



ADUK GmbH

Intelligent Electronics Engineering

Who We are?

Engineering Company

ADUK GmbH

We are a European **engineering** company that for more than **16 years** has been helping its customers make machines intelligent **around the Globe**.

Welcome to Establish Our Identity:

- We **guarantee** just in time purchasing components and reduce lead time by collaborating with the global leaders of electronic component [distributors](#) in the world.
- We feed the global cutting edge technological market – our **scientists** conduct R&D for the top research institutes such as:

The **Institute of Plasma Physics** (Prague, Czech Republic).

The **National Metrology Institute** of Germany (Braunschweig, Germany).

The **V. N. Karazin Kharkiv National University** (Kharkiv, Ukraine), etc.

Face Recognition

Focus Area: Security & Healthcare

Challenge: Face control and management.

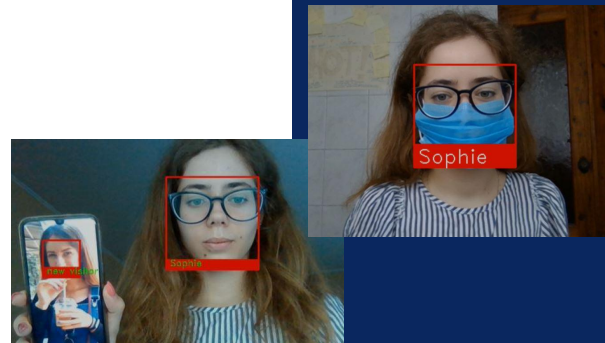
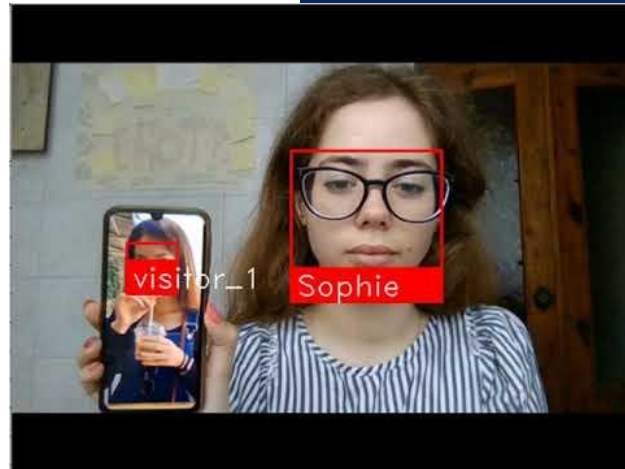
Technologies Used: Machine Vision, OpenCV, Object Recognition, Embedded Linux, On-board decision making, AI.

Solution Produced: The program recognizes the identity and allows the user to analyze and store their data for further actions.

How It Works:

- the camera detects a person
- the system sends the database query to determine whether there is the data or not
- once the person is determined, the system displays simple statistics about him/her
- in case the person is not determined, he/she is added to the database.

Killer Feature: The camera identifies people even wearing a mask and provides security, because it doesn't transfer personal data of visitors, e.g. photos or video images.



Cam1001

Focus Area: Measurement Automation

Challenge: Mechanical units data measurements digitalization such as barometers, electric meters, etc.

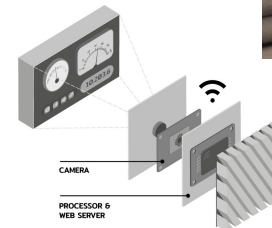
Technologies Used: Neural Network, CLAHE, Contours detection, Skeletonization, Kernel filter, Probabilistic Hough, Keras library, Google Cloud APIs, Flask as a server, Highcharts and Highstock, alerts, prediction on-board.

Solution Produced: The Cam1001 collects digital data from the mechanical units as a basis for all further analysis.

How It Works:

- the camera is placed in front of the measuring device scale
- the camera reads devices data and transmits it in digital format for further processing
- data is recorded, stored, and used depending on the need.

Killer Feature: Continuous supervising data (24/7) without human participation.



Laser Aligner Cutter

Focus Area: **Dental Healthcare**

Challenge: To cut out the dental aligner automatically within a few seconds.

