

HANDI

05. November 2019

Henriette Hofmeier, Peter Wägemann, Bernhard Heinloth,
Florian Harbecke, Wolfgang Schröder-Preikschat

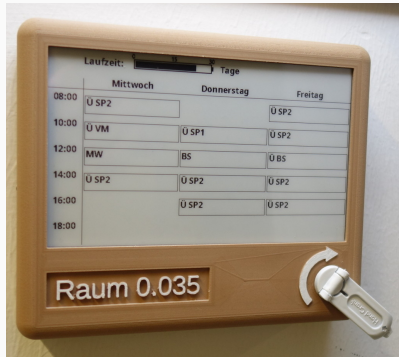


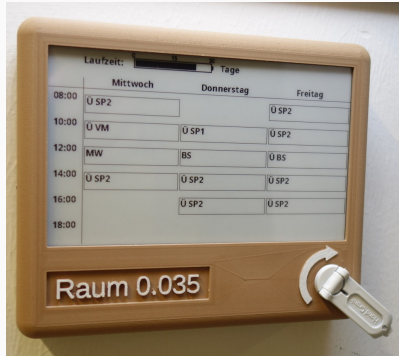
Chair in Distributed Systems
and Operating Systems



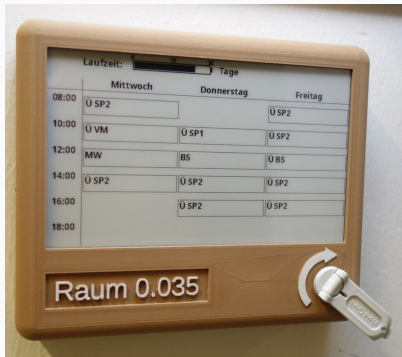
FRIEDRICH-ALEXANDER
UNIVERSITÄT
ERLANGEN-NÜRNBERG

FACULTY OF ENGINEERING





Hand-Cranked Display



Hand-Cranked Display

Energy-Neutral, WiFi-Connected Room Display
with Hand-Crank-Based Energy Harvesting

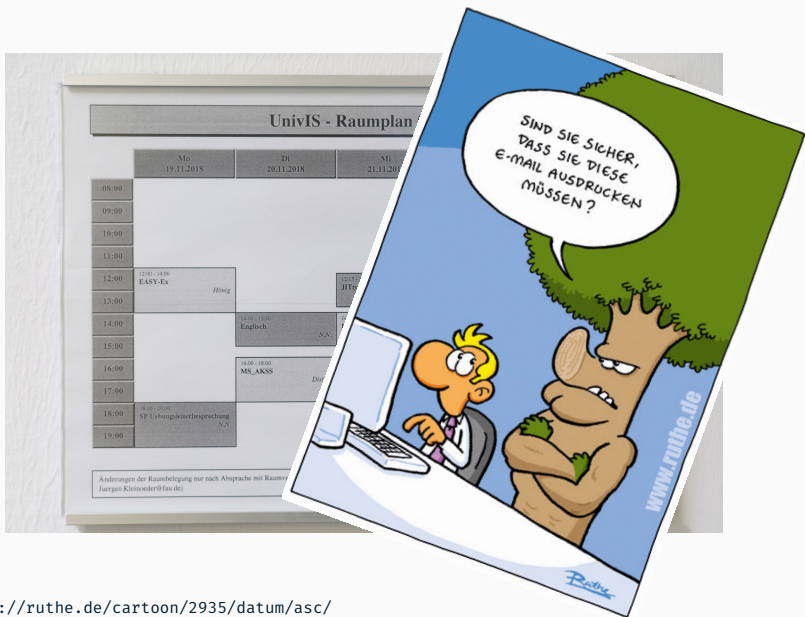
HANDI 1.0 – Motivation

UnivIS - Raumplan 0.035					
	Mo 19.11.2018	Di 20.11.2018	Mi 21.11.2018	Do 22.11.2018	Fr 23.11.2018
08:00					
09:00					
10:00					09:00 - 11:30 KO-ERGOO Kleinöder
11:00					
12:00	12:00 - 14:00 EASY-Ex Höwig		12:45 - 13:45 JITy Studentenrunde Heinrich		
13:00					
14:00		14:00 - 15:00 Englisch N.N.	14:00 - 16:00 EASY Höwig	14:00 - 18:00 PASST Langer	
15:00					
16:00		16:00 - 18:00 MS_AKSS Dittler			
17:00					
18:00	18:00 - 20:00 SP Lebungsleiterbesprechung N.N.				
19:00					

