MARTIN KUKUČÍN GRAMMAR SCHOOL AND VOCATIONAL SCHOOL, GENERÁLA VIESTA 6, REVÚCA

Small photovoltaic power plant up to 1000 Wp with storage and priority control of electricity

The competition was announced by the Youth Embassy.

Topic: Smart energy saving solutions for the home

Authors: Vattay Jakub, 2. ročník

Ganaj Lucas, 3. ročník

Guarantor: Mgr. Beľák Ivan

Ing. Máliková Andrea

Revúca 2026

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INTRODUCTION

The topic was chosen due to the growing importance of renewable energy sources and their potential use in apartment buildings. The work focuses on the design of a small balcony photovoltaic power plant with storage and priority control of electricity consumption. The aim was to design, implement, and verify a safe and effective system on a functional model.

The thesis includes a theoretical part on photovoltaics and a practical part with technical solutions, testing, proposed applications, and financial evaluation of the project.

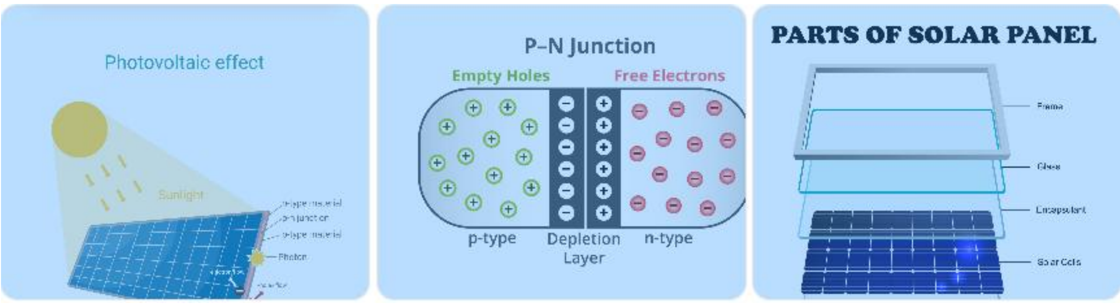
1 CORE OF THE WORK

1.1 Theoretical background

At the core of the work, we first focus on a theoretical explanation of the basic concepts on which the photovoltaic power plant project is based:

A, Photovoltaic

The sun is the main and almost inexhaustible source of energy on Earth. The photovoltaic effect occurs when light strikes a semiconductor material with a p-n junction. The light releases electrons, creating an electric voltage. When electrodes are connected to this junction, a photovoltaic cell is created, which is the basic component of a photovoltaic panel (Pic. 1).



Pic. 1 The schematic representation of a photovoltaic cell and the photoelectric effect.
Source: https://oze.tzb-info.cz/fotovoltaika/11772-nejpouzivanejsi-pojmy-ve-fotovoltaice

B, Photovoltaic panel

Photovoltaic panels differ according to the type of cells used: monocrystalline, polycrystalline, and thin-film. They differ in terms of production, efficiency, and price:

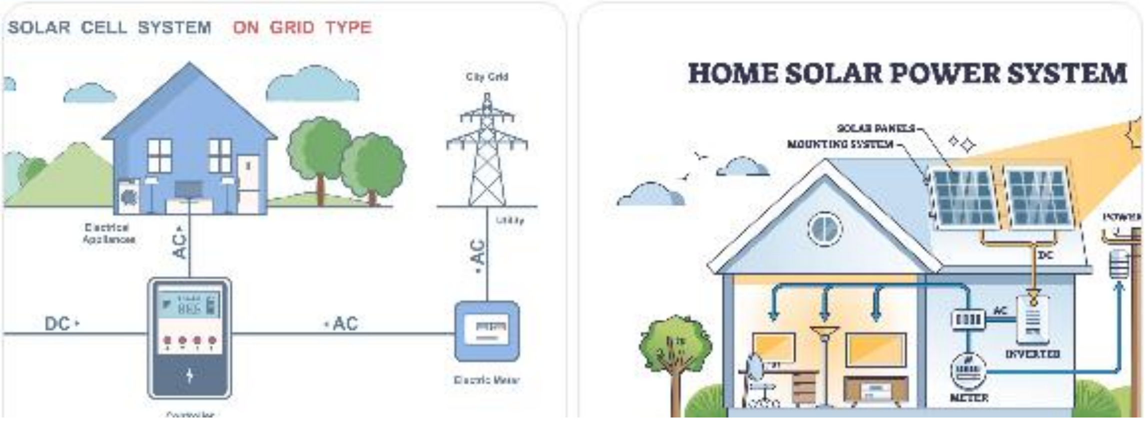
- • *Monocrystalline panels* have the highest efficiency (often above 20%) and a long service life. However, they are more expensive. They are made from a single silicon crystal.
- *Polycrystalline panels* are cheaper but have lower efficiency (around 13–16%). They require a larger surface area to achieve the same output.
- *Thin-film panels* are lightweight and cheap. They have the lowest efficiency, so they require more space for the same output.

