

ICT Support of PV Education and PV Data Web Presentation at FEE CTU in Prague

Martin Molhanec
Czech Technical University in Prague

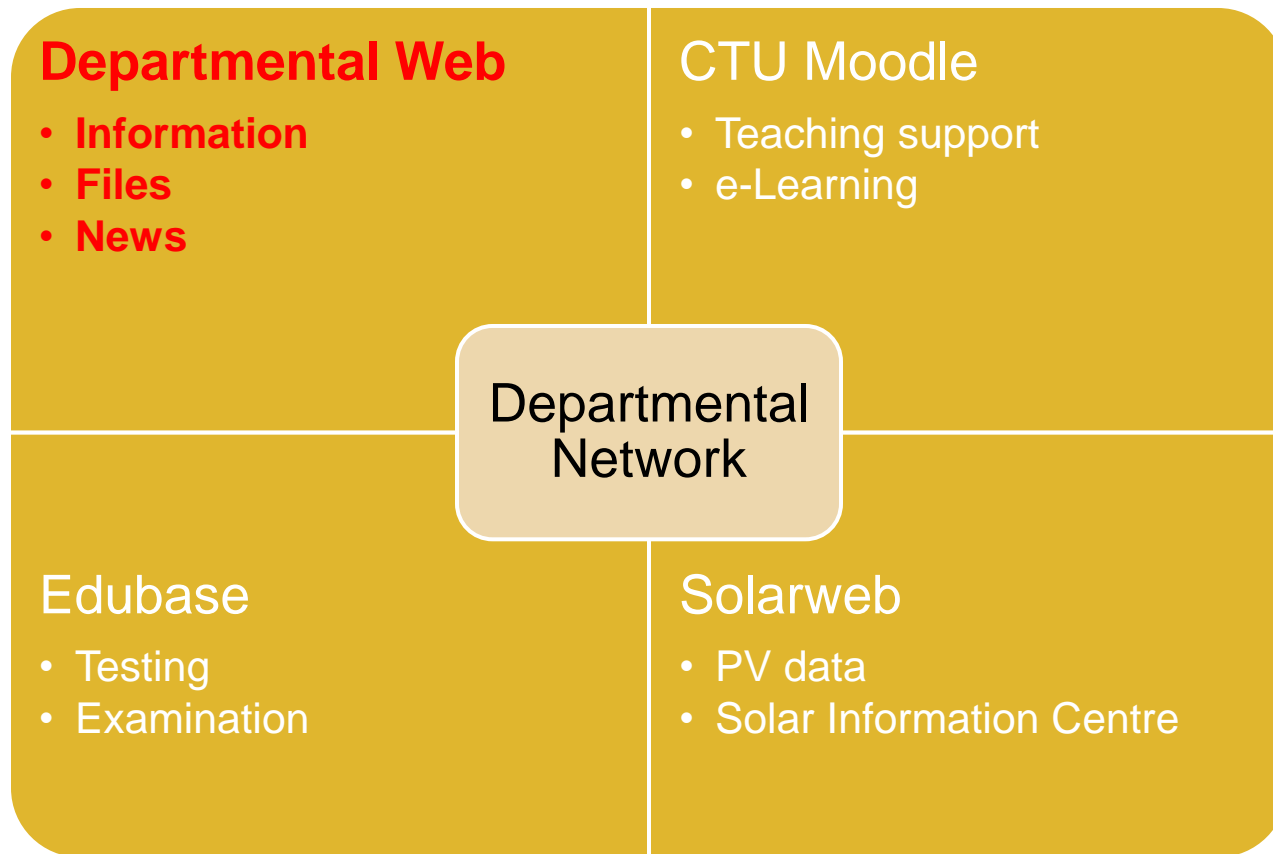
Structure of discourse

- Introduction
 - Structure of departmental network
- Departmental web
- Moodle
- Edubase
- Solarweb
 - Present status
 - Internet Connectivity
 - Detailed description
 - New web site
- Conclusion
 - Future and ideas

Introduction

Basic information about our network

Departmental network



Departmental Web

bordeaux - G... history of Bor... Duke of Gasc... Angevin Empir... Odo the Great... Home (K1311...
http://technology.feld.cvut.cz:8080/xwiki/bin/view/K13113/
Rozvrh učite Ing. M... Katedra elektrotechn... Ing. Martin Molhanec, ... Other bookmarks
Show Print

 **K13113 - Katedra elektrotechnologie**
Fakulta elektrotechnická, ČVUT v Praze

Log-in
Cs / En

Welcome
Department
of ElectroTechnology

K13113: Home

K13113 Menu

- Home
- Calendar
- Contact
- Location
- People
 - Staff
 - PhD Students
- Research groups
- Useful Information

search... GO

News

- Elektrotechnologie 2009 Published: Thu Apr 16 01:43:20 CEST 2009
- 32nd International Spring Seminar on Electronics Technology Published: Wed Feb 25 11:06:54 CET 2009

Quick Links

- Home
- All courses (in Czech)
- Courses with webpages (in Czech)
- SolarWeb
- EMC (in Czech)
- FEE
- CTU
- SHAP
- Moodle
- Tags



Webmaster: *Martin Molhanec*

Version 118.1 last modified by Martin Molhanec on 09/04/2009 at 21:36

COMMENTS: 0

technology.feld.cvut.cz:8080/xwiki/bin/view/.../o_katedre

XWiki platform

Photovoltaic Systems Diagnostics Lab

Právě se nacházíte: ČVUT / Fakulta elektrotechnická / Katedra elektrotechnologie / LDFS / O laboratoři



České vysoké učení technické v Praze
FAKULTA ELEKTROTECHNICKÁ



LDFS
Laboratoř Diagnostiky Fotovoltaických Systémů

[O LABORATOŘI](#) [SLUŽBY](#) [VĚDA A VÝZKUM](#) [AKREDITACE](#) [KONTAKTY](#) [PRO VÁS](#)

Laboratoř diagnostiky fotovoltaických systémů

Stručně o laboratoři

Laboratoř diagnostiky fotovoltaických systémů, která je součástí **Katedry elektrotechnologie** FEL ČVUT, byla slavnostně otevřena 5. listopadu 2010 ([fotogalerie](#)). Zabývá se zejména měřením fotovoltaických modulů tzv. flash testerem, který umožňuje ověřit mimo jiné jmenovitý výkon modulu. Vedoucím laboratoře je v současné době Ing. Ladislava Černá, která je postgraduální studentkou na katedře technologie. Dalšími zaměstnanci jsou Prof. Ing. Vítězslav Benda, CSc., který zastává funkci Odborného garanta laboratoře a Ing. Pavel Hrzina, PhD., který pracuje jako Manažer kvality laboratoře a zároveň je i jejím Metrologem.

Laboratoř je vybavena profesionálním flash testerem švýcarské firmy PASAN - Sun Simulator IIIc, který splňuje požadavky na zařízení třídy AA (dle IEC 60904-9) pro zkoušení modulů při umělém osvětlení. Kromě flash testů nabízí laboratoř i další služby a měření:

- zkoušky izolační pevnosti modulů na testeru HiPot Sefelec SXS56,
- termografická měření ve spolupráci s firmou **Workswell**,
- diagnostiku poruch a dle možností jejich opravu,
- diagnostiku fotovoltaických článků, tj. určení parametrů článků, LBIV, LBIC, apod.,
- poradenské služby.

Hlavním cílem laboratoře je získat akreditaci pro svou činnost, která podpoří věrohodnost laboratoře.