Änderungen der Raumbelegung nur nach Absprache mit Raumverantwortlichen Jürgen Kleinöder (App. 28028, Juergen.Kleinoder@fau.de)

Individuelle Lehrveranstaltungsliste vom 16.11.2018 bis 23.11.2018
Beschwerde vom 19.11.2018 bis 23.11.2018
Stand: Donnerstag, 19. November 2018 13:36:34

HANDI 1.0 – Motivation

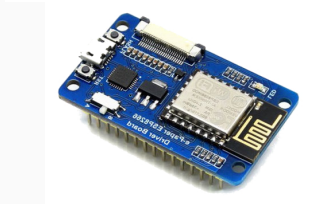


<https://ruthe.de/cartoon/2935/datum/asc/>



Waveshare Epaper-Display 7.5" [1]

- Resolution: 640 × 384 px
- Colours: black and white
- Communication protocol: SPI



Driver Board [2]


- ESP 8266
- WiFi module
- Arduino compatible pin header

[1] <https://www.waveshare.com/7.5inch-e-paper-hat.htm>


[2] <https://www.waveshare.com/e-paper-esp8266-driver-board.htm>

HANDI 2.0 – Motivation

31.10.2019
14:05:07




Regionales
Rechenzentrum
Erlangen - RRZE



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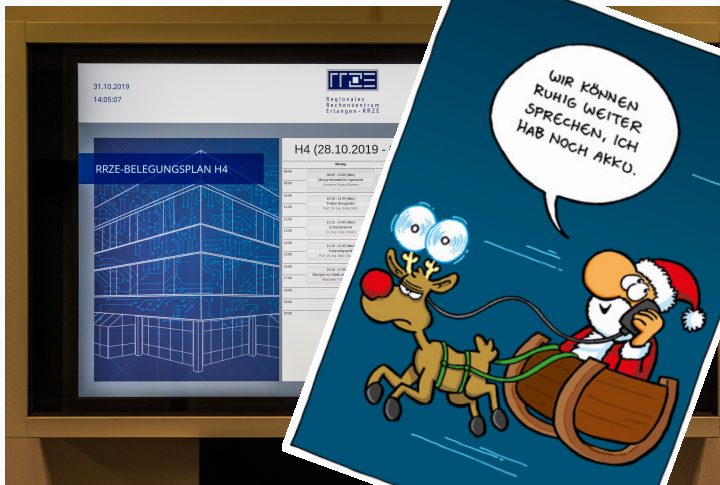
RRZE-BELEGUNGSPLAN H4



H4 (28.10.2019 - 01.11.2019)