The label on the panel indicates its efficiency, which expresses the ratio between the electrical energy produced and the incident solar radiation. Higher efficiency and longer panel life usually mean a higher price.

C, Photovoltaic power plant

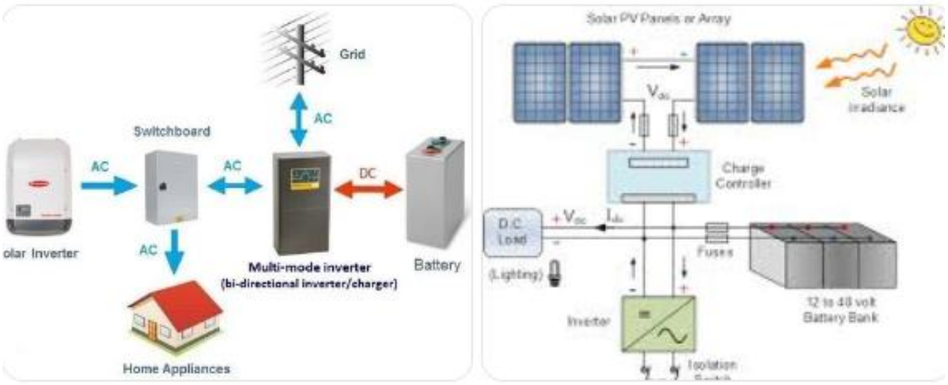
A photovoltaic power plant is a facility that converts solar radiation into electrical energy. The basic elements are photovoltaic panels, which generate direct current. The panels are connected in series and in parallel to form a photovoltaic array and are interconnected with other system components. Depending on the connection method, we distinguish between three types of photovoltaic power plants:

- *ON-GRID system* – connected to the public power grid, allowing surplus energy to be fed into the distribution network (Pic. 2).



Pic. 2 ON-GRID photovoltaic system diagram
Source: http://www.sosst.sk/new/fotovoltika.htm

- *OFF-GRID system* – is completely independent of the public grid and uses batteries to store the energy produced. (Pic. 3).



Pic. 3
OFF-GRID (island) system diagram
Source: https://www.jakama-ge.sk/jakama-ge/8-Dalsie-informacie/4-Co-je-Ostrovny-system

- *HYBRID system* – combines the advantages of both previous solutions. When the public grid is available, it operates as an ON-GRID system, with excess energy stored in batteries. In the event of a grid failure, it switches to island mode.

The performance of the power plant is greatly influenced by the correct placement of the panels. It is best when they are oriented to the south with an inclination of about 30° to 40°. When oriented to the east or west, the performance reaches about 86% of the maximum. A north orientation is unsuitable.

D, Photovoltaic power plant accessories

The basic components of a photovoltaic power plant include charge controllers (PWM and MPPT), batteries, voltage converters, DC and AC network protection devices, as well as connecting cables and connectors (Pic. 4). The correct selection and dimensioning of these components has a fundamental impact on the safety, reliability, and efficiency of the entire system.

Pic. 4 Types of connectors A – MC4 connector, B – MC4 coupler pair, C – MC41X3 coupler
Source: https://www.neosolar.sk/kable-a-konektory

1.2 Practical part

1.2.1 Technical description of the solution

After entering the competition, we began to focus on photovoltaic systems and how to use the electricity generated in the home efficiently. We focused on a system that prioritizes the use of its own energy and is safe without complicated permits.

A small photovoltaic power plant has limited power and battery capacity, so electricity consumption must be managed. We designed the system so that electrical energy is not returned to the grid and can be used safely.