Spolupráce
Laboratoř spolupracuje při řešení úkolů s následujícími organizacemi a firmami:



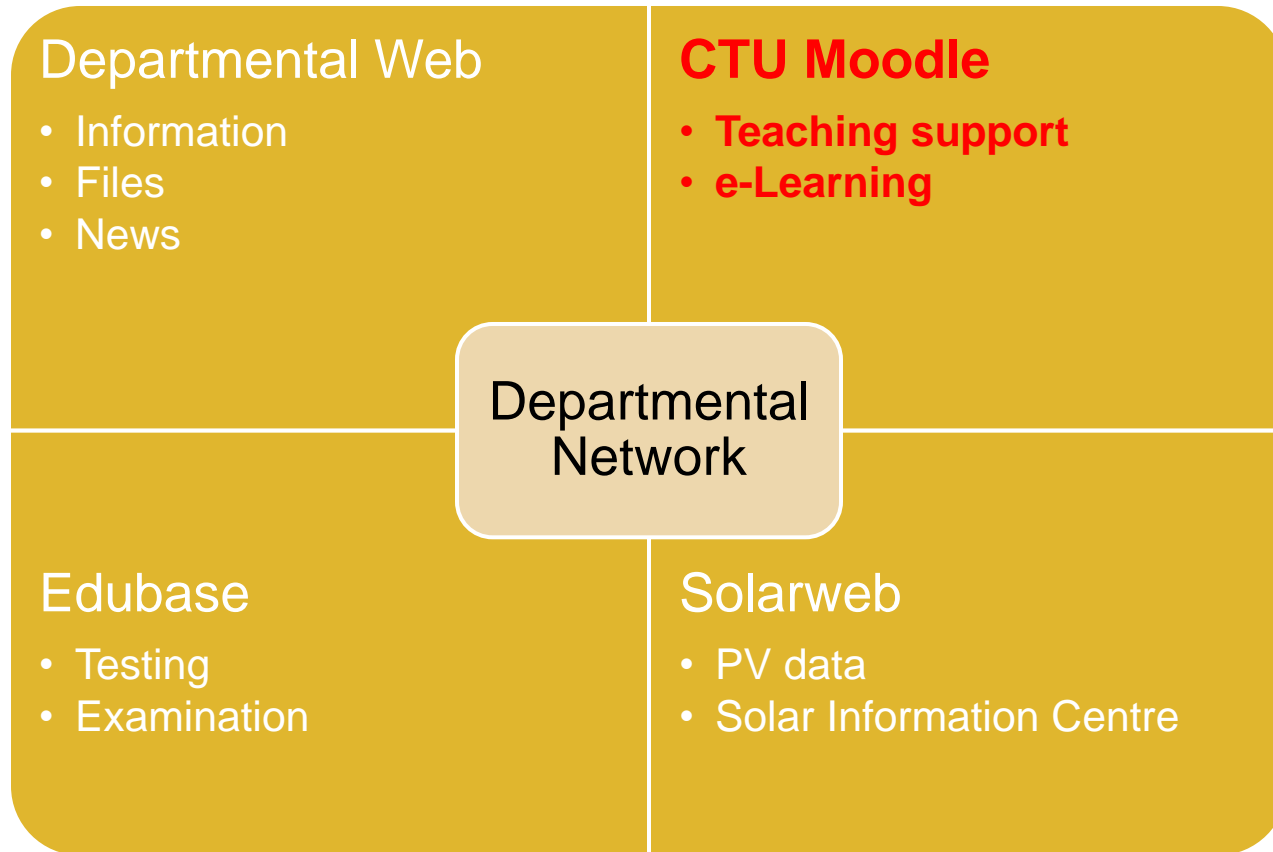
TUV SUD Czech Partner



Workswell



Departmental network



CTU Moodle

XE13FVS - Photovoltaic systems You are logged in as [Martin Molhanec](#) (Logout)

moodle > XE13FVS

People

[Participants](#)

Activities

[Forums](#)
[Quizzes](#)
[Resources](#)

Search Forums

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Administration

[Grades](#)
[Unenrol me from XE13FVS](#)
[Profile](#)

My courses

- [18ARIS pro FJFI](#)
- [18SOP pro FJFI](#)
- [EA - Enterprise Architect](#)
- [X13DFA - Datová a funkční analýza výrobních systémů](#)
- [X13EZF Elektrochemické zdroje a fotovoltaika](#)
- [X13PMT - Projekt v týmu](#)
- [X13TPR - Technologické projektování](#)
- [X13UIT - Užité informatika v technické praxi](#)
- [X38SSP - Správa softwarových produktů](#)
- [XE13FVS - Photovoltaic systems](#)
- [Y13ANW - Analýza a návrh webových aplikací](#)
- [X38ASS - Architektura softwarových systémů](#)

[All courses ...](#)

Weekly outline

[Novinky](#)

| | |
|---|--------------------------|
| 29 September - 5 October | <input type="checkbox"/> |
| Introduction | |
| Course structure | |
| Solar energy | |
| 1. lecture | |
| 6 October - 12 October | <input type="checkbox"/> |
| Photovoltaic effect | |
| Basic parameters | |
| 2. lecture | |
| 13 October - 19 October | <input type="checkbox"/> |
| 3. lecture | |
| 20 October - 26 October | <input type="checkbox"/> |
| 4. lecture | |
| 27 October - 2 November | <input type="checkbox"/> |
| 5. lecture | |
| Test #1 | |
| 3 November - 9 November | <input type="checkbox"/> |
| Basio interactive animation | |
| 6. lecture | |
| 10 November - 16 November | <input type="checkbox"/> |
| 7. lecture | |
| 17 November - 23 November | <input type="checkbox"/> |
| 8. lecture | |
| 24 November - 30 November | <input type="checkbox"/> |
| 9. lecture | |
| 1 December - 7 December | <input type="checkbox"/> |
| 10. lecture | |
| 8 December - 14 December | <input type="checkbox"/> |
| 15 December - 21 December | <input type="checkbox"/> |

Latest News

(No news has been posted yet)

Upcoming Events

There are no upcoming events

[Go to calendar...](#)
[New Event...](#)

Recent Activity

Activity since Saturday, 13 June 2009, 08:31 AM

[Full report of recent activity...](#)

Nothing new since your last login

CTU Moodle

A0M13MKV - AE0M13MKV

You are logged in as [Martin Molhanec](#) ([Log out](#))

[moodle](#) > [A0M13MKV-AE0M13MKV](#)

People

[Participants](#)

Activities

[Forum](#)
 [Study Materials](#)

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[Advanced search](#)

Management

[Signs](#)
 [Reports](#)
 [Delete from](#)
[A0M13MKV-AE0M13MKV](#)
 [Profile](#)

My courses

[A0M13MKV - AE0M13MKV](#)
 [A1M13TPR - Technological design](#)
 [X36ASS - Architecture of software systems](#)
 [X36SSP - Management software products](#)
 [Y13ANW - Analysis and design of web applications](#)
 [K13113](#)
 [SGS-K13113-Molhanec FMEA](#)
 [Molhanec-BP + DP + PROJ](#)
 [EXPERIMENT WITH A COPY](#)
 [Blank Course - Molhanec](#)

Outline weeks

Translation to any language through the "Google Translator"

[News](#)
 [Exam Questions](#)
 [Exam Questions \(Exam questions\)](#)

13. February - 19. February

Lecture : Introduction. The basic physical principles.
Exercise: Organizational issues, introduction to the problem.
 [Lecture 1 GB ver.2011](#)
 [Lecture 1 EN](#)