	Montag	Dienstag	Mittwoch	Donnerstag	Freitag
08:00	08:00 - 10:00 Uhr Übergang Internet in Aggregation Eckstein, Pöschel, Nöcker	08:00 - 10:00 Uhr Dienst Learning Prof. Dr. Ing. Ingrid Isenhardt, Nöcker	08:00 - 10:00 Uhr Installation & Rollout-Workshop Dr. Ing. Thomas Christian	08:00 - 10:00 Uhr Übergang von Servern zu Cloud-Infrastruktur Eckstein, Pöschel, Nöcker	
10:00	10:00 - 12:00 Uhr Kultur-Workshop Prof. Dr. Ing. Ingrid Isenhardt	10:00 - 12:00 Uhr Übergang von Servern zu Cloud-Infrastruktur Eckstein, Pöschel, Nöcker	10:00 - 12:00 Uhr Workshop zur Optimierung der IT-Infrastruktur Dr. Ing. Ingrid Isenhardt, Nöcker	10:00 - 12:00 Uhr Übergang von Servern zu Cloud-Infrastruktur Eckstein, Pöschel, Nöcker	
12:00	12:00 - 12:45 Uhr Sitzung Dr. Ing. Ingrid Isenhardt	12:00 - 12:45 Uhr Installation & Rollout-Workshop Dr. Ing. Thomas Christian	12:00 - 12:45 Uhr Workshop zur Optimierung der IT-Infrastruktur Dr. Ing. Ingrid Isenhardt, Nöcker	12:00 - 12:45 Uhr Übergang von Servern zu Cloud-Infrastruktur Eckstein, Pöschel, Nöcker	
14:00	14:00 - 16:00 Uhr Lernaktivitäten Prof. Dr. Ing. Ingrid Isenhardt	14:00 - 16:00 Uhr Einführung in die Cloud-Infrastruktur Eckstein, Pöschel, Nöcker	14:00 - 16:00 Uhr Übergang von Servern zu Cloud-Infrastruktur Eckstein, Pöschel, Nöcker	14:00 - 16:00 Uhr Übergang von Servern zu Cloud-Infrastruktur Eckstein, Pöschel, Nöcker	
16:00	16:00 - 17:45 Uhr Übergang von Servern zu Cloud-Infrastruktur Eckstein, Pöschel, Nöcker	16:00 - 17:45 Uhr Einführung in die Cloud-Infrastruktur Eckstein, Pöschel, Nöcker	16:00 - 17:45 Uhr Übergang von Servern zu Cloud-Infrastruktur Eckstein, Pöschel, Nöcker	16:00 - 17:45 Uhr Übergang von Servern zu Cloud-Infrastruktur Eckstein, Pöschel, Nöcker	
18:00					
19:00					

HANDI 2.0 – Motivation



<https://ruthe.de/cartoon/2921/datum/asc/>

HANDI 2.0 – Components



Wägemann et al., "An Energy-Neutral, WiFi-Connected Room Display with Hand-Crank-Based Energy Harvesting"
FAU Idea Competition on Energy Saving '19.

HANDI 2.0 – Components



Wägemann et al., "An Energy-Neutral, WiFi-Connected Room Display with Hand-Crank-Based Energy Harvesting"
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HANDI 2.0 – Components



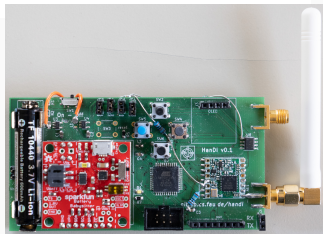
Wägemann et al., "An Energy-Neutral, WiFi-Connected Room Display with Hand-Crank-Based Energy Harvesting"
FAU Idea Competition on Energy Saving '19.

HANDI 2.0 – Components



Waveshare Epaper-Display 9.7" [3]

- Resolution: 1200×825 px
- Colours: 16 (grey scale)
- Communication protocol: SPI



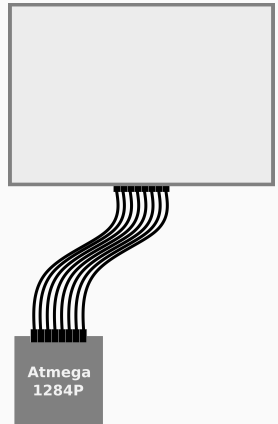
HANDI PCB

- Atmega microcontroller
- LoRa module
- LiPo battery
- LiPo battery manager

[3] <https://www.waveshare.com/9.7inch-e-paper-hat.htm>

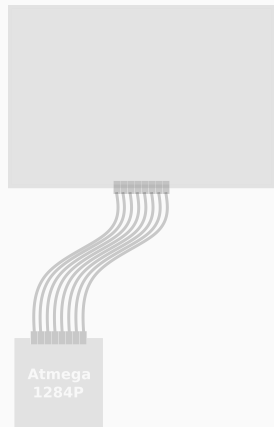
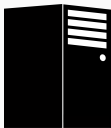
HANDI 2.0 – Implementation