For safety reasons, current sensors and relays are used in the circuits to protect the battery and converter from overload. The HC-05 Bluetooth module allows you to monitor the status of the system on your mobile device. It sends information about the current battery voltage, the status of individual relays, and the current load on individual circuits. Two ACS712 current sensors are used to measure the current in the socket circuits:

- The sensor at input A1 measures the current in the circuit controlled by relay K2.
- The sensor at input A2 measures the current in the circuit controlled by relay K3.

If the current in any circuit exceeds 1.2 A (at 230 V), the corresponding relay automatically switches off. It can only be switched on again once the current has fallen below 1 A. This protects the converter from overload.

The proposed solution thus enables intelligent consumption management, safe operation, and system overview for the user.

At the beginning, we created a block diagram of the system (Appendix A), where we set up power management and circuit priorities. The main control unit is an Arduino NANO microcontroller. It monitors the battery status and gradually turns the consumer circuits on or off depending on the battery charge. The most important circuits, such as lighting, always have priority.

When the battery is fully charged, Arduino activates relay **K1**, which starts the **12/230 V DC/AC** converter. After 10 seconds, relay **K2** (living room sockets) is activated, and after another 10 seconds, relay **K3** (children's room and bedroom sockets) is activated. The system gradually disconnects the circuits according to the battery status:

- at 75% capacity, K3 switches off,
- at 50 % capacity K2 switches off,
- at a voltage of 11.8 V, K1 and the entire converter switch off.

This protects the battery and ensures that the most important circuits always have priority.

This protects the battery from excessive discharge while maintaining priority power supply to the most important circuits.

The proposed solution enables intelligent energy consumption management based on battery status, protection of individual system components, and provides the user with an overview of the current status of the device via wireless communication. The costs of manufacturing the control unit are shown in Table 1.

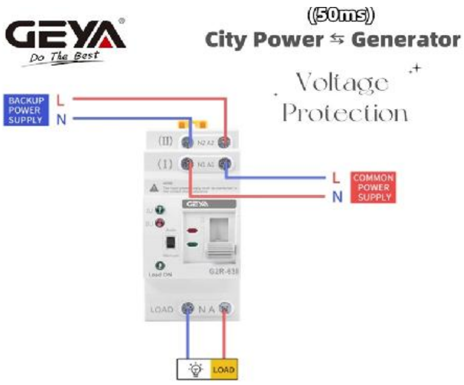
Table 1 Production costs of the control unit

Name of electrical component	Cost per unit	Total cost
Arduino Nano	5,45€	5,45€
Arduino Nano Terminal Adapter	2,90€	2,90€
Voltage divider 0–25 V	1,20€	1,20€
Current sensor ACS712 (5 A)- 2ks	2,50€	5,00€
Bluetooth module HC-05	5,60€	5,60€
Relay module 1 channel 5 V-3ks	1,20€	3,60€
LM2596	1,30€	1,30€
Total cost		**25,15€**

We used donated and recycled materials for production, and did not include consumables because their value was negligible.

1.2.2 Switching between the photovoltaic system and the distribution network

We use the ***GEYA G2R automatic transfer switch*** (Pic. 5) for safe switching between power supply from the photovoltaic power plant and the public grid.



Pic. 5 GEYA G2R Din Rail 2P ATS Automatic transfer switches Dual transfer switch Electrical selector switch uninterrupted power 25A Source:https://www.aliexpress.com/item/1005005694176122.html?spm=a2g0o.order_list.order_list_main.16.2fa01802ckMThF

This switch switches appliances between two power sources:

- photovoltaic power plant via DC/AC converter,
- 230 V public distribution network.

The sensor also ensures that they can never be interconnected.

GEYA G2R automatically detects the availability of the photovoltaic system. If energy is available, appliances are powered by the inverter. In the event of an inverter failure, battery discharge, or system malfunction, the power supply automatically switches to the distribution network.