20. February - 26. February

Lecture : Power diodes (static and dynamic characteristics) **Tutorial**: Fundamentals of measurement of semiconductors.
 [Lecture 2 GB ver.2011](#)
 [Low Level Measurements Handbook](#)
 [GaN Power Device Technologies \(ISPS2010\)](#)
 [SiC Power Devices \(page 1-28\)](#)
 [SiC Power Devices \(page 29-54\)](#)
 [Lecture 2 EN](#)

27. February - 4. March

Lecture : Power PIN diodes. Application-specific diodes with fast commutation.
Exercise: Measurements of permeability characteristics of semiconductor diodes.
 [Specifying the role of No. 2](#)
 [Measured parts catalog](#)
 [Application DIODA.EXE](#)
 [Lecture 3 EN](#)
 [The English version of a similar award from the subject of KVE](#)

5. March - 11. March

Lecture : Schottky diodes. Combined diode

Latest News

[Post new topic ...](#)

14. May., 19.02
Paul Hrzina
[Reading presentations Vice](#)
...

13. May., 21.40
Paul Hrzina
[Exercise on the 15/05 Vice](#)
...

17. May., 20.26
Paul Hrzina
[Questions and lectures ...](#)
[more](#)
[Older topics ...](#)

Upcoming Events

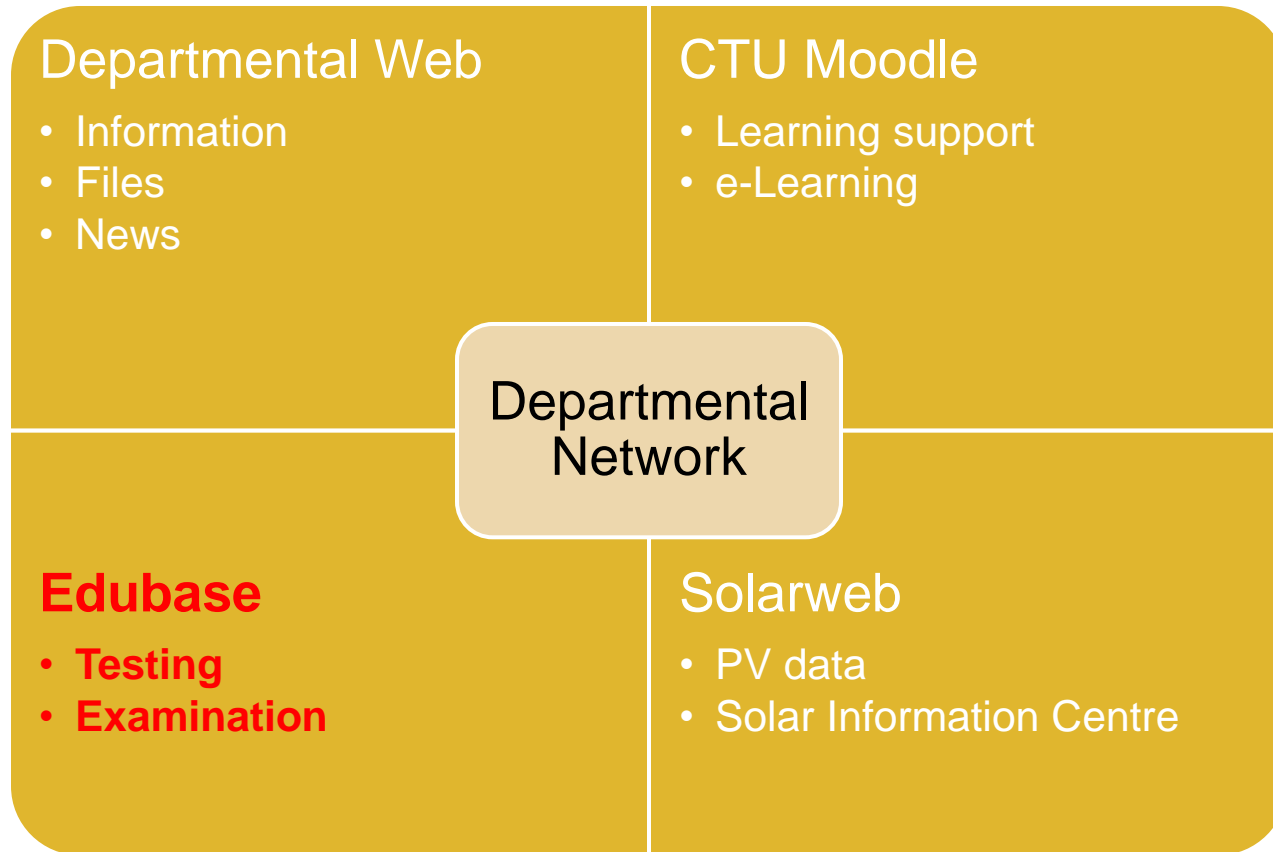
No upcoming events
[Go to calendar ...](#) [New Event](#)
...

Recent Activity

Extract from Monday, 18 June 2012, 08.45
[Full report of recent activity](#)
...

Nothing new since your last login.

Departmental network



Edubase

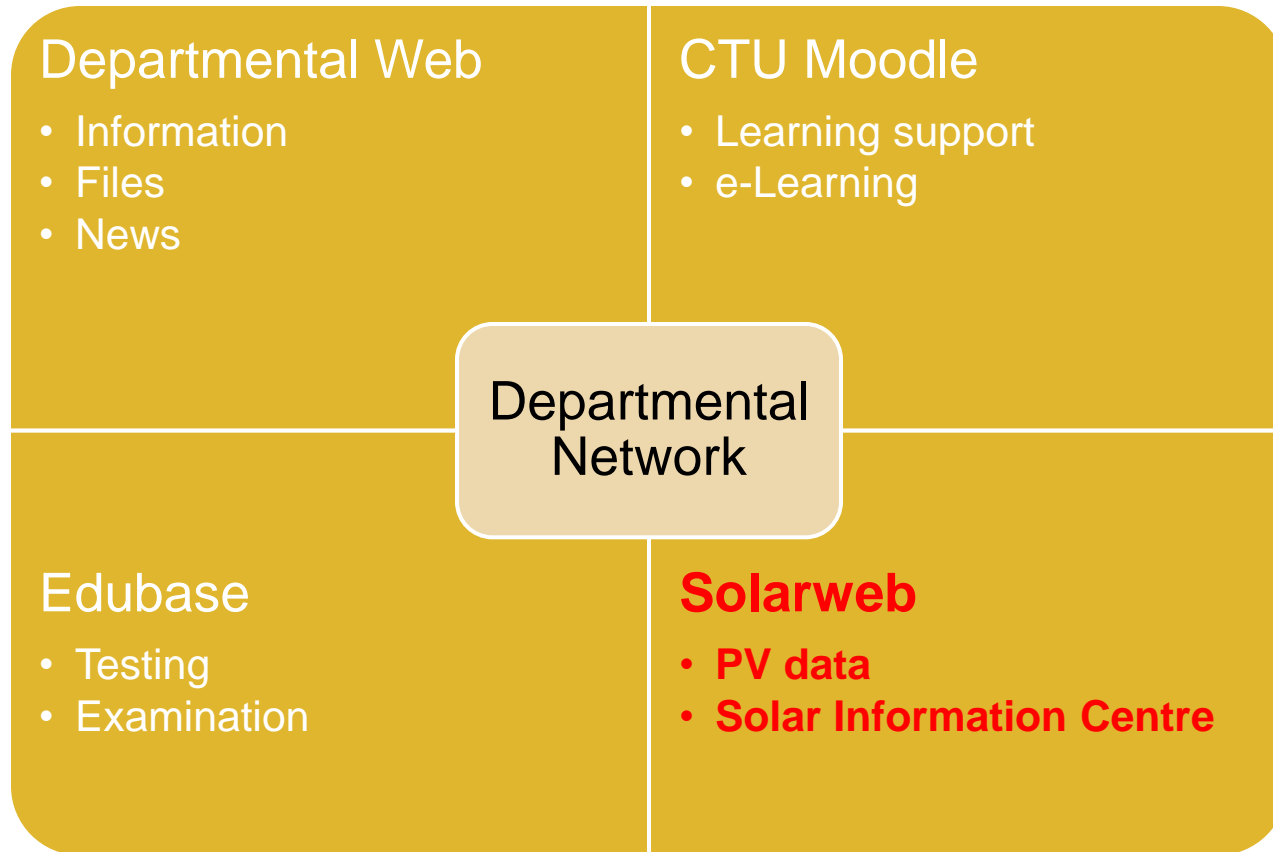
The screenshot shows the Edubase software interface. The window title is "doSystem - Klient (EduBase)". The main menu bar includes "Tematické celky učiva". Below this, there is a section for "Tematické celky" with a "Seznam tematických celků" (List of thematic units) on the left. This list is organized into folders: "VVTKu", "X13KVE", "X13UIT", "X13UPS", and "X13CPU". The "X13UPS" folder is expanded, showing a list of units from 01 to 10. Unit "06 ups_logika_jednoduché" is selected and highlighted.

