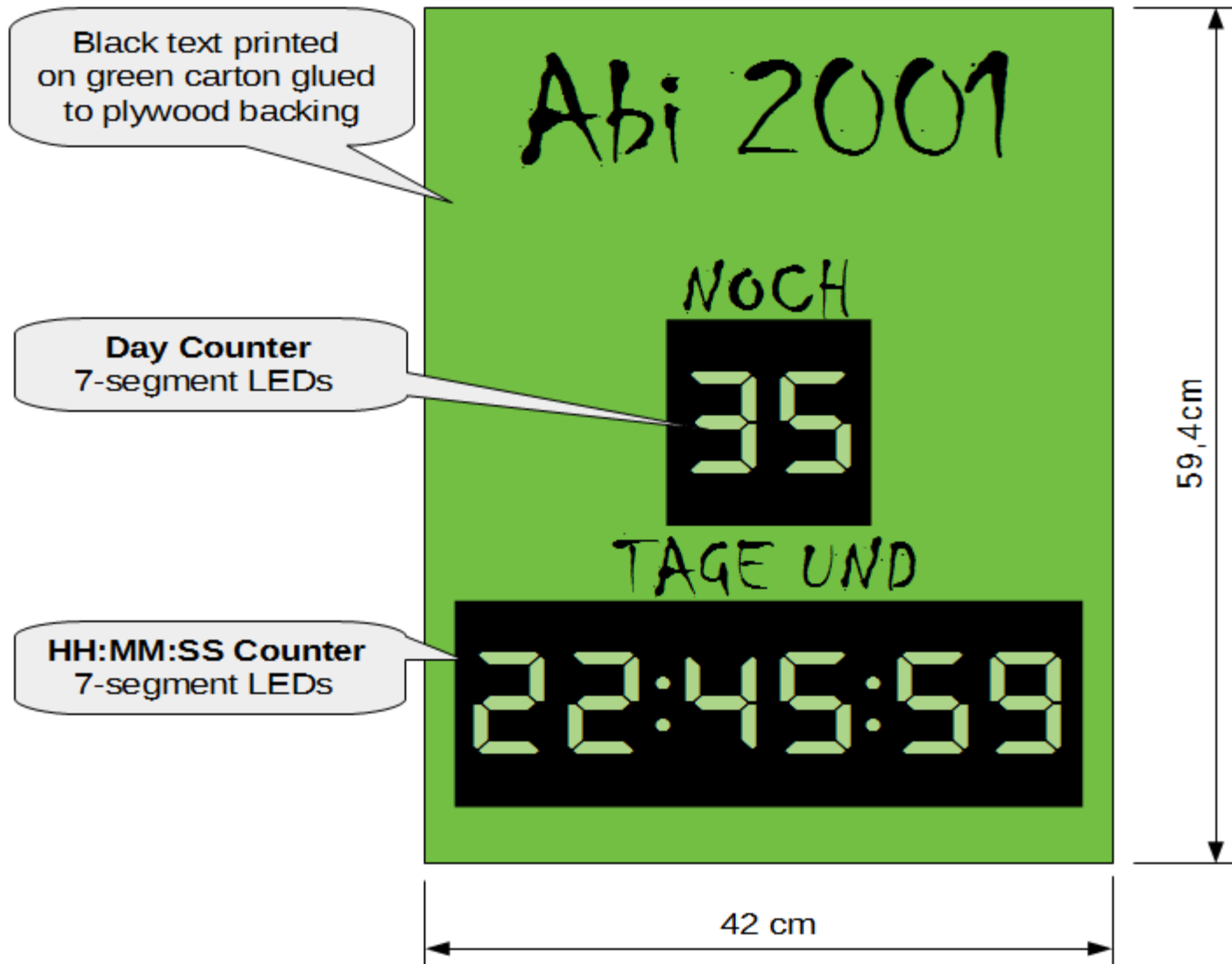# AbiCountdown Project

IDS2018 Exercise – Herbrich, Dennis

## Objective

Build a battery-powered, microcontroller-based electronic device in poster size to hang up publicly in school to display a live countdown towards the class of 2001 obtaining their Abitur, with a 1-second resolution, starting from 99 days.
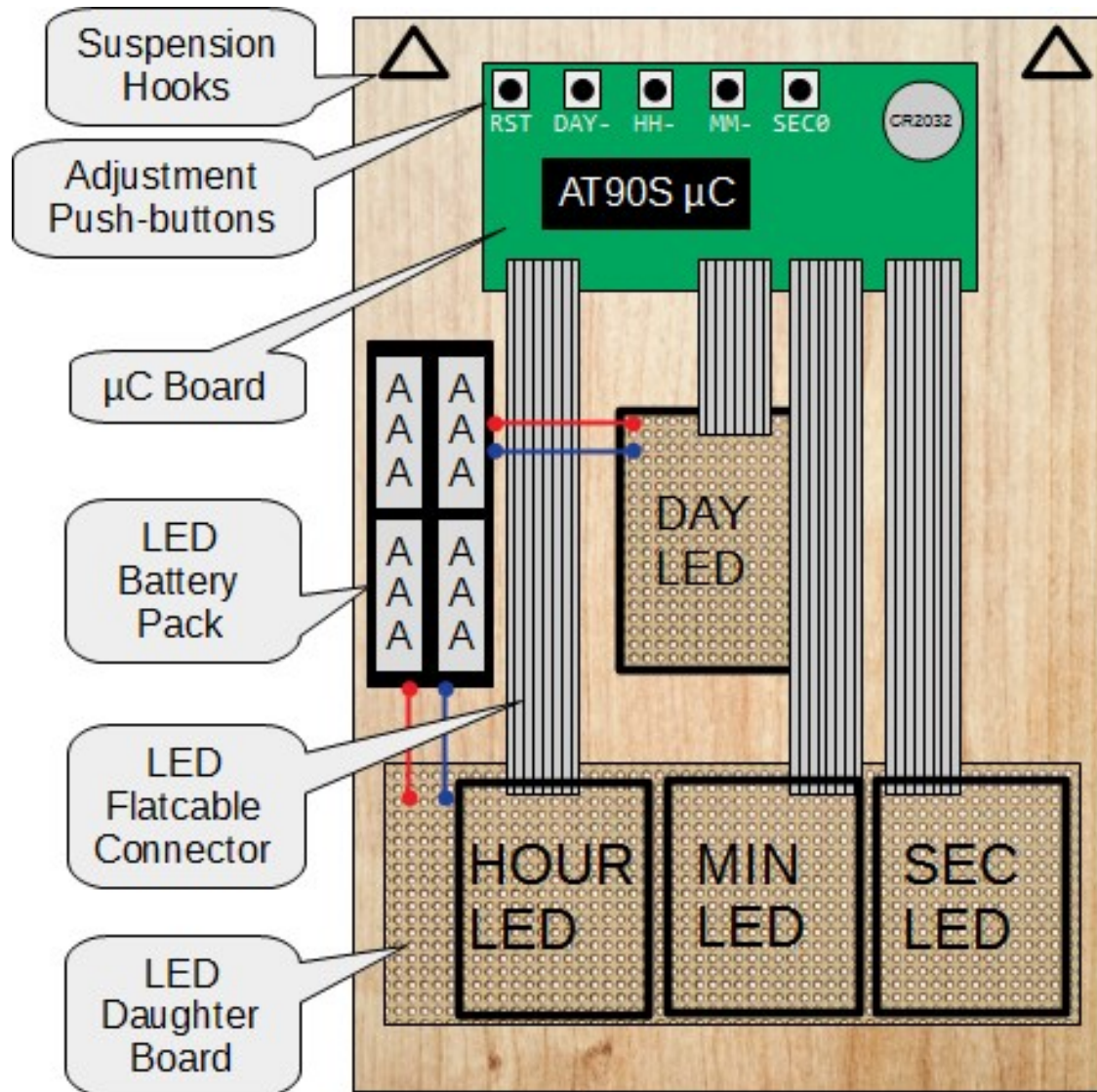
# AbiCountdown Project

## Front View

# AbiCountdown Project

## Back View

# AbiCountdown Project
## Parameters / Limitations / Scope (1/3)

## Customer

➢ A second-resolution capable live countdown of the remaining time until reaching the „Abitur" **shall** be displayed
➢ The countdown **shall** be well-visible at a distance of up to 30 meters
➢ The device **should** be decorative, and **shall** be attachable to a wall like a picture frame
➢ The device **shall not** require mains power, and may run off an internal battery supply

## Money

➢ No external capital is available, the project must be fully privately financed
➢ Additional cost should not exceed 50 EUR (=effective budget) for the single device
➢ Privately-owned components are used to avoid cost for supplies
➢ Development and production time is zero-cost
➢ The device and its components are reclaimed after the intended one-time use

# AbiCountdown Project
## Parameters / Limitations / Scope (2/3)

## Laws of Nature

➢ Battery capacity must be sufficient to power the device for at least 99 days

➢ The 1 Hz countdown frequency must be sufficiently stable to end the countdown at the expected point in time, without manual adjustments during runtime

➢ A µC firmware must be build, in assembly, for the countdown logic and LED display control