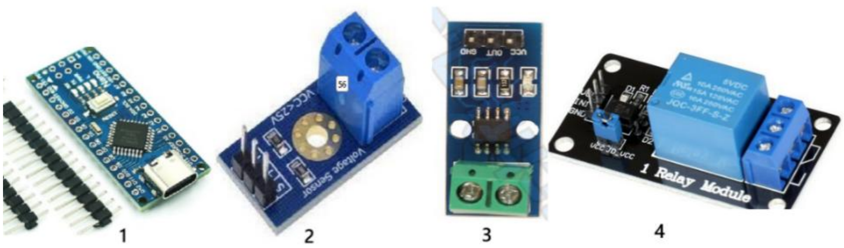
With GEYA G2R, the system becomes a hybrid solution that combines a solar power plant with reliable grid power. It is safe, simple, and suitable for both homes and schools.

The use of an automatic transfer switch offers several *advantages:*

- *Increased system safety* – prevents the backflow of electrical energy into the distribution network, thereby eliminating the risk of danger to distribution company employees.
- *Operation without the need for permits* – since there is no parallel connection to the grid, the system does not function as a conventional ON-GRID power plant.
- *Automatic operation without user intervention* – switching between sources is fully automatic.
- *Increased comfort and reliability of power supply* – appliances remain powered even in the event of a power shortage from the photovoltaic system.

1.2.3 Production of a functional mock-up

In the first phase, we designed a system for controlling electricity consumption from a photovoltaic power plant. The control unit is an Arduino Nano, which processes the measured values and controls the relay. We measure the battery voltage via a 0–25 V voltage divider, the current of the socket circuits is sensed by ACS712 5A, and the data is sent to a mobile phone via Bluetooth HC-05. The switching of the power parts is ensured by a 1-channel 5 V relay (Pic. 6).



Pic. 6 Electrical equipment for managing consumption from a photovoltaic power plant

Explanatory notes: 1 Arduino Nano, 2. Arduino 25V voltage divider, 3. ACS712 /5A current sensor, 4. Bluetooth HC05, 1-channel 5V relay

We placed the electronic components in a modular plastic box. We connected the components according to the wiring diagram we designed (Appendix B).

The function of the control unit is to prevent battery undercharging. It controls the activation of socket circuits according to battery charge and prevents current overload of the photovoltaic system. We used beech plywood with DIN rails as the base for connecting the photoelectric power plant and residential distribution system, on which we installed electrical equipment according to the drawing documentation (Appendices B and C).

The control electronics are powered via an LM2596 DC-DC converter set to 5 V DC. During the design phase, we focused on:

- separation of control and power sections,
- safe wiring,
- easy measurement and servicing,
- clear layout of the model for teaching purposes.

This functional model allows for a clear demonstration of the principle of managing electricity consumption from a photovoltaic power plant and serves as a practical teaching aid in vocational training. Table 2 shows the costs of producing the model, which are approximately €568.

Table 1 Costs of a functional mock-up

Name of electrical component	Number of items	Cost per unit	Total cost
Control unit	1	25,15€	25,15€
Solar panel	1	55,35€	55,35€
Photovoltaic controller	1	10€	10€
Battery for photovoltaics	1	172€	172€
Fuse base with fuse	1	15,93€	15,93€
Converter DC/AC 1000W	1	118€	118€
ATS- CHINA	3	26€	78€
Contactor 1P 230V 2xNO	2	8,30€	16,6€
RCBO B16/0,03	3	23€	69€
Switch n.1	1	2,8€	2,8€
One socket	2	2,5€	5 €
Total cost			**567,83€**

1.2.4 Verification of model functionality and operational safety

After completing the assembly, we began testing the functional mock-up. The aim was to verify the correct wiring, the functioning of the control program, the system's response to changes in battery voltage, and its behaviour under various loads on the socket circuits.

First, we tested the control section (Arduino Nano, voltage and current measurement, Bluetooth) without 230 V voltage. Using an adjustable divider, we simulated battery depletion and monitored the gradual disconnection of circuits and shutdown of the converter.

Then we tested the power section. After switching on the converter, we verified the correct switching of relays K1, K2, and K3 with a time delay. When the current exceeded 1, 2 A, the corresponding circuit automatically switched off and only switched on again after the current had dropped.

We also tested switching between the photovoltaic system and the distribution network via an automatic transfer switch. The system safely switched between sources without interrupting the power supply and never connected both sources at the same time. During the tests, we always worked under the supervision of a master electrician and followed safety regulations when working with 230 V.