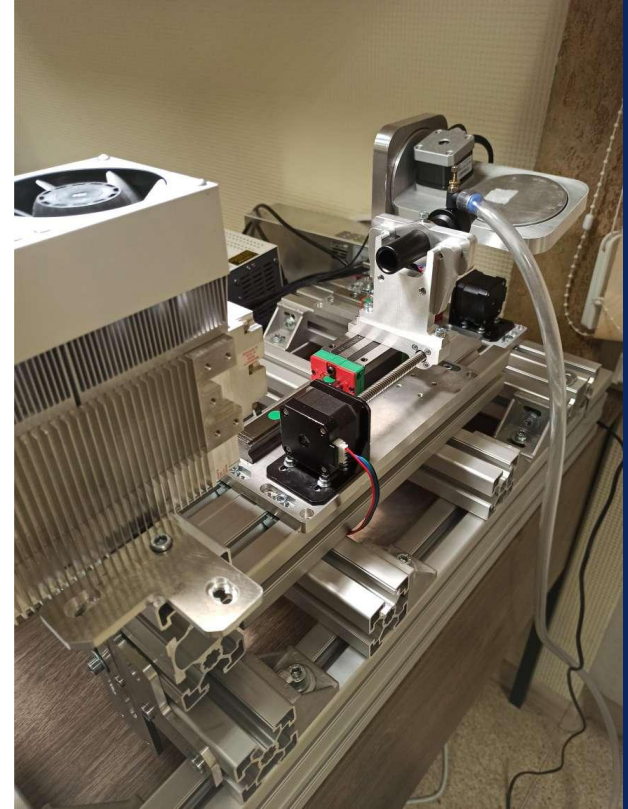
Solution Produced: The device that cuts dental aligner by machine cutting from the carrier film.

Technologies Used: STM32, CO2 Laser, CAM, Mach3, Linux CNC, mechatronics, optical engineering, machine vision.

How It Works:

- The sample is installed in the cut compartment.
- The cut compartment is locked for safety.
- The sample coordinates are automatically determined and the laser cut trajectory is built.
- The system sets the starting point of the cutting path, triggers the CO2 laser and makes the cut.
- The system unlocks the cutting compartment.
- The sample is ready to use.

Killer Feature: The installation allows automatically cut out the molds from plastic using the highest laser focus accuracy and the programmed cutting time of <15s for a moving workpiece.



Indoor Navigation

Focus Area: Security

Challenge: Getting coordinates of indoor objects with high accuracy without or with a weak GPS signal

Technologies Used: Machine Vision, Machine Learning, optical navigation, drones, camera 360, optical tags

Solution Produced: Optical navigation system for super accurate determination of the position of an unmanned vehicle in the in an unprepared room

How It Works:

- a calibrated camera determines the position relative to a set of contrast points, positioned in the space around the drone.

Killer Feature: Determining the exact position of an unmanned vehicle in a room with an accuracy of 1 cm



3D Cube

Focus Area: **Manufacture & Measurement**

Challenge: Accurate measurement of the unstable magnetic field.

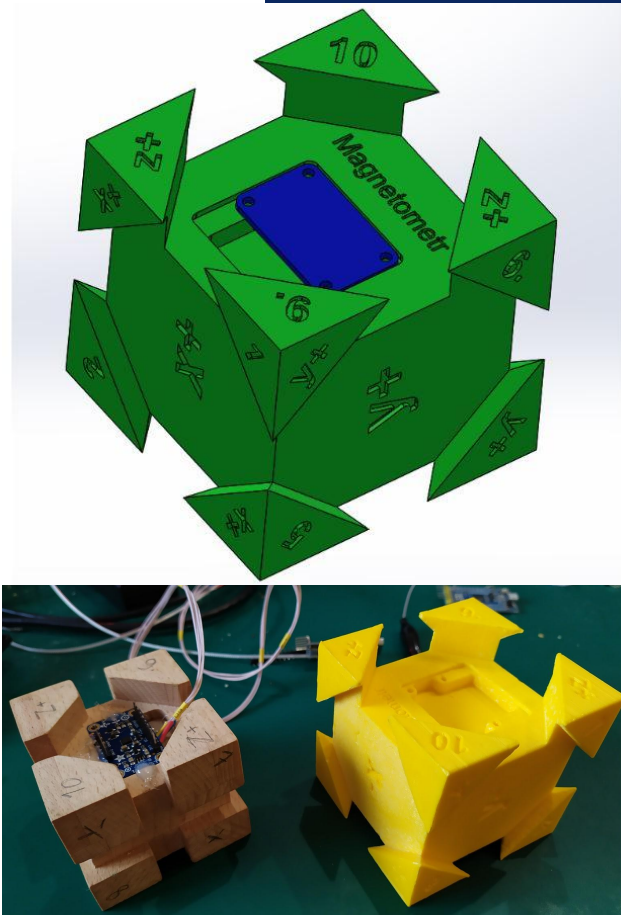
Solution Produced: Electronic software and hardware IMU with an advanced magnetometer calibration was developed.

Technologies Used: magnetometer, gyroscope, accelerometer, STM32, IMU, Matrix calculation, C/C++, C#, Motion FX library

How It Works:

- Calibrated 3D Cube measures the direction of the magnetic field lines.
- The data is transmitted to the embedded microcontroller and sent to the user.

Killer Feature: The device shows accurate data despite being underwater or in case of metal constructions presence nearby.



eCozy Smart Radiator Thermostat

Focus Area: Energy Management

Challenge: Remote control of conventional radiator thermostat.

Technologies Used: ZigBee, TI MSP430, Colour OLED, Embedded Linux, IoT, Ultra low power, Stepper motor control, IOS, Android, touch sensor.

Solution Produced: The self-learning thermostat system that is controlled via eCozy app remotely from anywhere.