UnivIS



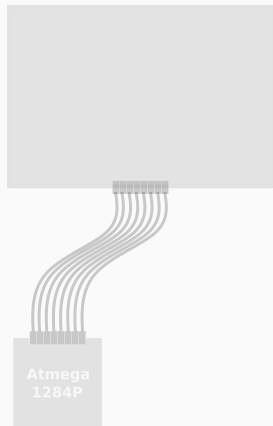
HANDI 2.0 – Implementation

UnivIS



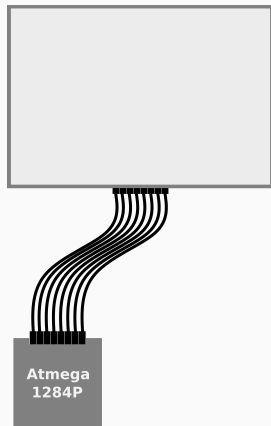
HANDI 2.0 – Implementation

UnivIS



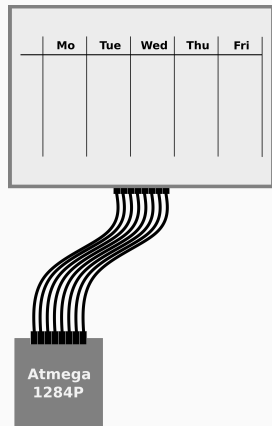
HANDI 2.0 – Implementation

UnivIS

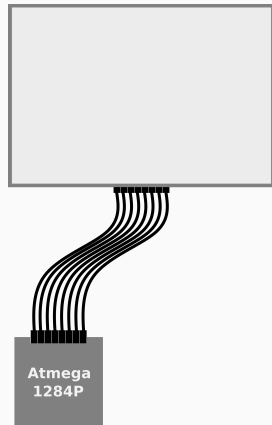


HANDI 2.0 – Implementation

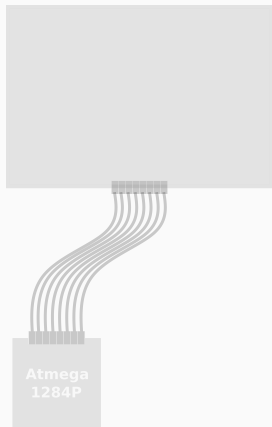
UnivIS



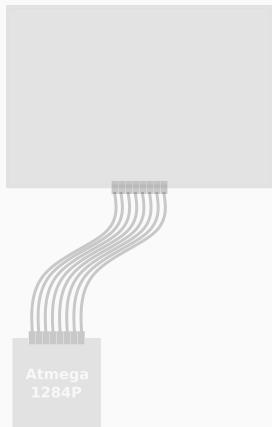
HANDi 2.0 – Implementation



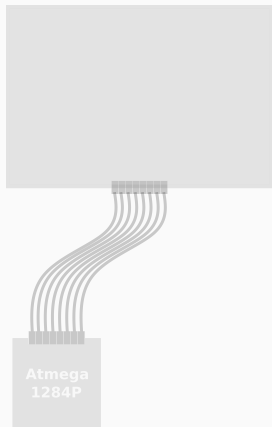
HANDI 2.0 – Implementation



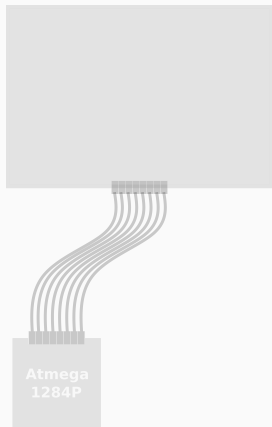
HANDi 2.0 – Implementation



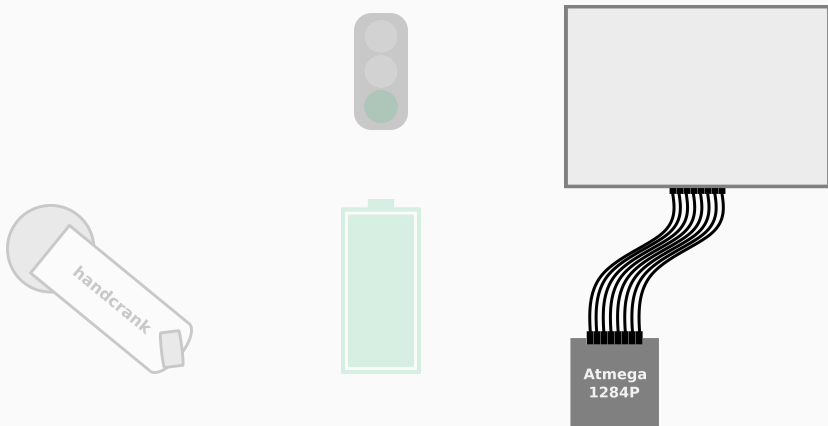
HANDi 2.0 – Implementation



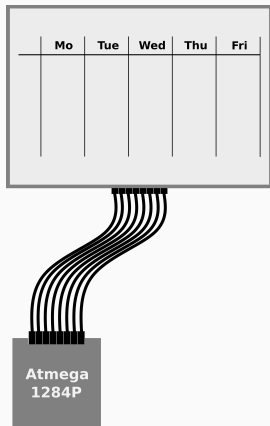