1.2.5 Proposal and technical solution for a balcony photovoltaic power plant

For practical use, we have designed a photovoltaic power plant for apartment building balconies. Placing the panels directly on the balcony is the simplest solution, and there are already ready-made solutions available, such as the Raptor Solar Balustrade (Pic. 7). The disadvantage of such systems is their low output in relation to the available balcony area (approximately 440–450 Wp).

Pic. 7 Raptor photovoltaic railing

Source: https://www.hutermann.sk/produkt/balkonova-solarni-elektrarna-fve-600w-kompletni-sada?gad_source=1&gad_campaignid=17482286811&gbraid=0AAAAADDhc5eh03yp7PLD4OD_YEu6T8D7o&gclid=CjwKCAiAwNDMBhBfEiwAd7ti1KRLoxwq7og4RDfgxPw1OyssZhfWKRudHr-t48waYhU5jC5uZ8s22hoCARwQAvD_BwE

Our goal was to use classic balcony railings with a length of about 3.5 to 4 meters. With this length, a maximum output of approximately 440-450 Wp can be achieved, which we considered insufficient. Therefore, we chose the SOLARFAM balcony mounting system, which allows classic photovoltaic panels to be mounted on the balcony (Pic. 8).

Our system will be 24V, with 1180 Wp panels, a 24V LiFePO4 battery, an MPPT controller, an 800–1200 VA inverter, and consumption control via Arduino with current measurement and Bluetooth.

Pic. 8 Balcony mounting systems for solar panels Solarfam with bracket for solar panel on balcony
Source: https://www.tipa.sk/sk/drziak-pre-solarny-panel-na-balkon-solarfam/d-277291/?utm_source=google&utm_medium=cpc&utm_campaign=1%20%7C%20PLA%20%7C%20ALL%20%7C%203%20%7C%20ROAS&utm_id=2005253169&gad_source=1&gad_campaignid=2005253169&gbraid=0AAAAAC2B-Q2I7OhTBf8BLgjMLHgrJz1_R&gclid=CjwKCAiAncvMBhBEEiwA9GU_foPbA4bOhelhwdg-NJoa-UAlMku85iDIwTnXgwX7DKliQLCnVwwCSRoC7msQAvD_BwE

We have designed the following electrical components for our photovoltaic power plant:

1) Photovoltaic panels – price per unit €92.75

- 2× JA Solar 590 W bifacial (total 1.18 kWp),
- Connection: SERIAL(2S),
  - Advantage: lower current in PV cables (≈ 14 A), lower losses,
  - VOC of one panel is ~48.5 V, total ~97 V (may increase in winter, therefore we choose MPPT with higher PV input),

2) MPPT controller (24 V battery) - price per unit €214.60

Recommendation: EPEVER Tracer 6415AN (150 V / 60 A**)**

- Can handle a 24 V battery and PV input up to 150 V (suitable for 2 panels in series)
- Power output: 1.18 kWp / 24 V ≈ 49 A → 60 A controller is OK

3) The LiFePO4 150 Ah (≈3,840Wh) battery (25.6 V) is suitable for a ~1 kW inverter, price per unit €738.

4) Converter 24 V → 230 V, price per unit €92.50

We want the converter to have a pure sine wave of at least 1000 W (ideally 1200 W if you want a reserve), Green Cell 24 V 500 W / 1000 W

5) Protective and mounting material (inexpensive and important):

