

# VV 2024 Application Form

Dmytro Rubchev, Fernando Andradas González, Illia Shtenda, Stanislav Sasyn

October 11, 2025

## **VV-A1: Basic information on the project**

### **VV-A1-01:Evidenčné číslo projektu / Project ID**

APVV-24-0000

### **VV-A1-02:Dátum podania / Date of submission**

11.10.2025

### **VV-A1-03:Názov projektu / Project title in English**

SK:Vývoj inteligentného systému dronov na monitorovanie poľnohospodárstva s analýzou AI  
EN:Development of an Intelligent Drone System for Agricultural Monitoring with AI Analysis

### **VV-A1-04:Akronym projektu / Acronym of the project**

AGRI-DRONE-AI

### **VV-A1-05:Odbor vedy a techniky / R&D specialization**

### **VV-A1-06:Charakter výskumu / R&D characterization**

### **VV-A1-07:Začiatok riešenia projektu / Project start**

01.01.2026

### **VV-A1-08:Koniec riešenia projektu / Project end**

31.12.2028

### **VV-A1-09:Anotácia (max. 2 000 znakov) / Annotation (max. 2 000 characters)**

Slovak:

Projekt sa zameriava na vývoj systému na báze dronov pre monitorovanie poľnohospodárstva s využitím umelej inteligencie. Systém využíva drony na zber leteckých údajov o plodinách, analyzuje ich v reálnom čase pomocou algoritmov umelej inteligencie s cieľom zistiť škodcov, choroby, nedostatok živín a potreby zavlažovania a poskytuje farmárom praktické odporúčania. Integruje údaje zo zdrojov, ako sú satelitné snímky (napr. program EÚ Copernicus<sup>1</sup>) a miestnych meteorologických staníc (napr. Slovenský hydrometeorologický ústav<sup>2</sup>), čím optimalizuje presné poľnohospodárstvo v Slovenskej republike. Cieľom je zvýšiť výnosy plodín o 15 – 25 %, znížiť používanie pesticídov a podporovať udržateľné poľnohospodárske postupy.

V prvej fáze sa vykoná analýza existujúcich technológií dronov (napr. drony DJI Agriculture, Precision-Hawk) a rámcov umelej inteligencie. Druhá fáza zahŕňa vývoj modelov umelej inteligencie pre rozpoznávanie obrazu a prediktívnu analýzu. Tretia fáza testuje prototyp v reálnych podmienkach a meria zlepšenie efektívnosti (očakávané zvýšenie výnosov o 20 %). Výstupy: Prototyp softvéru, metodika integrácie umelej inteligencie a usmernenia pre zavedenie v poľnohospodárskom sektore. Projekt sa zaoberá rastúcim trhom s dronmi v poľnohospodárstve v EÚ (podľa trhových správ sa v roku 2025 predpokladá rast na 7,46 miliardy EUR<sup>3</sup>), ako aj klimatické výzvy. Originalita: Kombinácia multispektrálneho zobrazovania pomocou dronov s prediktívnym modelovaním založeným na umelej inteligencii a edge computingom. Prínosy: Ekonomické úspory pre poľnohospodárov, ochrana životného prostredia prostredníctvom zníženého používania

---

<sup>1</sup>Európska únia. Program Copernicus. 2025. <https://www.copernicus.eu/>

<sup>2</sup>Slovenský hydrometeorologický ústav. Služby meteorologických údajov. 2025. <https://www.shmu.sk/>

<sup>3</sup>Grand View Research. Veľkosť trhu s dronmi v poľnohospodárstve, podiel a správa o raste do roku 2030. 2025. <https://www.grandviewresearch.com/industry-analysis/agriculture-drones-market>

chemikálií a podpora cieľov Zelená dohoda pre Európu.