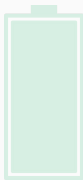
HANDi 2.0 – Implementation



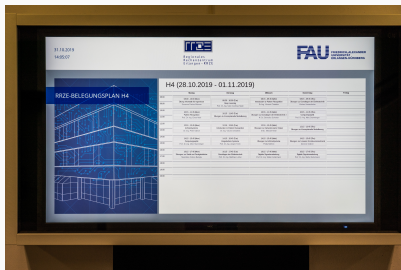
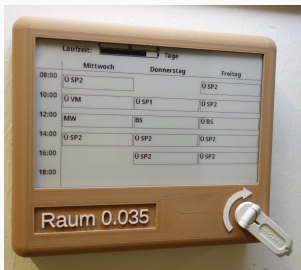
HANDi 2.0 – Implementation



HANDi 2.0 – Implementation



HANDI vs. LCD



3.066 kWh

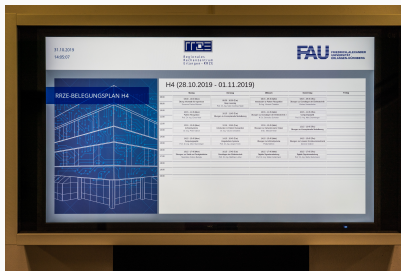
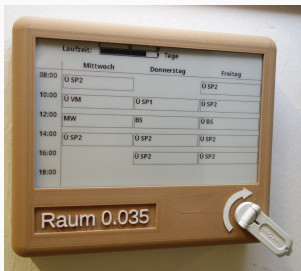
1139 kWh



0.011 kWh

569.5 kWh

HANDI vs. LCD



3.066 kWh

⇒ 106 × 




0.011 kWh

⇒ 

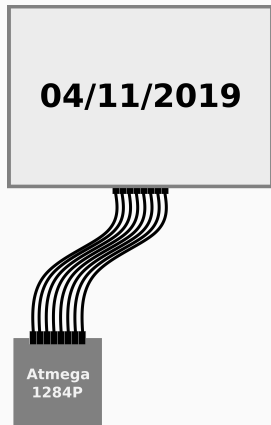
1139 kWh

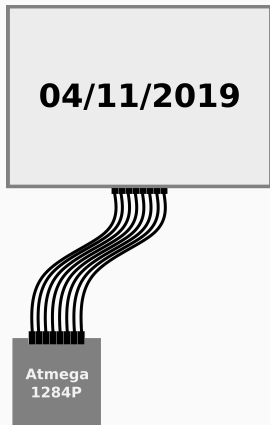
⇒ 39 276 × 

569.5 kWh

⇒ 19 638 × 

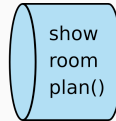
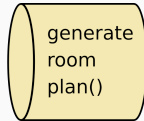
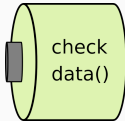
HANDI – The Science