How It Works:

the system consists of:

- the conventional radiator thermostat
- eCozy Central Unit
- eCozy App, which is installed on your Smartphone.

eCozy App lets you control your eCozy thermostats and creates heating plans.

Killer Feature: Energy economy by using a custom developed smart algorithm.



Energy Management System

Focus Area: Energy Management

Challenge: Remote control of the operating mode of home heating devices both automatically and manually.

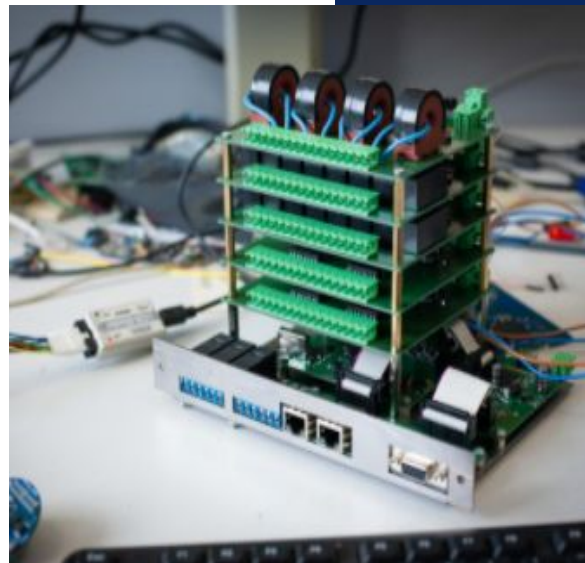
Solution Produced: Energy management system for remote control of the home heating devices operating mode both automatically and manually

Technologies Used: STM32, Embedded Linux, Qualcomm Snapdragon 410, PCB, ADC, DAC, Linux, galvanic isolation, FFT.

How it works:

- the device connects to the electric system
- analyzes network payload
- distributes power consumption

Killer Feature: Calculating the optimal energy tariffs and ensures the economical heaters' consumption.



Body Temperature Monitoring System

Focus Area: **Healthcare**

Challenge: People temperature control in crowded places due the COVID-19.

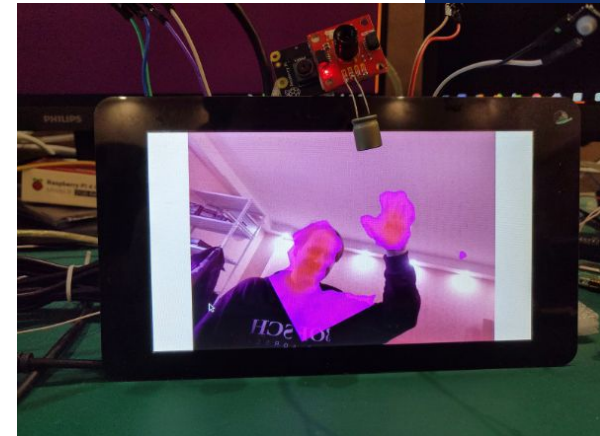
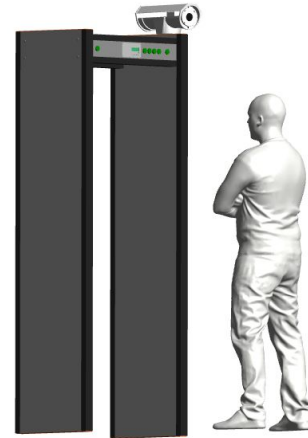
Technologies Used: Machine Vision, OpenCV, Object Recognition, Face ID, GUI, AI, On-board decision making, PCB design.

Solution Produced: The Body Temperature Monitoring System is used to measure people temperature in crowded places remotely.

How It Works:

- the frame scans people when they pass through
- the alarm triggers when a person with an elevated body temperature passes the frame
- the data of the person (name, photo, etc.), 10 people who passed before and afterward, is collected and processed for their further isolation.

Killer Feature: The calibration algorithm prevents temperature fluctuations caused by environmental conditions



EyeWeather Sensor

Focus Area: Precision Agriculture

Challenge: Crop control.

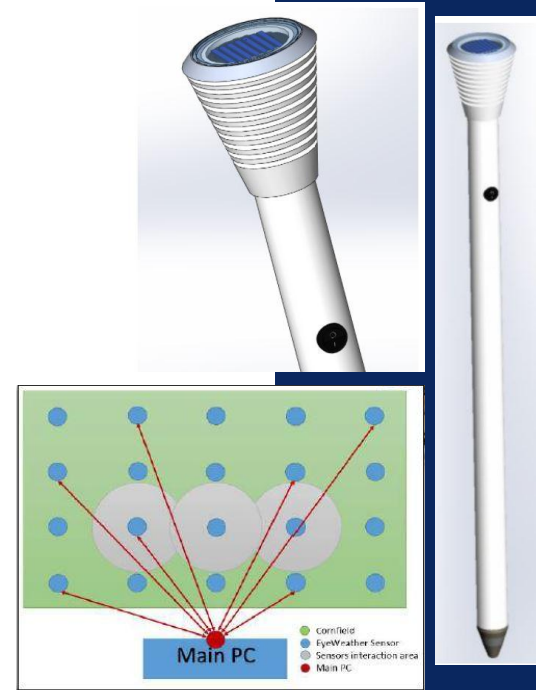
Technologies Used: LoRa, GPS, Capacitive sensor, Moisture sensor, On-board decision making, DSP, Ultra-Low Power.

