Driver Activated Scare System – DASS

Technical specification

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The DASS system is a driver activated unit that records animal movements on camera and displays pre-selected audio signals to scare wildlife off railways in front of the approaching train. It is mounted inside front window of the drivers cabin (suction cups) with an external loudspeaker in front of the train (magnetic foot).

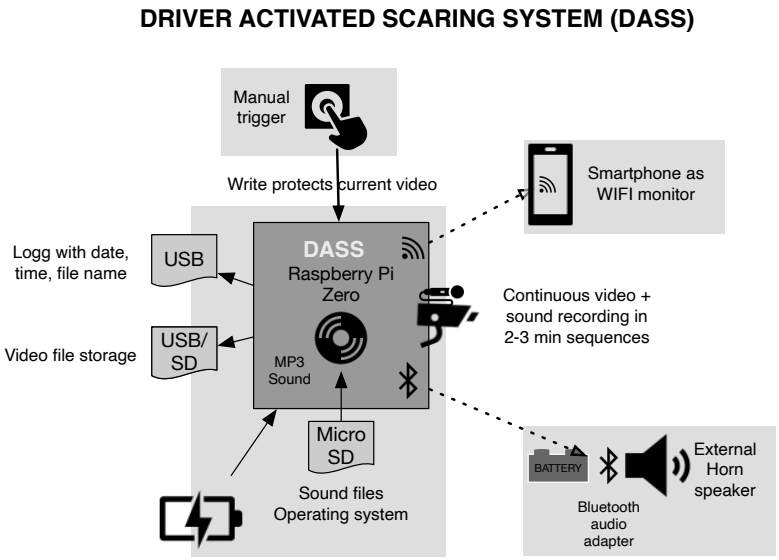

Figure 1. Original concept of DASS unit.

System

The DASS consists of (fig 1):

- Manual alarm trigger (simple alarm button)
- Manual on-off switch
- Single-board computer (e.g. Raspberry Pi Zero), including:
  - Monitor
  - Realtime clock
  - Internal sound card
  - Wifi and Bluetooth communication
  - USB connections for output to SD cards
  - Raspberry camera
  - Microphone input (to detect alarm signals in real time)
- Wifi link (for automatic image transfer)
- USB-C connection to battery or AC adapter (5V)
- External horn loudspeaker (with BT connection and extra battery)

Components

Raspberry

- Raspberry Pi 4 https://raspberrypi.dk/en/product/raspberry-pi-4-model-b-1-gb/

Monitor

- A mounted touch screen or a WIFI connected smartphone can be used as external monitor – for the driver to check the orientation and get verification on that the system is running https://dk.rs-online.com/web/p/raspberry-pi-skaerme/1245487/

Camera

- The simple Raspberry camera works OK; the HighQuality camera is not much better but a lot more bulkier … https://raspberrypi.dk/en/product/raspberry-pi-camera-board-v2-1-8mp/

Real time clock

- A simple clock suffices https://www.elfa.se/en/raspberry-pi-rtc-ds1307-seeed-studio-103030277/p/30127507

Microphone

- A simple USB microphone suffices: https://hitechchain.se/raspberry-pi/mini-usb-microphone-compatible-with-raspberry-pi-4?gclid=Cj0KCQiAvP6ABhCjARIsAH37rbQTALOdo-V4sNUzt3b4zyONe58ppmFhTFUaY4tY78dPh-SCZclr9z4aAqSTEALw_wcB (all sound will be deleted prior to any publication of the video)

Case

- **Camera case**: Hammond 1591 https://se.rs-online.com/web/p/general-purpose-enclosures/8180501/
- **Alarm box**: CAMDENBOSS 2000 https://se.rs-online.com/web/p/general-purpose-enclosures/2816863/ .
- **Suction cup** to be mounted at the inside of the front screen:
- https://www.actionking.se/fasten/kamerafaste-sugpropp-sugkopp-med-14-skruv-och-gopro-adapter.html?gclid=Cj0KCQjwlMaGBhD3ARIsAPvWd6hxJqN0gjotUiZ2RfZ5FpXkS-n-tLd15Oa0hUrmN7EkD6i4AByTks4aAo0DEALw_wcB
- **Push buttons** in red (for alarm) and white/black/blue (for video), must be soldered to audiocable https://www.electrokit.com/produkt/tryckknapp-o15mm-1-pol-off-on-rod/
- **Audiocable** (between alarm box and camera case enclosure) https://se.rs-online.com/web/p/jack-cable-assemblies/7424551

Memory

- SD Micro cards 32 GB - Samsung EVO Plus MB-MC32G - Flash-minneskort https://www.atea.se/eshop/product/samsung-evo-plus-mb/?prodid=1748552
- USB drive for video memory: Kingston DataTraveler Micro 3.1 - USB flash-enhet - 32GB https://www.atea.se/eshop/product/kingston-datatraveler-micro-3-1/?prodid=1702577
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Power supply

- Powersupply https://raspberrypi.dk/en/product/official-raspberry-pi-usb-c-power-supply-eu-5v-3a-white/

- Power adapter 3A (if not from Raspberry) DELTACO USBC-AC136 - Strömadapter - 18 Watt - 3 A - PD (USB, USB-C) https://www.atea.se/eshop/product/deltaco-usbc-ac136/?prodid=2126439
- USB-C cable for power from adapter or power bank, 2m, DELTACO USBC-2002 - USB typ C-kabel - 2 m https://www.atea.se/eshop/product/deltaco-usbc-2002/?prodid=2029329
- *PowerBank delivering 3A (only if no electricity is available) - https://www.atea.se/eshop/product/trust-primo-compact/?prodid=2071399*

External loudspeaker (not finalized)