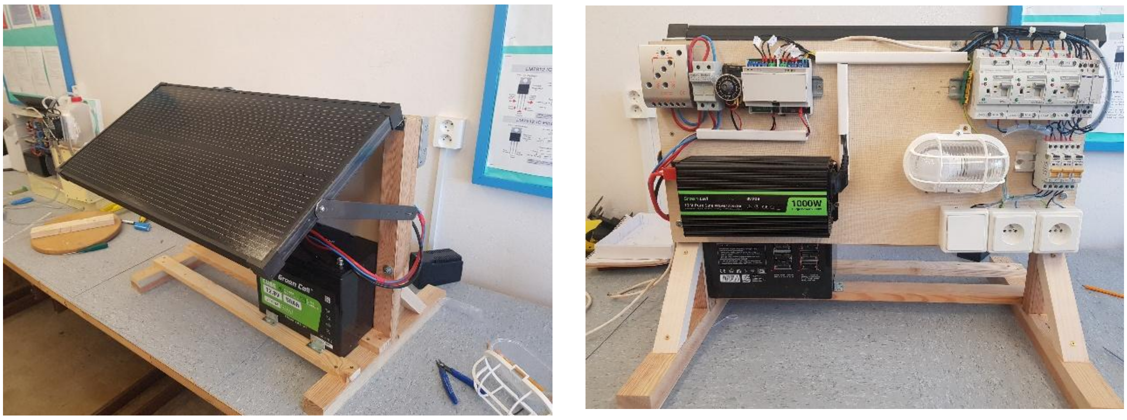
price per unit15.49

DC circuit breaker Tongou 63A 2P (DIN)

MC4 connectors + parallel/serial connection, Price 1.50

6) PV cable (DC side)

The costs of a real photovoltaic power plant with management without labour costs are shown in Table 3 and amount to €1515.



Pic. 9 The final product of our system

Table 2 Real photovoltaic power plant costs with labour-free management

Name of electrical component	Number of items	Cost per unit	Total cost
Control unit	1	25,15€	25,15€
Solarfam balcony mounting system	1	36€	36€
Solar panel	1	92,75€	185,5€
EPEVER Tracer 6415AN (150 V / 60 A)	1	216,6€	216,6€
Battery for photovoltaics	1	738€	738€
Fuse base with fuse	1	15,93€	15,95€
Converter Green Cell 24 V 500 W / 1000 W	1	92,5€	92,5€
ATS- CHINA	3	26€	78€
Contactor 1P 230V 2xNO	2	8,30€	16,6€
RCBO B16/0,03	3	23€	69€
Mega holder and 125 A fuse	1	8€.	8€.
Cable CYA 35=H07V-K	1	13€.	13€.
Wire clips	1	20€.	20€.
Total			**1514,60€.**

1.2.6 Project benefits

The proposed control system for a small photovoltaic power plant has technical, economic, safety, and educational advantages. The solution is designed to be suitable for apartment buildings, affordable, and safe.

Technical benefits:

- Intelligent power management – the system automatically turns circuits on and off depending on the battery status.
- Classification of appliances according to importance – they are divided into three groups. The most important group (lighting) has priority.
- Battery protection – the system prevents deep discharge by switching off the inverter at low voltage.
- Converter protection – in the event of high current, the relevant circuit is automatically disconnected.
- Safe switching of sources – an automatic switch prevents the simultaneous connection of photovoltaics and the distribution network.
- Wireless monitoring – users can monitor battery status, load, and system operation via Bluetooth.

Safety benefits:

- Prevents energy from flowing back into the grid.
- The control section is galvanically isolated from the power section.
- Safety is ensured by protective elements.
- The system automatically shuts down in the event of a malfunction or battery discharge.
- It is designed for safe long-term operation.

Economic benefits:

- Annual electricity production is approximately 1,420 kWh (under ideal conditions).
- Annual savings are approximately €284 at a price of €0.20/kWh.
- The return on investment is approximately 5.3 years.
- The system helps reduce household electricity costs.

Practical benefits:

- Use of photovoltaics in an apartment in an apartment building.
- Installation of the system on a balcony.
- Safe switching between the inverter and the distribution network.
- Consumption management without the need for permits (no parallel connection to the grid).
- Protection of the system against overload and damage.
- The solution is simple, modular, and expandable.

Environmental benefits

- Reduction in electricity consumption from the grid.
- Indirect reduction in CO_2 emissions.
- Promotion of renewable energy sources.
- Promotion of economical and environmentally friendly behaviour.

Educational benefits:

- Creation of a functional model as a teaching aid.
- Combining theory with practice.
- Use in professional training and presentations.
- Development of technical skills in electrical engineering, programming, and renewable energy sources.

The proposed solution represents a safe, economically returnable and technically workable system of a small photovoltaic power plant for apartment buildings. In addition to financial savings, it also brings environmental and educational benefits and supports a modern approach to the use of renewable energy sources.

2 ESTIMATED FINANCIAL BUDGET

To estimate annual electricity production and return on investment, we consider ideal conditions for photovoltaic power plant operation. We assume that the panels face south, have the correct inclination, and are not shaded. We also assume that the household will use 100% of the electricity produced. Since this is an OFF-GRID system with a battery, the energy produced during the day is stored in the battery. This energy can be used in the evening or at night. This results in better utilization of the electricity produced and higher system efficiency.