The right side of the interface displays the content for the selected unit, titled "06 ups_logika_jednoduché". It has a navigation bar with tabs: "1. Učební text", "2. Poznámky", "3. Otevřené otázky", "4. Testové otázky", and "5. Soubory". The "4. Testové otázky" tab is active, showing a "Seznam testových otázek" (List of test questions) section. This section includes a toolbar with "Uložit změny" (Save changes), "Storno" (Cancel), and navigation buttons. Below the toolbar are tabs for question types: "Klasické", "Obrázkové", "Přřazovací", "Seřazovací", and "Doplňovací". The "Klasické" tab is selected, showing a list of "Klasické otázky" (Classic questions). The list has columns for "Ident..." (ID) and "Zadání otázky" (Question text). The first question is selected, with its ID "18636" and the text "Vyberte logický výraz, kterému odpovídá logický výraz $Y = A \text{ NAND } B$?". Below the question text are several radio button options for logical expressions:

- $Y = A \cdot \bar{B} + \bar{A} \cdot B + \bar{A} \cdot \bar{B}$
- $Y = \bar{A} \cdot \bar{B}$
- $Y = A \cdot \bar{B} + \bar{A} \cdot B$
- $Y = \bar{A} \cdot B + A \cdot \bar{B} + A \cdot B$
- $Y = A \cdot B$
- [Empty field]

At the bottom of the question list, there is a page indicator showing "7" and navigation buttons.

Departmental network



Solarweb as a part of our departmental network

A detailed description

The Present Status of PVDA

- About 9 years old (installed in 2002 year)
- Located on the roof of our faculty
 - See photo on the next slide
- 3 independent system
 - @ 1kW per system
- Each system has 10 PV panels
- The PV system is connected to the standard 230 V, 50 Hz power supply network
- All produced energy is consumed at faculty building

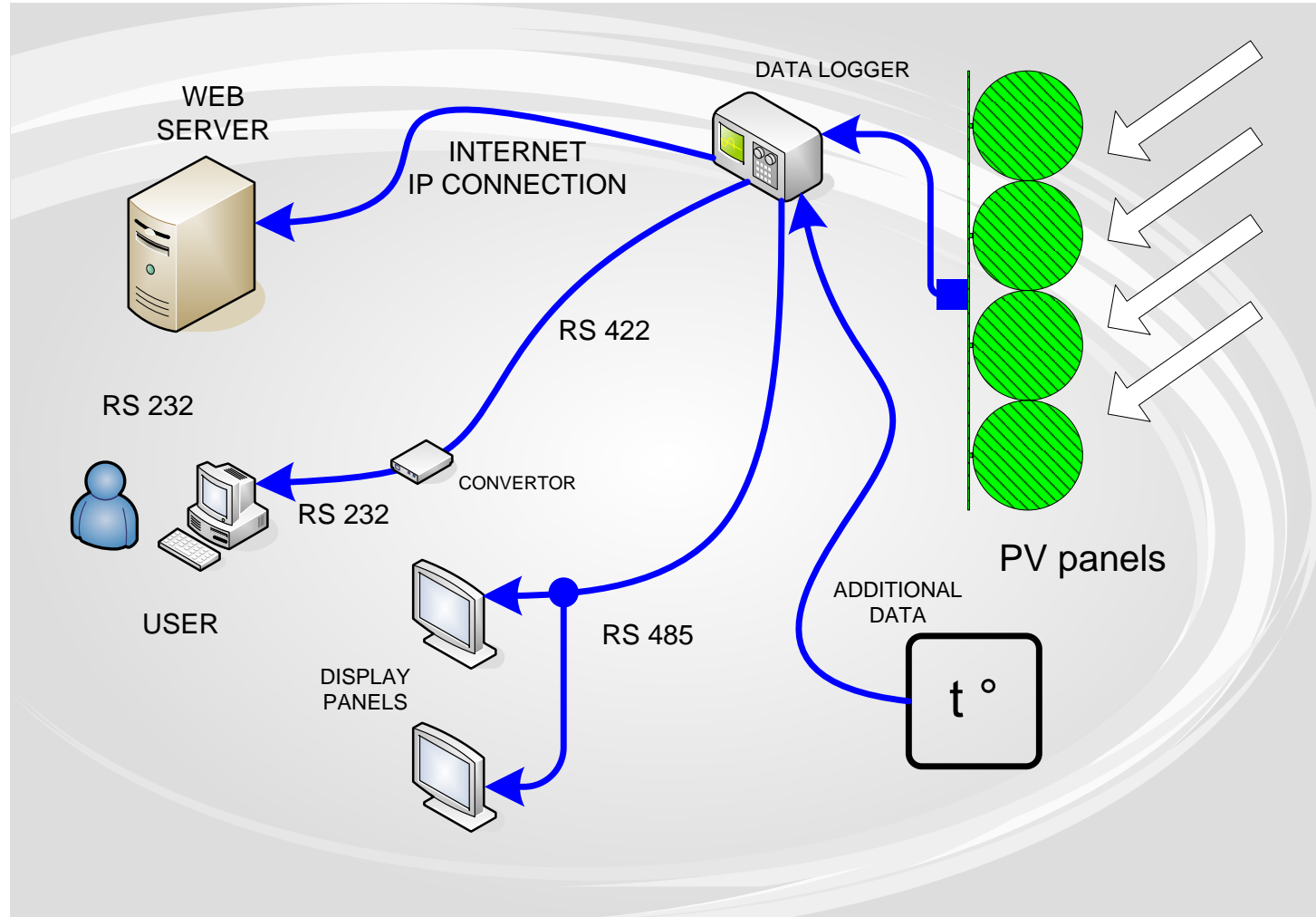
Emplacement of our solar panels on the roof of faculty