- Bluetooth connector: https://www.dustin.se/product/5010814393/bluetooth-audio-adapter
- Speaker example: https://www.supersonic.se/product.html/toa-cs-530bs-eb--en-54-24-certifierat-musikhorn?category_id=293
    - Must have good (natural) range in frequency
    - Directional volume >100 dB (to be heard over the train noise)
    - Must be waterproof (IP 66) and fastened with magnetic foot outside at the train front
    - Battery driven! (must last for one day or maybe 20 alarms per day)
- BT adapter, battery and cable connections shall be encapsuled in a waterproof case next to the speaker

Operation logic

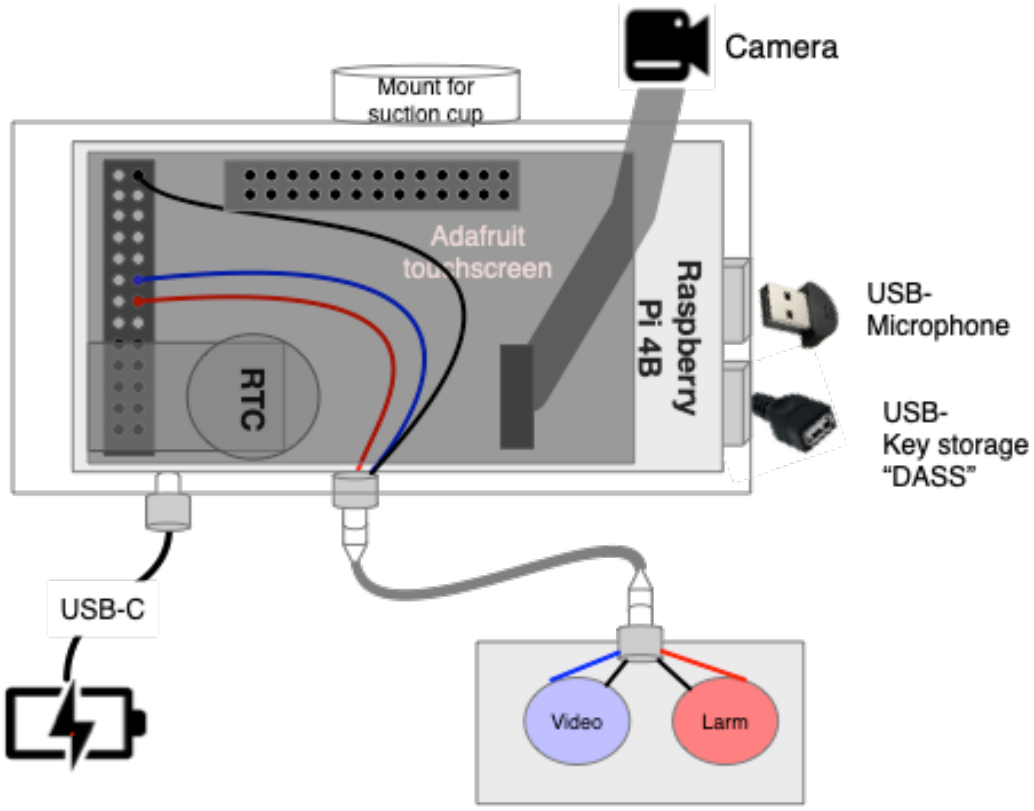
1) At the start of a working day, the driver first attaches the loudspeaker to the train front and powers on the bluetooth connector. The speaker-system is now in receiver mode.
2) Then, the DASS unit is mounted to the front screen and powered on by connecting to battery or AC-adapter. The system boots automatically and starts video recording and establishes a BT-link to the speaker. (A confirmation signal is displayed).
3) When booted, the DASS can be accessed via WLAN from a smartphone. This will allow direct video transfer for adjustment of the camera. The system is running…
4) The DASS unit now records continuously video & audio in consecutive video sequences of 3 minutes in length. These sequences are stored in the “loop-folder” on an external USB/SD card and are overwritten by new sequences when disk space is full. Thus the card contains only the most recent videos.
5) When driver detects wildlife in front of the train she/he presses the alarm-button to alert the DASS-unit.
    1. This activates the display of a randomly chosen sound file (from internal memory card),
    2. saves the current video sequence in a separate “alarm-folder” outside the standard “loop-folder” on the external USB/SD card, and
    3. writes a log entry containing date, time, name of sound file and name of video sequence into a log-file located in “alarm-folder”.
    4. When a new alarm is triggered, the new log entry will be appended to the previous entry in the log-file and a new video sequence will be saved.
6) While activated (i.e. 10 or 20 sec after alert = length of the sound file), the system cannot be triggered again irrespectively of how often the alarm button is pressed. However, one 3 min video sequence can contain / be linked to several alarms.
7) After the working period, the train driver powers down the DASS unit and the speaker. The driver then takes out the memory card with the recorded videos and transfers the content of the “alarm-folder” (videos and log-file) to the upload function of the projects website. After that, the

content of the “alarm-folder” shall be deleted. Possibilities for an automatic upload via WiFi may be explored later.

The saved alarm videos and the log-file of the day provide the essential output of the system. They will be stored online and analysed with respect to how the animals respond to different sounds, and how the response changes with distance between train and animal, train speed and other environmental parameters. Audio recording in video is essential as this will allow for the exact timing and identification of the alarm sound. All audio recording will be deleted or masked prior any publication.

Automatic image transfer via WiFi shall be developed later.

Design drawings:



Ljudsignaler, 10-20 sec, omkring 20 ggr per dag
(ca 6 minuter uppspelning per dag)
ljudvolym > 70 dBA vid 200 m avstånd

Example of how the horn speaker could be positioned in front of a RX10 train engine. This mounting solution must be developed with the train operators/owners.