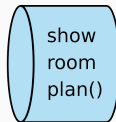
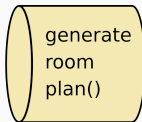
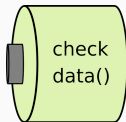
```
void main() {  
    check_data();  
    generate_room_plan();  
    show_room_plan();  
}
```

HANDI – The Science



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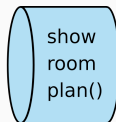
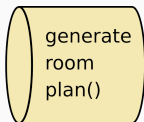
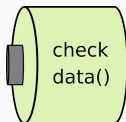

HANDI – The Science



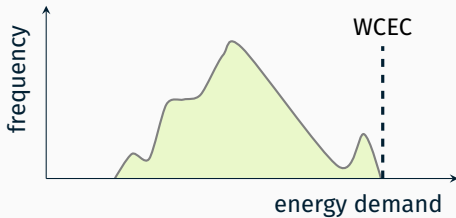
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Worst-Case Energy-Consumption [4]

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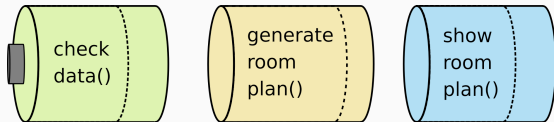
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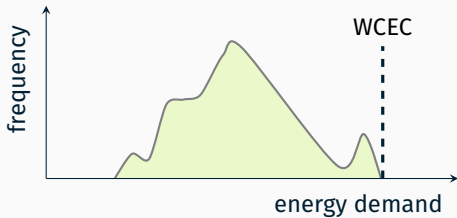
Worst-Case Energy-Consumption [4]

[4] Wagemann et al., "Whole-System Worst-Case Energy-Consumption Analysis for Energy-Constrained Real-Time Systems", ECRTS '18.

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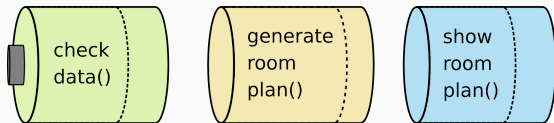
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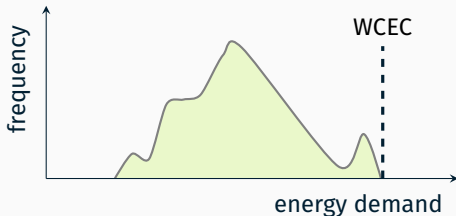
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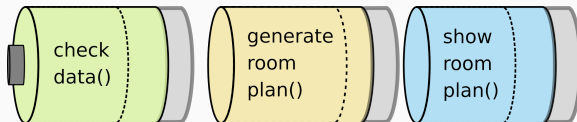
```
void main() {  
  
    check_data();  
    /* check battery */  
    generate_room_plan();  
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    /* check battery */  
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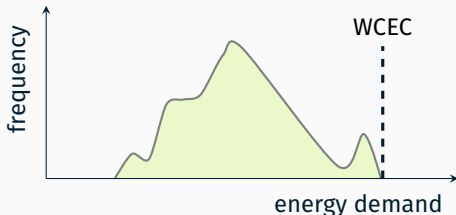
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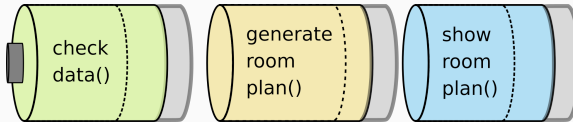
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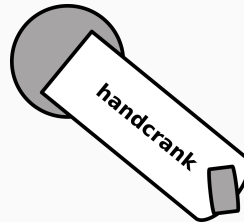
Worst-Case Energy-Consumption [4]

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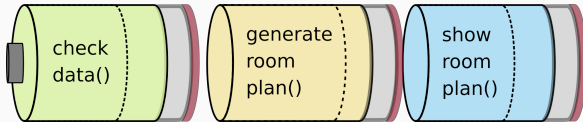
HANDI – The Science



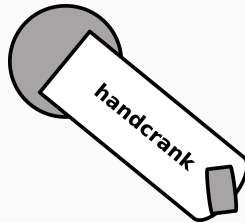
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HANDI – The Science



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Would You Use It?

<https://gitlab.cs.fau.de/handi>