Gathered PV Data

- sum of energy
- direct-current voltage of panel A(inclination 45°)
- direct-current current of panel A(inclination 45°)
- direct-current voltage of panel B(variable inclination)
- direct-current current of panel B(variable inclination)
- direct-current voltage of panel C(inclination 90°)
- direct-current current of panel C(inclination 90°)
- momentary performance supplied to grid (P_{ac})
- panel temperature
- intensity of incident sun radiation (I_{rrad})

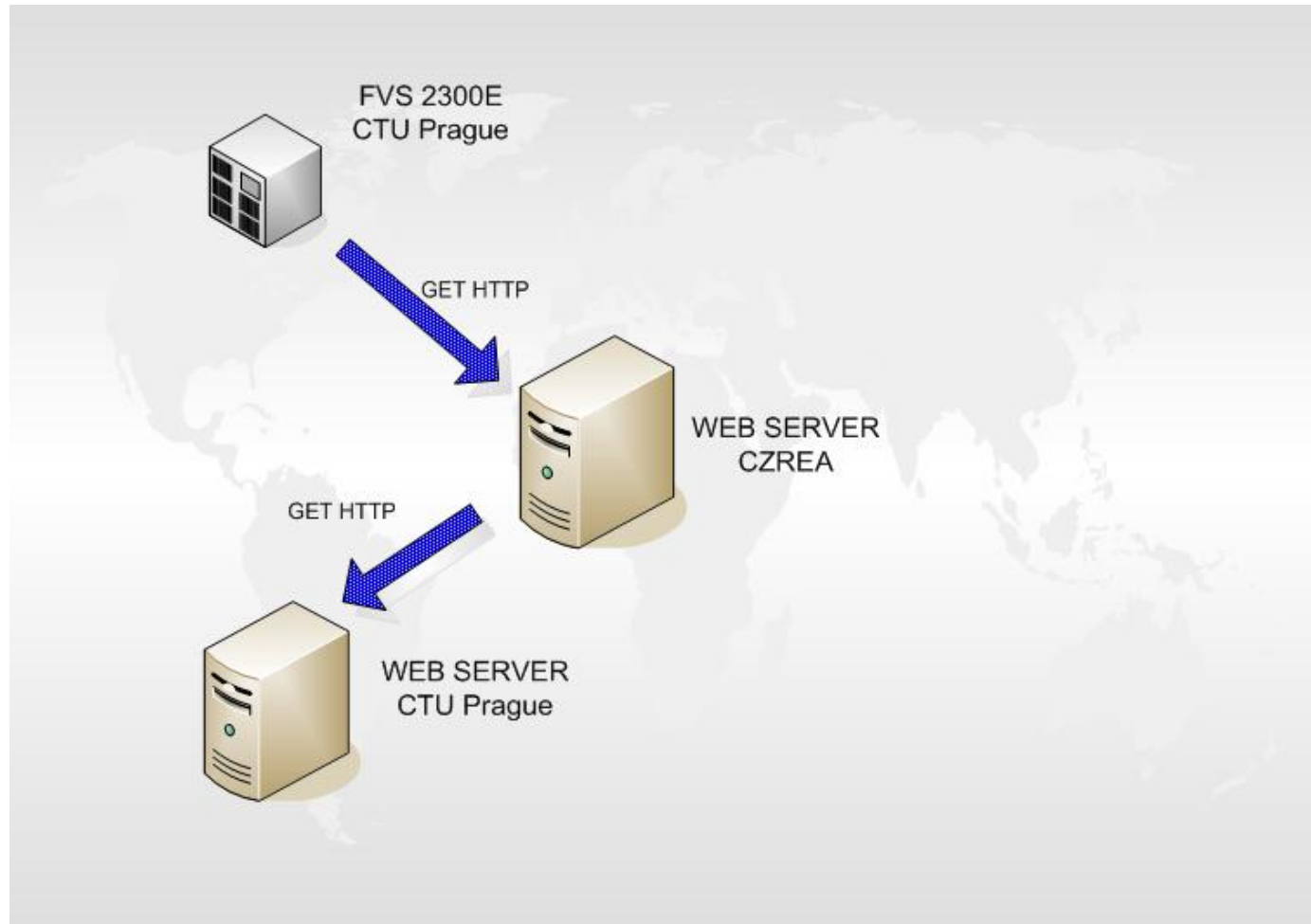
Interconnection between parts of our system



Demonstrational table with solar data in faculty doorway



Scheme of data gathering through Internet connectivity



Our data presented on Czech RE Agency



Interaktivní mapa obnovitelných zdrojů energie

O projektu

- Úvodní stránka
- Popis projektu
- Virtuální laboratoř
- Mapa ČR
- Statistiky

Zařízení

- Všechny instalace
- Fotovoltaické elektrárny
- Vodní elektrárny
- Větrné elektrárny
- Fototermika - ohřev vody
- Spalování biomasy
- Tepelná čerpadla
- Bioplyn

Administrace

- Nová instalace
- Přihlásit

Vyhledávání

OK

Kontakt

czrea@czrea.org
Czech RE Agency

Instalace: ČVUT

Souhrn | Mapa | Fotografie | **Grafy** | Hodnoty | Upravit

Nastavení grafu

Období: Denní Datum: 29 Březen 2006 Zobrazit

Průměrný hodinový výkon dne 29. 3. 2006



| Hodiny [h] | Výkon [kW] |
|------------|------------|
| 8 | 0.05 |
| 9 | 0.35 |
| 10 | 0.60 |
| 11 | 1.00 |
| 12 | 0.75 |
| 13 | 1.80 |
| 14 | 1.75 |
| 15 | 0.95 |
| 16 | 1.10 |
| 17 | 0.65 |
| 18 | 0.05 |
| 19 | 0.05 |

Vysvětlivky

Advantages of present time solution

- All data are presented by well-arranged diagrams.
- It is possible to show daily, monthly or yearly data behaviour diagrams.
- The web site system is not only a presentation tool, but also a full-featured content management system (CMS).
- The whole system has a modular structure, suitable for future expansion.
- English and Czech versions exist with a possibility to be outreached by other languages too.

Disadvantages of contemporary solution

- A dependency on the CZREA web server.
 - An unexpected cessation of PV data receiving.
- An impossibility to easily change the address of the target (receiver) web server.
 - We always must call a maintenance service of data-logger producer.
- An impossibility to obtain historical data from the data-logger through the Internet connection.
 - But we can get historical data by another way using a direct connection to the personal computer installed in an office and consequently we can upload this data to the web site

Detailed Description of *Solarweb*

Our Solarweb is located at:
<http://technology.feld.cvut.cz/SolarWeb>

Home Page of *Solarweb*

CTU - Solar pannels

Main Solar panels Articles Discussion Files Links

About web system

System supports an activity of a group conversant of photovoltaics in the Department of Electrotechnology, FEL CTU. The system is made for gathering of data collected in solar panels. Another part of the system - CMS system, support communication between users of system, enable publication of their articles and support e-learning.

News

4th INTERNATIONAL WORKSHOP ON TEACHING IN PHOTOVOLTAICS - Prague, 27 - 28 March 2008.

Solar panels
In this part of application you can browse data obtained from solar panels installed on the roof of FEL CTU building. Measured data are displayed in the form of graphs or tables. You can view daily, monthly and yearly data.

Articles
Here can registered user publish his own articles. It is possible to publish yet written article (e.g. in .pdf or .doc file format), or to write here and save a new one directly

Discussion
Here can registered users start a new discussion phorum and reply to placed posts

Files
In this part of application you can share or temporary save files, related to problematic of solar energy.

Links
Links list, which can be changed by registered users.