Solution Produced: The system of sensors with the solar panel that control the statement of farmers' crops by measuring the main indicators of the soil: acid-base balance, humidity, mineral substances

How It Works:

- The EyeWeather sensors are installed into the soil and collect data by key indicators: acid-base balance, humidity, mineral substances.
- the data is transmitted to the system
- the system analyzes data

Killer Feature: The device shows measurement results with high accuracy and helps farmers to track the state on fields even without using the Internet. The solar panel and low energy consumption allows to work for a long time.



Smart Parking System

Focus Area: Smart City

Challenge: Recognizing car numbers and tracking the state of parking spaces in real time.

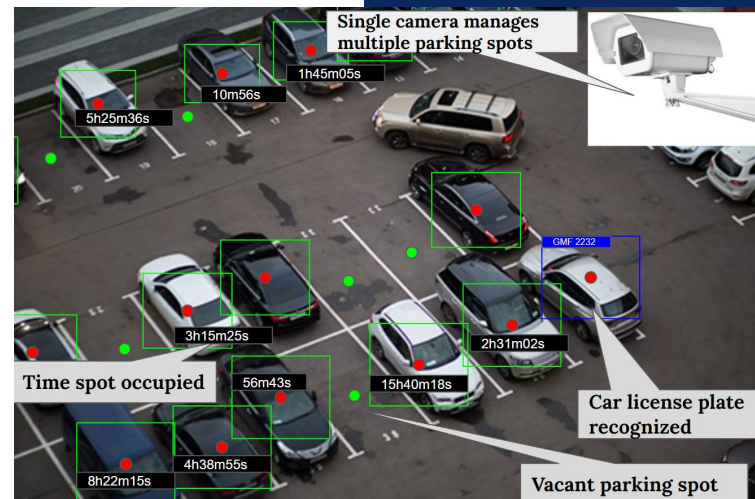
Solution Produced: A custom on-board decision camera was installed that processes information and sends not video to the computer, but only data on the parking space occupancy and car license plate.

Technologies Used: On-board Decision making camera, Embedded Linux, Machine Vision, OpenCV, Object recognition, IoT, AI.

How It Works:

- On-board decision making camera is installed in a parking space.
- The camera processes information and sends not video to the computer, but only data on the parking space occupancy and car license plate.
- One computer can process information from thousands of cameras and sends information for users.

Killer Feature: High level of security due to the fact that the camera does not transmit video, but numeric and text data. The amount of data is small data transfer is low energy, servers and a huge number of wires are not needed.



Mosquito Sensor

Focus Area: **Tracking Insects**

Industry Challenge: Detecting and informing about the appearance of insects in the field.

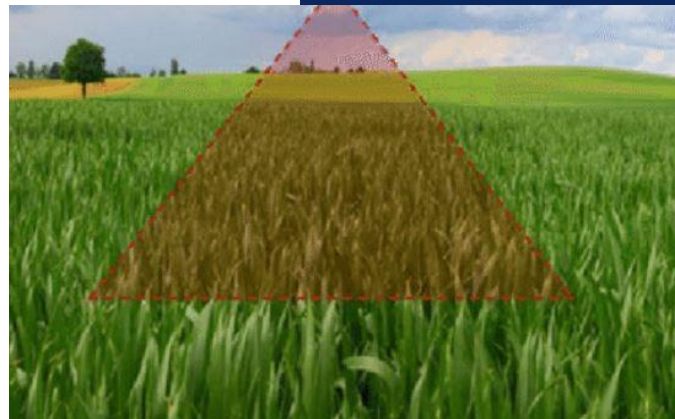
Technologies Used: STM32L4, Cortex M4 ultra low power, Linux, PHP, C, GPS, LoRa, UART, SPI, M2X API, SX1276,

Solution Produced: The Mosquito Sensor registers particular forms of insects and transfers this data to the user.

Workflow of the system:

- Sensors installation. The sensor array is deployed in certain geometry pattern (the pattern could be selected by user).
- The system registers particular forms of insects by wing frequency analysis and transfers this data to the user.

Killer Feature: a user defines the number of sensors that required to implement into the network.



Fusion Camera with **Augmented Reality**

Focus Area: **Healthcare**

Challenge: Minimization of disease prevalence in manufacturing by a timely diagnosis of people with a high temperature.

Technologies Used: Raspberry PI, Embedded Linux, IMX219, MLX90640, LCD, C++, OpenCV, Bash.

Solution Produced: The Fusion Camera allows identification of potentially ill in a large number of people (workspaces, in the passenger flow at transport, etc.) by body temperature detecting.