➢ A custom circuit board must be etched, LED daughter boards built, and all components soldered and interconnected properly

➢ The complete device must not weigh more than 5kg

## Time

➢ The final product should be built and installed on site when 99 days are left for the countdown
=> **2 months** of time left for development and build from scratch

➢ Installation shall not take longer than **30 minutes** on site

## Capacity

➢ Project team of three students, each with unique strengths in Electrical Engineering, Software Development, and a little bit of both, respectively
➢ Surprisingly well-equipped, private EE lab available

## Legal Compliance

➢ The device must be electrically safe, i. E. low-power, low-voltage only
➢ The installed device must be reasonably safe and secure to avoid physical damage and injury

# AbiCountdown Project

## Biggest Challenges

**Frequency Stability**

➢ The countdown ran much too slowly, showing an offset of more than an hour per day

– The countdown offset was manually corrected on a daily basis, with additional adjustment push-buttons on the back of the device

**Battery Life**

➢ The LED current draw was much higher than expected, causing the tiny CR2032 to drop out after a few days

✓ The CR2032 was kept as the low-current µC board supply, with an additional pack of AA cells for the LEDs only

**µC Firmware Development**

➢ Little expertise with ATMEL AVR90S µC assembly, and no available C compiler, made software development tricky and time-consuming

✓ Development took longer than expected, but allowed installation of the final device with 60 days left on the countdown