According to available sources, the annual specific power output in Slovakia ranges from approximately 900 to 1,250 kWh/kWp per year, depending on the location and conditions. For ideal conditions, we will choose a value close to the upper limit of this range: Yideal=1200 kWh/kWp/year

Calculation of annual production for our system

Installed capacity of the proposed panels: P=2×590 Wp=1180 Wp=1.18 kWp

Annual electricity production is calculated as follows: Erok=P×Yideal

Substitution: Erok=1.18×1200=1416 kWh/year

Result (ideal condition): **Erok= 1420kWh/year**

Return on investment

Our estimate of annual production and return on investment is based on ideal conditions for photovoltaic power plant operation. We assume that the panels are south-facing, have the correct angle of inclination, are not shaded, and that 100% of the energy produced is used in the household. Since this is an OFF-GRID system with storage, the electricity generated during the day can be stored in a battery and then consumed at night, maximizing self-consumption of energy. This achieves maximum utilization of the energy produced and increases the efficiency of the entire system.

1. Installed system capacity

Two photovoltaic panels with an output of 590 Wp are used:

P = 2 × 590 Wp = 1180 Wp = 1.18 kWp

2. **Estimated specific output**

For ideal conditions in Slovakia, we consider a specific annual output of 1200 kWh/kWp/year.

3. **Annual electricity production**

E_year = 1.18 × 1200 = 1416 kWh/year Rounded: approximately 1,420 kWh/year

4. Annual financial savings (at 100% utilization)

At an electricity price of €0.20/kWh:

U_year = 1416 × 0.20 = €283.2

Rounded: approximately **€284/year**

5. Return on investment

Total investment costs: €1,513.28

T = 1,513.28 / 283.2 ≈ 5.34 years

Rounded: approximately **5.3 years**

In an ideal model, with 100% utilization of the energy produced, the proposed system with an output of 1.18 kWp can produce approximately **1,420 kWh** of electricity per year. At an electricity price of €0.20/kWh, this represents a saving of approximately €284 per year. This results in a return on investment of approximately **5.3 years**.

If we consider that the apartment building has, for example, 5 entrances, 4 floors, and 3 apartments on each floor, the savings would be €**17,040.**

Photovoltaics in apartments and family homes can be financed from state subsidies, bank loans, personal savings, or through a residential building repair fund. The most common approach is to use a combination of subsidies and personal funds, which significantly shortens the return on investment. Examples of additional financing for family homes:

1. State subsidies - Slovak Innovation and Energy Agency – Green Households program:
    - The most well-known support program for households.
    - Subsidies for photovoltaic panels, batteries, and controllers.
    - Intended for family homes and apartments (e.g., balcony systems).
    - The subsidy can cover a significant portion of the cost of the equipment.

- The goal is to increase the use of renewable energy sources.

2. *Bank loans and "green" loans:*
   - Consumer loans for renewable energy sources.
   - Special eco-friendly (green) loans with lower interest rates.
   - Option to repay the investment from savings on electricity costs.
3. *Self-financing:*
   - One-time investment from savings.
   - The simplest solution without administration.
   - The fastest return on investment, as no interest is paid.
4. *EU funds (indirect):*
   - Financing through EU-supported state programs.
   - Focused on reducing energy consumption and emissions.

Funding for apartment buildings:

- Apartment building repair fund.
- Investment through the homeowners' association.
- Shared installation on the roof or balconies.
- Combination of multiple sources—subsidy + own funds or subsidy + loan.

CONCLUSION

The aim of the work was to design and verify a system for managing the consumption of electricity generated by a small photovoltaic power plant using ???? in an apartment building. We focused on the safe and efficient use of the energy generated, battery protection, and automatic switching of appliances between the inverter and the distribution network.

In the theoretical part, we covered the basic principles of photovoltaics, panel construction, and the classification of photovoltaic systems into ON-GRID, OFF-GRID, and hybrid. The practical part focused on the design and implementation of a functional model that demonstrates consumption control using a microcontroller, voltage and current measurement in consumer circuits, and wireless data display. The solution also includes an automatic transfer switch that ensures safe separation of the inverter from the distribution network and prevents reverse power flow into the network.