How It Works:

- Cameras are installed in places of large concentrations of people and read temperature data.
- The images are displayed on the LCD screen in real-time.
- If a person with an elevated temperature is detected, the personnel are alerted.

Killer Feature: Video stream is displayed in real-time and combines real shooting and the image from the IR camera.



Thermal Imager - Thermal Vision Device

Focus Area: Safety & Healthcare

Challenge: Identifying potentially fire-prone areas by tracking heat zones of different sizes.

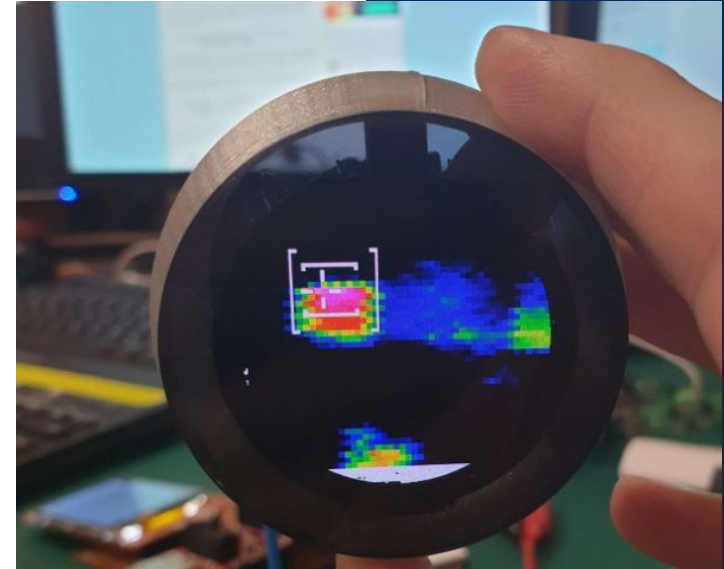
Technologies Used: OLED, STM32, MLX90640, DSI, I2C, Low-Power Energy.

Solution Produced: The Thermal Imager makes a pixel-by-pixel image of areas and displays it on a OLED-screen or web page (Wi-Fi, server, web-socket).

How It Works:

- the Thermal Imager is installed opposite the observed area and starts tracking
- real-time data is transmitted from sensors to the processing
- collected information can be used for timely detection of emergency locations or for determining the most mass concentrations of people.

Killer Feature: Possibility to transfer images via MQTT, send data to AWS, and combine with different systems and devices.



Thermal Imager

Focus Area: Security

Challenge: Improving security on top-secret objects in difficult weather conditions (darkness, sandstorm, storm) compared to conventional video surveillance cameras.

Technologies Used: Machine Vision, IoT, OpenCV, object recognition, Embedded Linux, Camera interface.

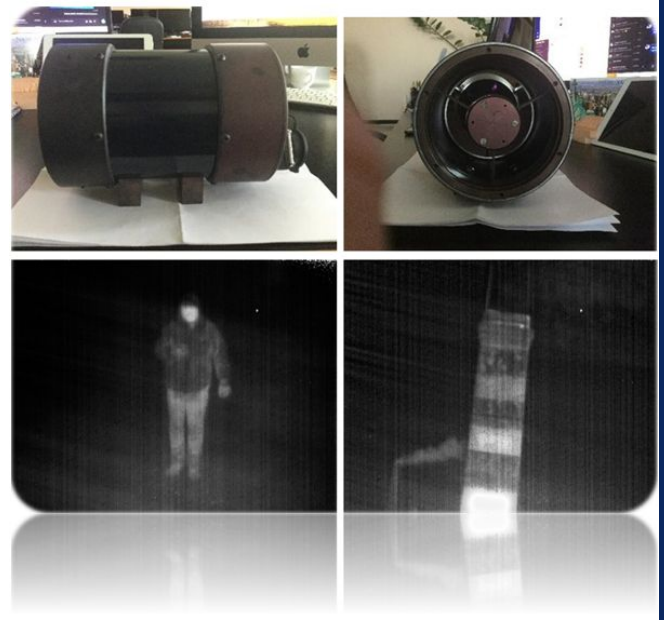
Solution Produced: The Thermal Imager provide the ability to distinguish between thermal traces of people and heated units by 120mm mirror thermal imaging lens.

How It Works:

The Thermal Imager:

- scans the object territory
- detects thermal traces of people and heated objects
- transmits the image to the connected remote screen.

Killer Feature: Ensured image 1.5 pixels per FLIR by using the 10-15 μm resolution matrix. Operating mode control by Interface Muon>FPD3>USB.



Air-Cleaning Fan

Focus Area: **Healthcare**

Challenge: To clean the indoor air automatically.

