49-52, Jan 2009.
- [2] http://http://www.draisberghof.de/usb_modeswitch/