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5 Main Sections

- Solar panel – is a part targeted for a presentation of gathered PV data.
- Articles – is a part of CMS targeted for a publishing of an articles with solar energy subject matter.
- Discussion – is a part of CMS targeted for a free discussion about solar energy subject matter.
- Files – is a part of CMS targeted for a file upload.
- Links – is a part of CMS targeted as an area of useful links to another web sites relevant to solar energy subject matter.

Output Energy Graph



CTU - Solar panels



Main

Solar panels

Articles

Discussion

Files

Links

FVS system description

Daily data

Monthly data

Yearly data

Export data

Login

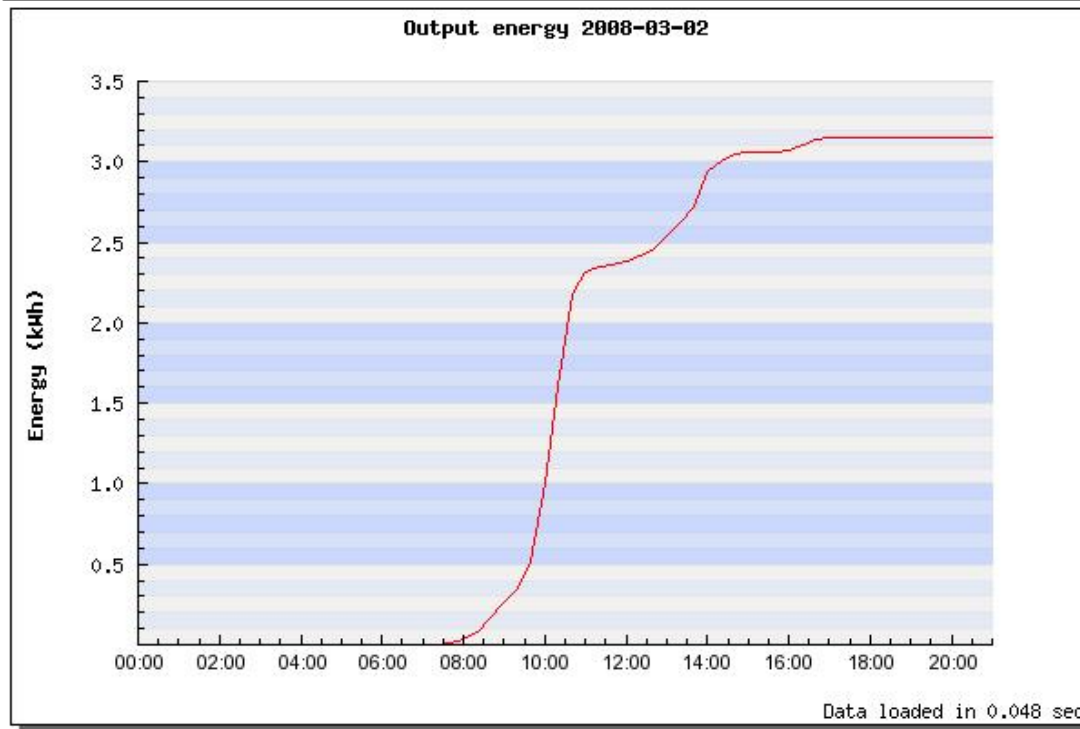
Username

Password

Login

Registration

All PV fields - day values



March

2008

Ok

March 2008



| Mon | Tue | Wed | Thu | Fri | Sat | Sun |
|-----|-----|-----|-----|-----|-----|-----|
| 25 | 26 | 27 | 28 | 29 | 01 | 02 |
| 03 | 04 | 05 | 06 | 07 | 08 | 09 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 01 | 02 | 03 | 04 | 05 | 06 |

Show table

Temperature

Energy

Voltage

Current

Pac

Pdc

Irrad

Irrad + Pac

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Example of table output format

CTU - Solar pannels

Main Solar panels Articles Discussion Files Links

FVS system description

Daily data

Monthly data

Yearly data

Export data

Login

Username

Password

Login

Registration

All PV fields - day values

March 2008

March 2008

| Mon | Tue | Wed | Thu | Fri | Sat | Sun |
|-----|-----|-----|-----|-----|-----|-----|
| 25 | 26 | 27 | 28 | 29 | 01 | 02 |
| 03 | 04 | 05 | 06 | 07 | 08 | 09 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 01 | 02 | 03 | 04 | 05 | 06 |

Show graph

| Time | Date | Temp [°C] | Energy [kWh] | Energy A [kWh] | Energy B [kWh] | Energy C [kWh] | Voltage A[V] | Voltage B[V] | Voltage C[V] | Current A[A] | Current B[A] | Current C[A] | Pac [W] | Pdc [W] | Irrad [W/m2] |
|-------|------------|-----------|--------------|----------------|----------------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|---------|---------|--------------|
| 03:53 | 2008-03-02 | 5.70 | 17364.10 | 6876.17 | 6778.92 | 4425.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 |
| 04:20 | 2008-03-02 | 6.00 | 17364.10 | 6876.17 | 6778.92 | 4425.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 |
| 06:05 | 2008-03-02 | 4.70 | 17364.10 | 6876.17 | 6778.92 | 4425.50 | 1.20 | 1.20 | 1.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 06:06 | 2008-03-02 | 4.70 | 17364.10 | 6876.17 | 6778.92 | 4425.50 | 1.20 | 1.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 06:07 | 2008-03-02 | 4.80 | 17364.10 | 6876.17 | 6778.92 | 4425.50 | 1.40 | 1.40 | 1.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 06:08 | 2008-03-02 | 4.80 | 17364.10 | 6876.17 | 6778.92 | 4425.50 | 1.70 | 1.90 | 1.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 06:09 | 2008-03-02 | 4.80 | 17364.10 | 6876.17 | 6778.92 | 4425.50 | 2.10 | 1.90 | 1.70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 06:10 | 2008-03-02 | 4.60 | 17364.10 | 6876.17 | 6778.92 | 4425.50 | 1.90 | 1.90 | 1.70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Accumulated Energy Graph