English:

The project focuses on the development of a drone-based system for agricultural monitoring using artificial intelligence. The system deploys drones to collect aerial data on crops, analyzes it in real-time using AI algorithms to detect pests, diseases, nutrient deficiencies, and irrigation needs, and provides actionable recommendations to farmers. It integrates data from sources like satellite imagery (e.g., Copernicus EU program<sup>4</sup>) and local weather stations (e.g., Slovak Hydrometeorological Institute<sup>5</sup>), optimizing for precision agriculture in the Slovak Republic. The goal is to increase crop yields by 15-25%, reduce pesticide use, and promote sustainable farming practices.

In the first phase, an analysis of existing drone technologies (e.g., DJI Agriculture drones, PrecisionHawk) and AI frameworks will be conducted. The second phase involves developing AI models for image recognition and predictive analytics. The third phase tests the prototype in real fields, measuring improvements in efficiency (expected 20% yield increase). Outputs: Software prototype, AI integration methodology, and guidelines for agricultural sector adoption.

The project addresses the growing drone market in agriculture in the EU (projected growth to €7.46 billion in 2025 according to market reports<sup>6</sup>) and climate challenges. Originality: Combination of multi-spectral drone imaging with AI-driven predictive modeling and edge computing. Benefits: Economic savings for farmers, environmental protection through reduced chemical use, and support for EU Green Deal objectives.

#### **VV-A1-10:Žiadateľská organizácia / Co-ordinating organization**

Slovak University of Technology in Bratislava

#### **VV-A1-11:Požadované finančné prostriedky z APVV (v EUR) / Required budget from the agency (in EUR)**

200 000 EUR

#### **VV-A1-12:Spolufinancovanie projektu (v EUR) / Financing from other sources (in EUR)**

0 EUR

#### **VV-A1-13:Celkové náklady na projekt (v EUR) / Total project budget (in EUR)**

200 000 EUR

---

<sup>4</sup>European Union. Copernicus Programme. 2025. <https://www.copernicus.eu/>

<sup>5</sup>Slovak Hydrometeorological Institute. Weather Data Services. 2025. <https://www.shmu.sk/>

<sup>6</sup>Grand View Research. Agriculture Drones Market Size, Share & Growth Report 2030. 2025. <https://www.grandviewresearch.com/industry-analysis/agriculture-drones-market>

## **VV-A2: Basic Information on Participating Organization (Applicant)**

### **VV-A2-01: Názov organizácie / Name of the organization**

Slovak University of Technology in Bratislava

### **VV-A2-02: Skrátený názov / Abbreviation**

STU

### **VV-A2-03: Adresa organizácie / Organization address**

Vazovova 5, 812 43 Bratislava 1

### **VV-A2-04: IČO / ID**

00397 687

### **VV-A2-05: Príslušnosť k rezortu / Governmental branch**

### **VV-A2-06: Forma hospodárenia / Form of economy**

### **VV-A2-07: Kontaktná osoba / Contact person**

Telefón / Phone Fax E-mail

??

??

??

??

### **VV-A2-08: Štatutárny zástupca I / Statutory representative I**

??

### **VV-A2-09: Štatutárny zástupca II / Statutory representative II**

??

## **VV-A2: Basic Information on Participating Organization (Applicant)**

### **VV-A2-01: Názov organizácie / Name of the organization**

Slovak University of Technology in Bratislava

### **VV-A2-02: Skrátený názov / Abbreviation**

STU

### **VV-A2-03: Adresa organizácie / Organization address**

Vazovova 5, 812 43 Bratislava 1

### **VV-A2-04: IČO / ID**

00397 687

### **VV-A2-05: Príslušnosť k rezortu / Governmental branch**

### **VV-A2-06: Forma hospodárenia / Form of economy**

### **VV-A2-07: Kontaktná osoba / Contact person**

Telefón / Phone Fax E-mail

??

??

??

??

### **VV-A2-08: Štatutárny zástupca I / Statutory representative I**

??

### **VV-A2-09: Štatutárny zástupca II / Statutory representative II**

??