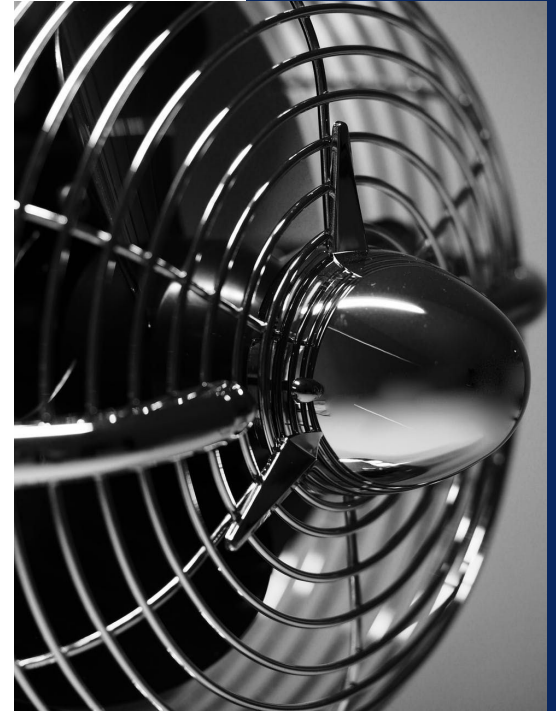
Solution Produced: Work of Air-Cleaning Fan based on a variety of factors (air purity, temperature, number of people in the room, time of day).

Technologies Used: ESP32 IDF, C, C++, I2C, SPI, Free RTOS, Memory management, TFT LCD, VS Code.

How It Works:

- The fan starts working and collecting information about the environment.
- After getting data it chooses operating the desired mode

Killer Feature: Selection of operating mode depending on real-time monitoring of air condition.



Pump Monitoring System

Focus Area: Sensors & Measurement

Challenge: To develop a full-automatized and easy-access system for the monitoring status of pumping equipment.

Solution Produced: A device that monitors data from sensors on the GUI. Data from sensors required for pump operation, pump start function is displayed on the screen. With the help of the GUI, it is possible to control the entire system.

Technologies Used: ESP IDF, C, C++, I2C, SPI, Free RTOS, Memory management, VS Code, Threading C/C++, ESP low-level drivers.

How It Works:

- The integrated system controls all operations on the pump
- The data transfers to the server for storing and retranslating
- Getting information from any device using special software.

Killer Feature: Optimized multithreading and monitoring from different devices.



SWARM intelligence

Focus Area: Indoor navigation

Industry Challenge: Development of simple management of swarm of drones.

Technologies Used: Obstacle avoidance algorithms, SLAM, Stereovision, MEMS IMU, GPS

Solution Produced: An aerial optical navigation system based on drone machine vision SLAM algorithms (relative optical navigation), Algorithm of Morphological Correlation-Extreme Navigation System. It is an absolute navigation system for a preloaded map and IMU.

Workflow of the system:

- the user controls the main drone.
- the main drone transmits commands to the rest of the drones in the swarm by radio channel.

Killer Feature: the ability to manage and track big amount of drones.



Air Purification System

Focus Area: **Healthcare**

Challenge: Air purification from bacteria, viruses and dust indoors.

Technologies Used: AI, UV lamp, sensors, STM32, PCB design.

Solution Produced: Air purification can be carried out by two methods: mechanical using filters and ultraviolet disinfection.

How It Works:

- devices are installed in ventilation;
- the filter system mechanically cleans the air from bacteria and notifies the user about the need to replace the filters;
- a safe system that disinfects the air using ultraviolet radiation.

Killer Feature: The system analyzes the indoor air quality and purifies the air in accordance with standards.



GeoCamera

Focus Area: Precision Agriculture

Industry Challenge: Analyze the quality of land cultivation and crop control..

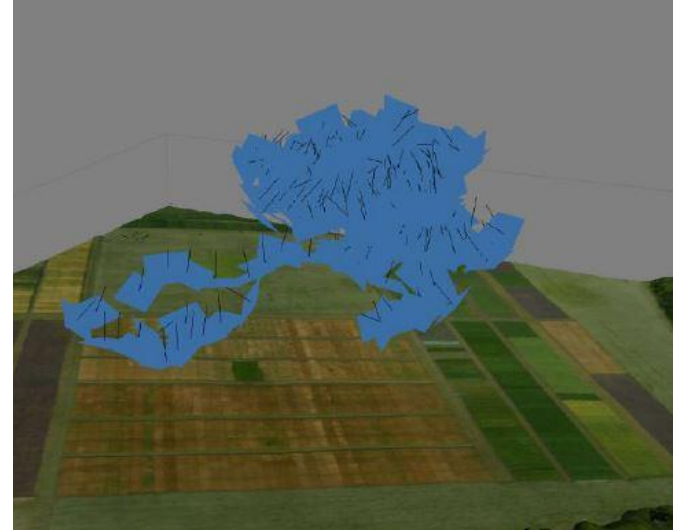
Technologies Used: Precision farming, Machine vision, Optical navigation, OpenCV, Multispectral camera, On-board decision making.

Solution Produced: The device that controls the quality of agriculture process and statement of crops.