CTU - Solar pannels



Main

Solar panels

Articles

Discussion

Files

Links

FVS system description

Daily data

Monthly data

Yearly data

Export data

Login

Username

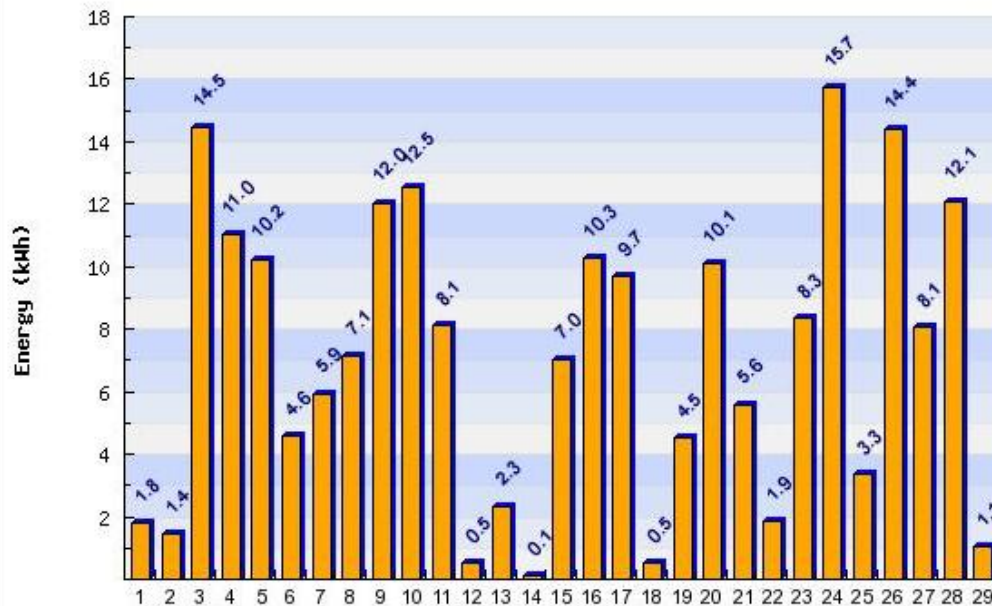
Password

Login

Registration

All PV fields - month values

Accumulated energy 2. month 2008



Data loaded in 0.850 sec

February

2008

Ok

February 2008



Show table

Temperature

Energy

Energy A+B+C

Voltage

Current

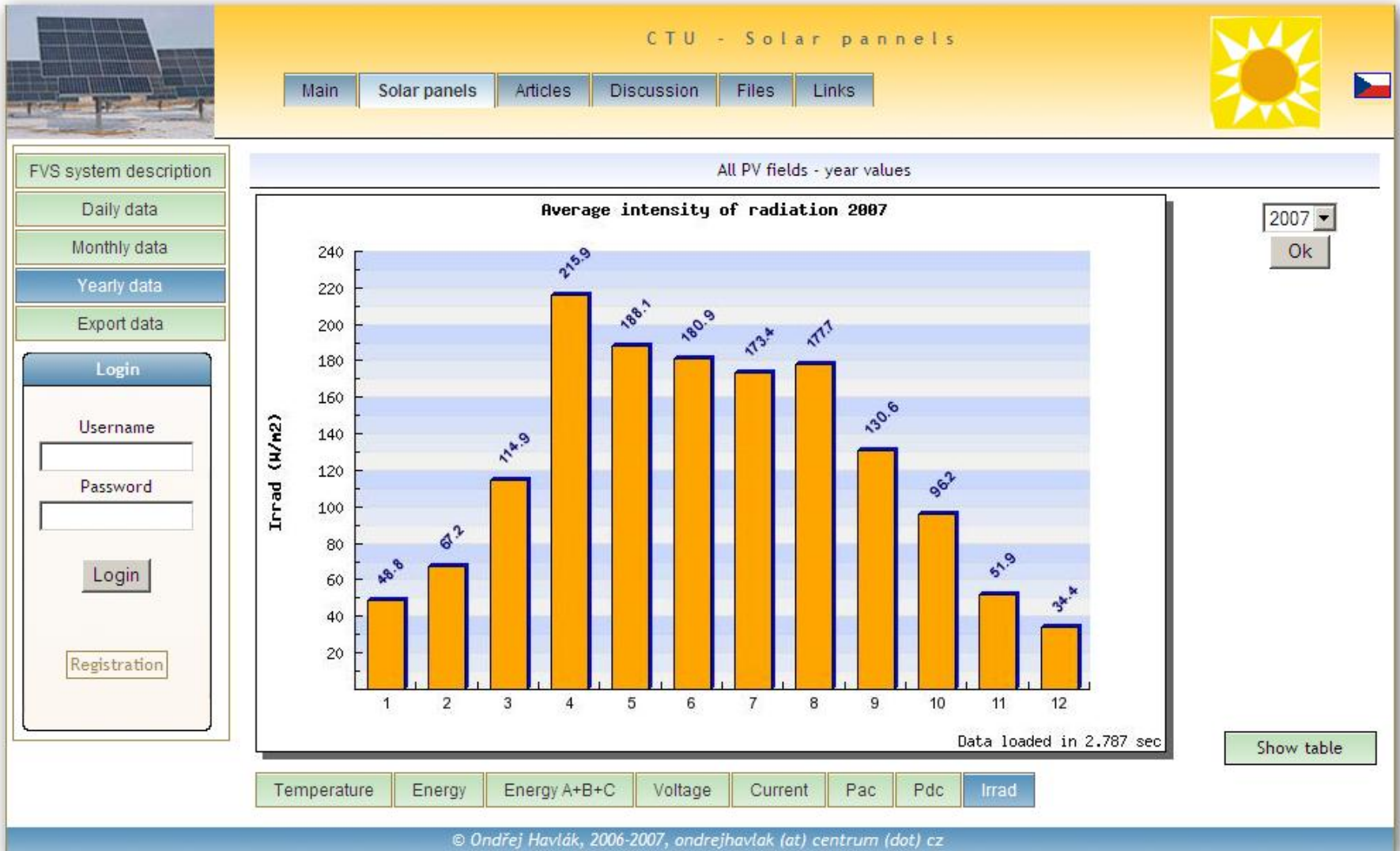
Pac

Pdc

Irrad

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Intensity of Radiation Graph



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Article Section of *Solarweb*



CTU - Solar pannels

[Main](#) [Solar panels](#) [Articles](#) [Discussion](#) [Files](#) [Links](#)



Articles list

New article

Login

Username

Password

Login

Registration

Articles

Solar pannels on FEL - on CTU FEL

[Popis systému FVS 2300E](#)

Author [havla01](#) Posted 2008-01-29, 22:22:21

System FVS 2300E byl vyvinut k zobrazování, pravidelnému ukládání a odesílání dat na server přes Internet pro FV systém nainstalovaný v objektu FEL ČVUT v Praze Dejvicích. [Read](#)

[Sběr fotovoltaických dat ze solárních panelů na ČVUT FEL Praha](#)

Author [molhanec](#) Posted 2007-04-19, 14:51:43

Příspěvek popisuje historii, současnost a budoucnost sběru fotovoltaických dat ze solárních panelů na FEL ČVUT v Praze. Solární panely byly na katedře elektrotechnologie FEL ČVUT v Praze nainstalovány prvně v roce 2002. Od tohoto okamžiku se provádí sběr fotovoltaických dat a jejich vědecké zpracování. [Read](#)

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- Files – is a part of CMS targeted for a file upload.
- Links – is a part of CMS targeted as an area of useful links to another web sites relevant to solar energy subject matter.

Link Section of *Solarweb*

CTU - Solar pannels

Main Solar pannels Articles Discussion Files Links

All links
New link

Login

Username

Password

Login

Registration

Links

Universities - partner universities

T.E.I. - Patras, Řecko

Other links

Solární energie v ČR

Solární energie na wiki (en)

Stránky katedry k313

Solární energie na wiki

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5 Main Sections

Mention and assessment

- Solar panel
 - The main output of the *Solarweb site*
- Articles
 - Best way of propagation of our *Solar Research Team*
- Discussion
 - Tool for an interaction with professional community
- Files
 - A possibility to share a content
- Links
 - An initial point to another sites concerning solar energy subject matter