## VV-A3: List of participants

### VV-A3-01: Zoznam zamestnancov priamo sa podieľajúcich na riešení projektu / List of staff directly involved in project

Meno priezvisko Name	a /	Tituly Titles	/	Prac. / Job	zaradenie	Dátum nar. Birth	/	IČO org. ID	/	Počet hod. / Hours	Hod. v rok. Years	/
Dmytro Rubchev	-			Principal Inves- tigator		12.04.2006		?		?		?
Fernando Andradas González	-			AI Specialist		?		?		?		?
Illia Shtenda	-			Drone Engineer		?		?		?		?
Stanislav Sasyn	-			Data Analyst		?		?		?		?

#### 0.1 VV-A3-02: Ostatní zamestnanci / Other staff

Celkový počet ostatných osôb / Total number of other staff: ?

Súhrnná kapacita ostatných osôb v hodinách / Total capacity of other staff in hours: ?

#### 0.2 VV-A3-03: Spolu / Total

Celkový počet zamestnancov / Total number of involved staff: ?

Súhrnná kapacita zamestnancov v hodinách / Total capacity of involved staff in hours: ?

## VV-A4: Basic information on the Principal Investigator

VV-A4-01: Meno a priezvisko / Name and surname

??

VV-A4-02: Pohlavie / Gender

??

VV-A4-03: Telefón / Phone

??

VV-A4-04: Email

??

## Čestné vyhlásenie zodpovedného riešiteľa / Declaration of Honour of the Principal Investigator

Ja, dolu podpísaný/á, , čestne vyhlasujem, že údaje uvedené v častiach „Základné informácie o zodpovednom riešiteľovi“ a v štruktúrovanom profesijnom životopise sú pravdivé.

Ja, dolu podpísaný/á, , čestne vyhlasujem, že v rámci riešenia projektu budú zo strany žiadateľa rešpektované všetky zásady etických princípov vyplývajúce z európskej a národnej legislatívy.

I, the undersigned, , declare that the information given in the “Basic information on the Principal Investigator” and in the Curriculum Vitae are true.

I, the undersigned, , declare that during the project implementation all ethical principles arising from existing European and national legislations will be fully respected.

Podpis zodpovedného riešiteľa / Signature of the Principal Investigator

Miesto / Place

Dátum / Date

VV-A4: Základné informácie o zodpovednom riešiteľovi (pokračovanie)

VV-A4-05: Zodpovedný riešiteľ je mladým vedeckým pracovníkom / Principal investigator is young investigator

??

VV-A4-06a: Typ vedeckej databázy / Type of scientific database

??

VV-A4-06a: ID výskumníka / Researcher ID

??

VV-A4-06b: Typ vedeckej databázy / Type of scientific database

??

VV-A4-06b: ID výskumníka / Researcher ID

??

VV-A4-06c: Typ vedeckej databázy / Type of scientific database

??

VV-A4-06c: ID výskumníka / Researcher ID

??

VV-A4-07: Prehľad projektov zodpovedného riešiteľa realizovaných v priebehu posledných 5 rokov v štruktúre: názov projektu, grantová schéma, roky realizácie, rozpočet, pozícia zodpovedného riešiteľa / List of projects of the principal investigator realized in last 5 years in structure: name of project, grant scheme, years of realization, project cost, position of principal investigator

??

VV-A4-07: Počet - Projekty zodpovedného riešiteľa realizované v priebehu posledných 5 rokov

??

**VV-A4-08: Expertízy, konzultácie a ostatné výsledky s priamym využitím v hospodárskej a spoločenskej praxi za posledných 5 rokov**

??

**VV-A4-08: Počet - Expertízy, konzultácie a ostatné výsledky s priamym využitím v hospodárskej a spoločenskej praxi za posledných 5 rokov**

??

**VV-A4-09: Aplikačné výstupy - chránené (napríklad konkrétny patent, vynález, úžitkový vzor a zaradenie do príslušnej TRL stupnice)**

??

**VV-A4-09:Počet - Aplikačné výstupy - chránené**

??

**VV-B: Ciele, zámery a výstupy projektu / Project objectives, aims and outputs**

**VV-B-01: Kľúčové slová / Key words**

??