How It Works:

- GeoCamera is installed on a drone.
- multispectral sensors allow optical navigation and indicates zones of interest.
- with the help of on-board decision making camera, already processed data is transmitted to the user.

Killer Feature: the ability to monitor the state of the crop remotely in real time.



Scout 'Turtle' Drone

Focus Area: **SWARM Indoor Navigation**

Challenge: An exploration in tight access areas without GPS and Internet access.

Solution Produced: SWARM of Ground Scout Drones with gesture recognition and voice control.

Technologies Used: Optical SWARM navigation, LoRa MESH, STM32 motor control, Nvidia Jetson Nano, Embedded Machine Vision, Machine Learning, Obstacle avoidance.

How It Works:

- User sends a Lead drone to the mission by gestures, or voice.
- SWARM of drones follows to the Lead drone according to SWARM configuration.
- the Lead Drone communicates to the SWARM elements via LoRa MESH network.
- The SWARM possesses a hive mind - the detecting data is transferred freely among elements.
- As a result the SWARM returns the digital map of the explored area.

Killer Feature: The drones detect and avoid obstacles and built digital maps by hive mind of a SWARM, Indoor Navigation technologies, unique algorithms of a gesture recognition and voice control.



Salvatio Push

Focus Area: Safety & Healthcare

Challenge: Compact device that can save lives.

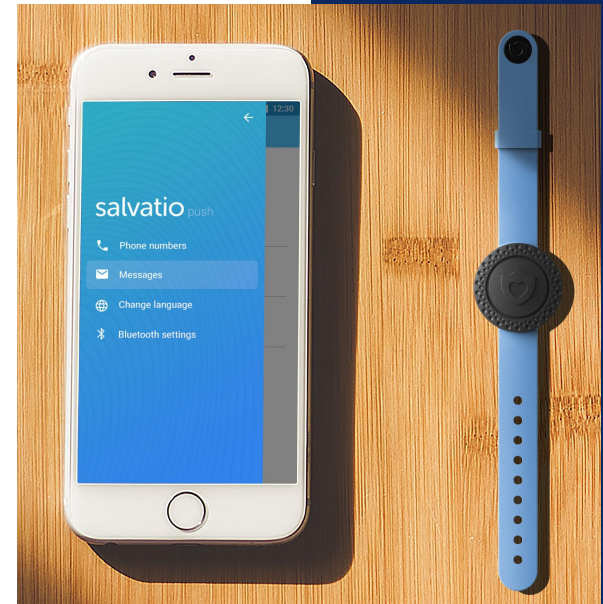
Solution Produced: Wearable device that monitors the state of human health and notifies the rescue services or the user's relatives in case of emergencies.

Technologies Used: BLE, NRF52, Accelerometer MPU 9050, I2C protocol, Low energy, IDE Segger Embedded Studio, Altium Designer.

How It Works:

- The user puts on the device as a bracelet or pendant.
- The device connects to the user's smartphone.
- Salvation Push monitors human temperature, heartbeat and transmits the data to the mobile application.
- In case of a fall or deterioration in human health indicators, the device informs the emergency service and relatives about the incident.

Killer Feature: This device allows reducing the waiting time during an emergency and informs emergency service about an accident.



Keyless Car Control

Focus Area: Carsharing

Challenge: Control a car without a driver's key.

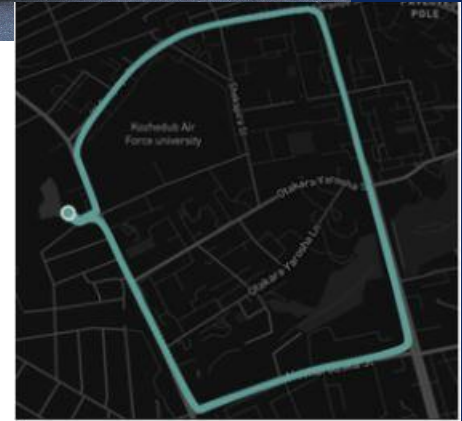
Technologies Used: BLE, CAN, 3G, GPS, Low Power, NB-IoT, Car Keyless entry

Solution Produced: Development of a device that allows controlling a car using a smartphone.

How It Works:

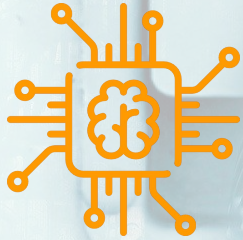
- The device is placed in the car and connects to the car electronics via CAN-bus.
- The user's smartphone is connected to the car by BLE.
- Using a mobile application user can control, open and close the car without the key.

Killer Feature: The ability to cool down or preheat the vehicle according to its needs remotely. A device navigation and speed measurement system based on GPS in real time has been developed and calibrated. The device allows the user to access engine control of the car. Car can be turned on and off with the tap of a smartphone.