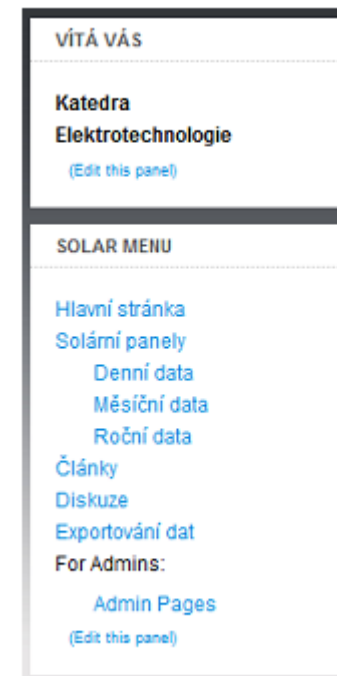
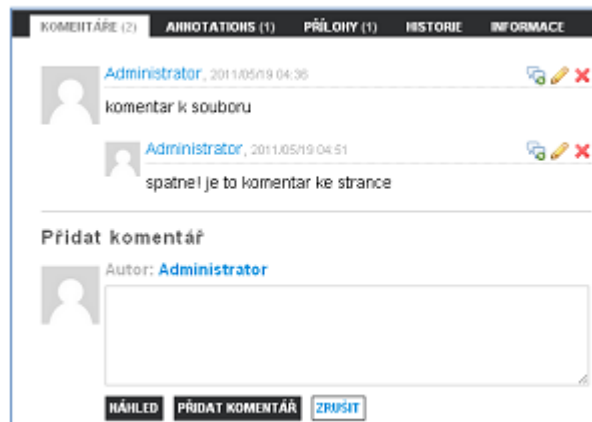
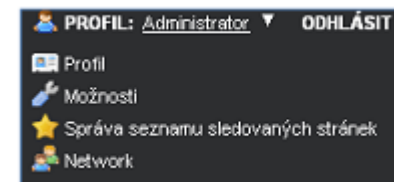
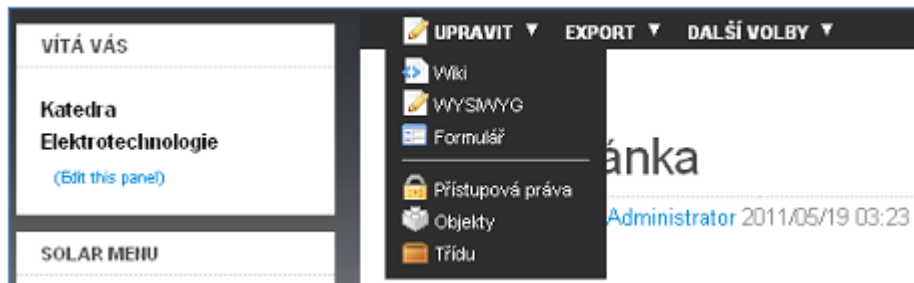
New version of the system

We need a new contemporary modern system

New version of the system

- Output of the bachelor theses lead by me
 - Defended in January, 2012 by Nurlan Abdrassilov - student, Kazakhstan
 - Based on Xwiki development platform
 - Wiki and CMS system
 - Development platform
 - The output of the work is regrettably not very good
 - We suppose a big rework and improvement before upgrading the old system to the new system
-

Some snapshots of User interface



Daily data

[Hlavní stránka](#) > [Denní data](#)

Denní data

Naposledy změněno Administrator 2012/01/04 23:12

[Komentáře \(2\)](#) [Annotations \(0\)](#) [Přílohy \(0\)](#) [Historie](#) [Informace](#)

1 Leden 2005

Energie z pole A

Zobraz tabulku Zobraz diagram

Vyhledat

Akumulovaná energie z pole A za 10.Červen 2009



Yearly data

Roční data

Naposledy změněno Administrator 2011/12/17 22:25

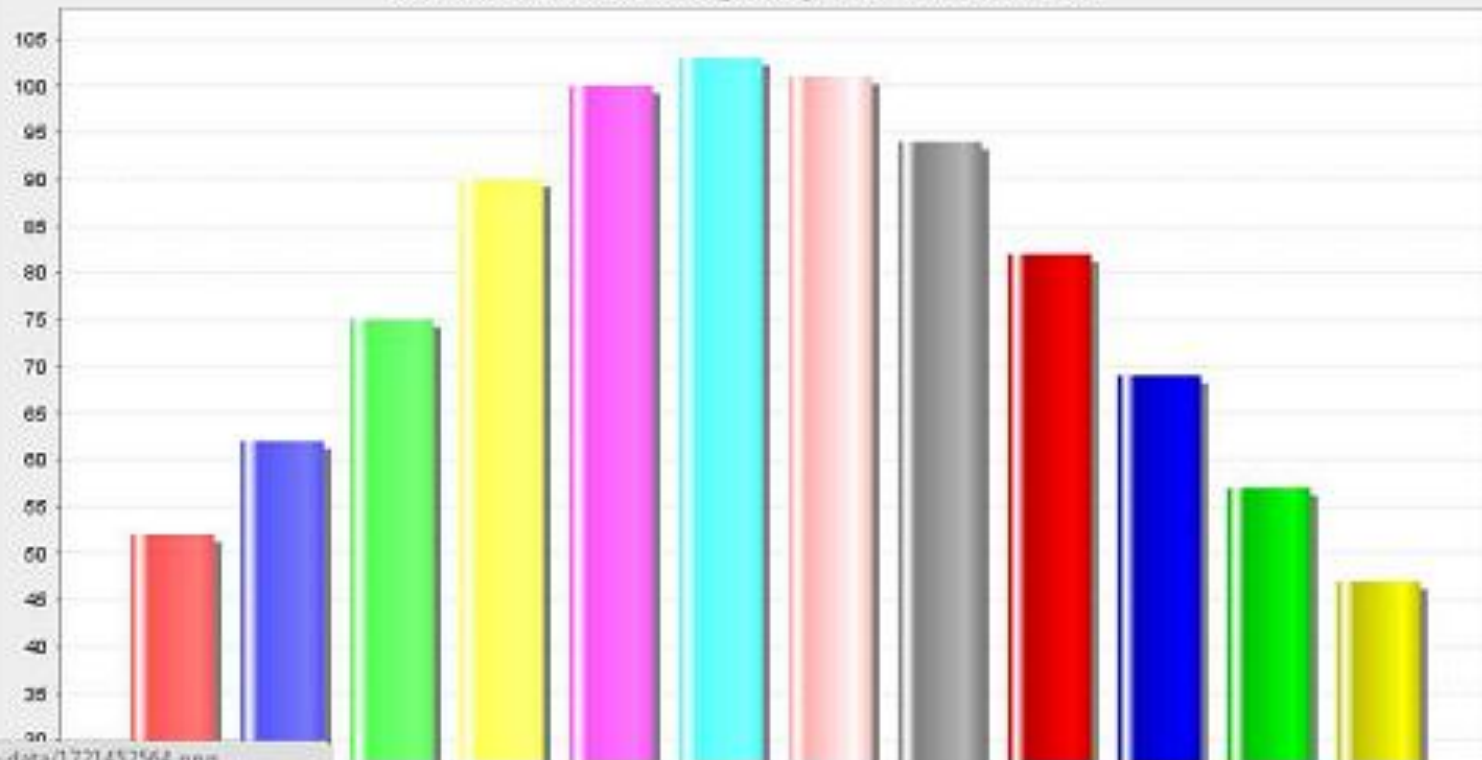
[Komentáře \(0\)](#) [Annotations \(0\)](#) [Přílohy \(0\)](#) [Historie](#) [Informace](#)

2005

Energie z pole A

Vyhledat

Akumulovaná energie z pole A za rok 2009



Roční data/1771257542.png

Conclusion

Future and Ideas

- Firstly, we want to fill up our Solarweb site with useful articles and links and actively conduct discussions too.
 - Another idea – create a Facebook feed for our users?
- We need to integrate a processing of our PV data with a meteorological data
 - Probably by using our own measuring equipment?
- We need to upgrade to a new modern and more suitable contemporary web platform.
 - We want to use the same platform as for the departmental web (XWiki).
 - We have some outputs from one bachelor theses lead by me.
- **Our strategic goal is to create a complex information center for photovoltaic education, e-Learning and research.**

Questions?

Questions?

Thank You!