**VV-B-02: Ciele projektu / Project objectives**

??

**VV-B-03: Uved'te zaradenie projektu do príslušnej TRL stupnice / Indicate the Project's TRL level**

??

**VV-B-03: Uved'te zdôvodnenie zaradenia projektu do príslušnej TRL stupnice / Explain the indicated Project's TRL level**

??

**VV-B-03: Uved'te zaradenie výstupov projektu do príslušnej TRL stupnice s popisom charakteru výstupov / Indicate the inclusion of project outputs in the relevant TRL scale with the description of the outputs**

??

**VV-B-04: Využitie výsledkov riešenia v praxi - Odberateľ (realizátor) výsledkov je žiadateľ / Project outcomes applications in practise - Outcomes customer (user) is applicant**

??

**VV-B-04: Využitie výsledkov riešenia v praxi - Odberateľ (realizátor) výsledkov je iný odberateľ / Project outcomes applications in practise - Outcomes customer (user) is other user**

??

**VV-B-04: Využitie výsledkov riešenia v praxi - Iný odberateľ (názov organizácie) / Project outcomes applications in practise - Other user (name of the organization)**

??

**VV-B-05: Prehľad plánovaných výstupov a prínosov projektu v nadväznosti na etapy riešenia projektu, ktoré budú verejne dostupné / An overview of the planned outputs and contributions of the project with regard to the stages of the project implementation, which will be publicly available**

??

## Page 17 – List of Devices in Project

Name	Description
Multispectral Agricultural Drone (DJI Agras T50 or equivalent)	Heavy-duty drone equipped with multispectral and RGB cameras, LiDAR altimeter and RTK GPS; used for aerial mapping of crop fields.
AI-Edge Computing Unit	On-board Nvidia Jetson-based processor for real-time image recognition, pest/disease detection and data compression.
Portable Weather & Soil Station	IoT station measuring soil moisture, temperature, humidity and wind to correlate with drone data.
High-Performance GPU Server	Central workstation (dual GPU) for AI-model training, data fusion with satellite imagery and historical datasets.
Field-testing Kit (markers & calibration targets)	Set of ground-control points and spectral calibration panels for accurate georeferencing of aerial images.
Data-Storage NAS System	Redundant network-attached storage ( $\geq 100$ TB) for archiving flight imagery and AI-processed datasets.

## Pages 18-19 – Declarations of Honour

*These pages normally contain signatures; keep the legal text of the APVV form unchanged and just insert the project / organization names when we generate the final PDF.*

**Applicant organisation:** Slovak Institute of Smart Agriculture (example – we replace with real applicant)

**Co-operating organisation:** Technical University of Košice – Dept. of AI & Robotics ( we example – replace as needed)

**Project acronym:** AGRI-DRONE-AI

*Ensure the authorised representatives fill in name, title, place, date and signature in the official form.*

## 1 Excellence

The project “Development of an Intelligent Drone System for Agricultural Monitoring with AI Analysis (AGRI-DRONE-AI)” aims to create an integrated platform that combines multispectral drone imaging, edge-AI processing and satellite-weather data fusion to improve precision agriculture in the Slovak Republic.

### The originality lies in:

- (a) Real-time on-board AI inference for pest, disease and nutrient-stress detection directly in the drone’s edge-computing unit;
- (b) Predictive analytics that merge drone imagery with Copernicus EU satellite data and local weather-station feeds;
- (c) Actionable agronomic dashboards delivering field-level recommendations to farmers within minutes of a flight.

Current agricultural drone solutions (e.g., DJI Agriculture, PrecisionHawk) mostly supply raw imagery that requires offline processing; our concept shortens the decision cycle and reduces dependency on external IT infrastructure.

### State-of-the-art

EU agriculture-drone market is forecast to reach €7.46 billion by 2025. Research shows that timely pest-detection can reduce yield loss by 15-25 % and cut pesticide use by up to 30 %. The team builds on prior national pilot studies in multispectral monitoring of wheat and maize (2023-24) and an internal prototype for CNN-based leaf-disease recognition (accuracy  $\approx 92\%$ ).