Our Services

Make Machines Intelligent



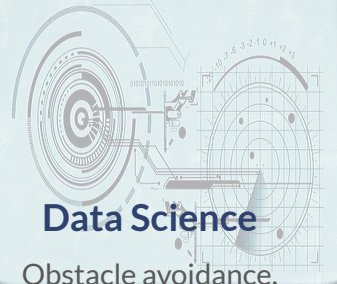
Firmware Engineering

IoT devices, monitoring systems, end-to-end, M2M solutions



Data Science

Obstacle avoidance, SLAM-algorithms, Machine learning, data processing, pattern recognition, predictive and prescriptive analytics



Hardware Engineering

Digital and analog electronics, microprocessor-based devices, wireless HF, UHF design, digital signal processing, FPGA, radar development, SDR



Connected Devices

Sensors arrays, distributed and local decision-making, remote/wireless firmware updates, ERP system integration



Technologies We Use

Make Machines Intelligent



UI/UX

Embedded-based web and mobile interfaces: SW – Apache, Nginx, Web toolkit; Displays – OLED, TFT, LCD, e-Inc; Sensors – capacity, touch, infrared



Data Science, ML

OpenCV, OpenCL, CUDA, Hadoop, Mahout, Tableau



Environments

Linux, Windows, iOS, Android, IAR, Eclipse, uVision, AWR, Azure, Intel IoT analytics, AWS IoT



Firmware Engineering

C/C++, Assembler, C#, Java, Scala, Python, PHP, MongoDB, Oracle, iOS, Android, VHDL, Verilog

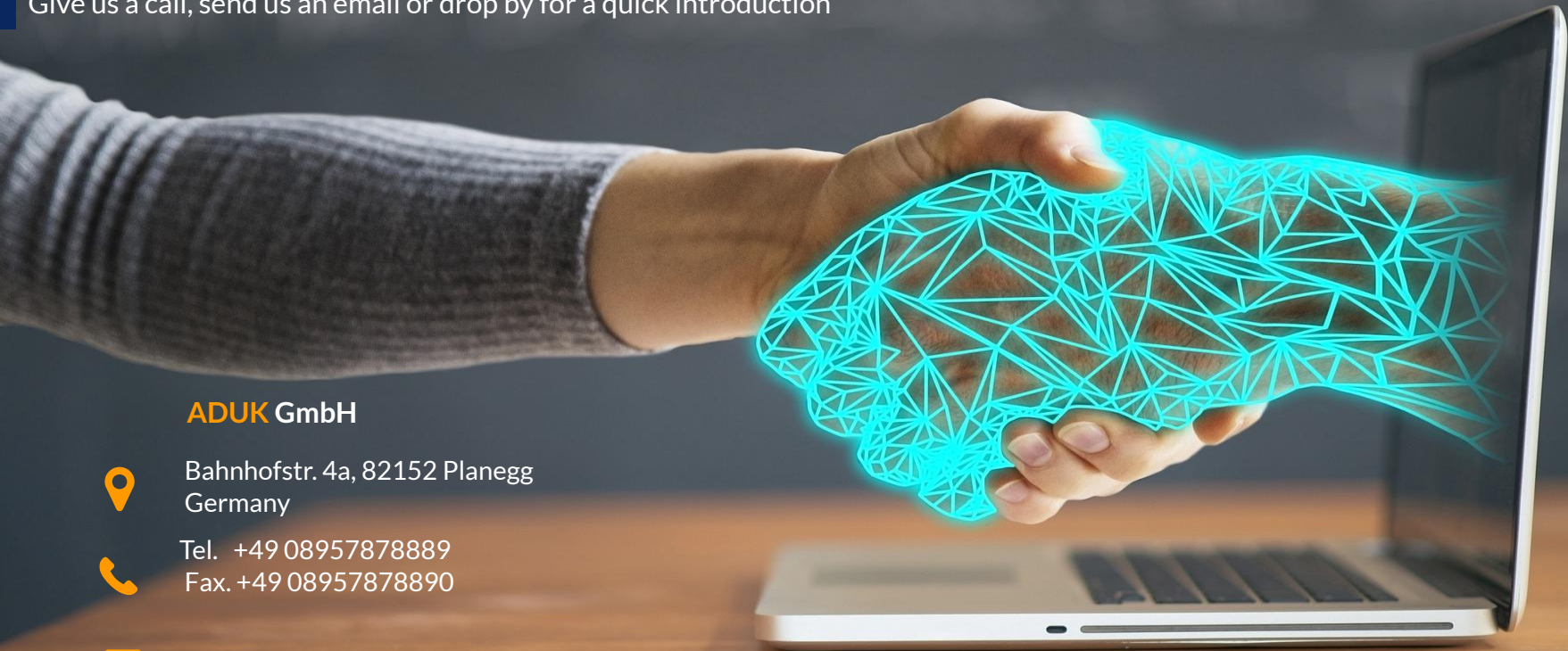


Hardware Engineering

Analog/digital electronics, mechanical engineering, BLE, LoRa WAN, ZigBee, Wi-Fi, GSM, LTE, SDR, DSSS

Contact Us

Give us a call, send us an email or drop by for a quick introduction



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