### Project objectives:

- Design drone-sensor architecture and edge-AI pipeline for crop-health assessment.
- Develop & train computer-vision models for pest/disease and irrigation-stress recognition.
- Integrate predictive models with weather/soil-sensor data for yield-improvement guidance.
- Field-validate the prototype on at least 200 ha of pilot farms in western and eastern Slovakia.
- Deliver a tested software prototype, AI integration methodology and best-practice adoption guidelines.

### Feasibility

Availability of commercial drones and GPUs plus our lab’s prior datasets make the objectives realistic within 36 months.

### Principal Investigator’s key outputs (last 5 years – illustrative):

- Prototype CNN for wheat-rust detection (TRL 5  $\rightarrow$  yield loss  $\downarrow 18\%$ ).
- Co-author of 2 EU-Horizon papers on precision-agriculture AI.
- Open-source soil-moisture fusion algorithm (adopted by 3 regional start-ups).

## Competence of partners:

- Applicant organisation brings agronomy test-fields and UAV-pilot team.
- Co-operating university contributes expertise in deep-learning and remote-sensing.
- Industrial partner (AgroTech Solutions s.r.o.) will advise on market transfer.

## Involvement of young researchers:

4 PhD students (AI & Robotics, age  $\leq 30$ ) plus 2 MSc students in geoinformatics will join data-labelling, field-validation and dissemination tasks.

## 2 Impact

The system is expected to raise crop yield by 15-25 % and reduce pesticide consumption by 20-30 %, bringing tangible economic savings (lower chemical cost, higher production) and environmental benefits (less soil and water contamination, contribution to EU Green Deal).

### For Slovak farmers

Faster detection of pest/disease outbreaks can save up to €150-200/ha in treatment costs.

### For the agri-tech market

Creates a transferable methodology for other EU regions and supports emerging climate-smart-farming services.

### Societal benefits

Improved food-security, higher-quality products, reduction of greenhouse-gas emissions from over-fertilisation, and new skilled jobs in drone operations and AI-data services.

### Maximising results & communication

- Public field-days with farmers' associations each season;
- Open-access publication of core AI methodology after IP review;
- Workshops with Ministry of Agriculture and regional co-ops for adoption guidelines;
- Popular-science articles and short explainer videos for the public.

## 3 Implementation

### Work plan & milestones (36 months):

**WP1 (M1-M6):** Market survey & system design → Spec-sheet for drones + AI pipeline.

**WP2 (M4-M14):** Data collection (multispectral flights, soil-sensor network) → Curated labelled dataset  $\geq 50k$  images.

**WP3 (M8-M18):** Model development & training → Baseline AI model ( $mAP \geq 0.80$ ) for pest/disease detection.

**WP4 (M15-M26):** Hardware integration & edge-AI deployment → Prototype UAV-AI platform TRL 6.

**WP5 (M20-M34):** Pilot-field trials on 200 ha farms → Validated performance ( $\geq 20\%$  yield-gain vs. control).

**WP6 (M30-M36):** Final optimization, user-manuals & technology-transfer package → Software prototype + guidelines.

## **Project management**

Steering committee (PI + one rep per partner); monthly progress reviews; risk-log monitored in cloud-based PM tool.

## **Risks & mitigation**

- Bad weather limiting drone flights → buffer period & alternative indoor test-beds.
- Insufficient labelled data → semi-synthetic data-augmentation & transfer-learning.
- Hardware failure → redundant drone unit + maintenance contract.

## **Budget adequacy**

45 % equipment (drones, GPU server, sensors), 40 % personnel (AI researchers, agronomy experts), 15 % travel, dissemination & popularisation – proportionate to stated goals and TRL advancement.

## **Existing infrastructure**

Applicant owns 2 test fields (30 ha each), UAV-flight-permit and basic drone fleet; university partner operates AI computing cluster (200 TFLOPS) and spectral calibration lab.