When testing the mock-up, we verified the correct functionality of the control system, the system's response to a drop in battery voltage, behaviour during circuit overload, and safe switching of the power supply to the distribution network in the event of a failure or shutdown of the converter.

In our proposal for a realistic solution for an apartment building, we designed a balcony installation with an output of 1.18 kWp and storage using a 24 V LiFePO4 150 Ah battery. Under ideal conditions, we calculated an annual electricity production of approximately 1,420 kWh. An economic calculation based on 100% utilization of the energy produced shows a return on investment of approximately 5 to 6 years, although in real operation, the return on investment may be affected by losses from the inverter, battery charging and discharging, and installation conditions.

The result of this work is a functional and safe consumption management model that can be used as a teaching aid in vocational education and also provides a practical basis for real-life solutions for balcony photovoltaic power plants in apartment buildings.

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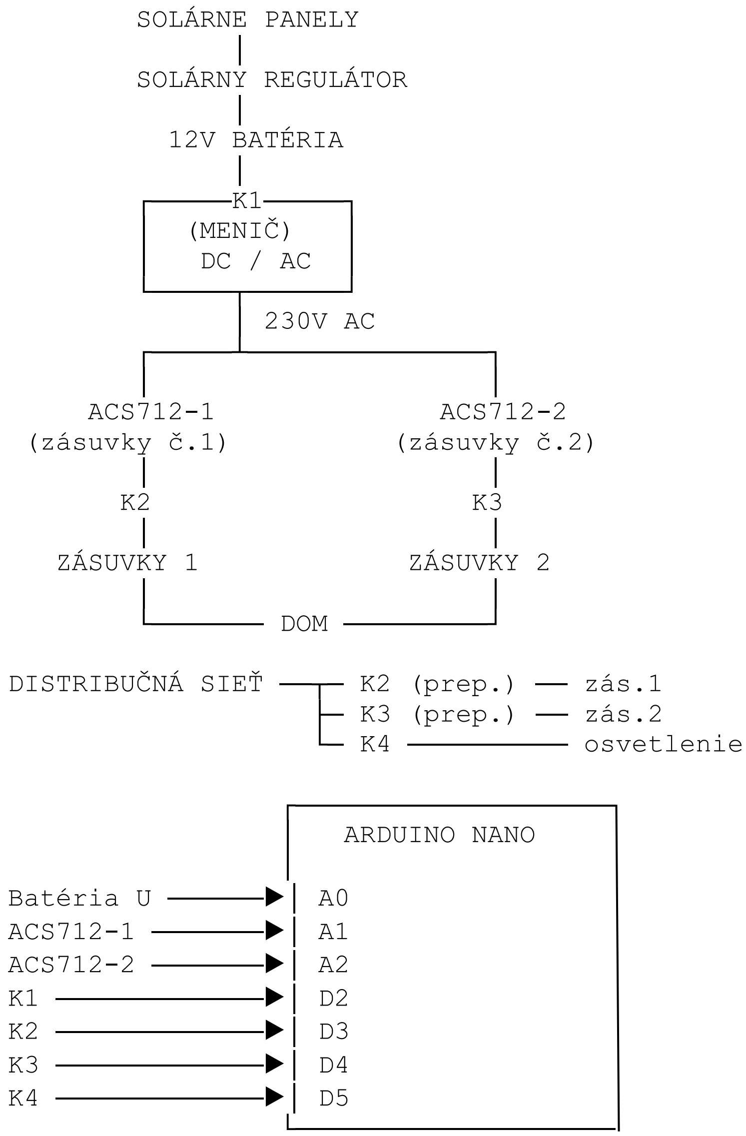
LIST OF ATTACHMENTS

APPENDIX A - SYSTEM BLOCK DIAGRAM (logical)

APPENDIX B - PHOTOVOLTAIC POWER PLANT CONNECTION DIAGRAM

APPENDIX C - DIAGRAM OF CONNECTION OF RESIDENTIAL DISTRIBUTION SYSTEMS WITH CONTROL AND PHOTOVOLTAIC POWER PLANT

APPENDIX A - SYSTEM BLOCK DIAGRAM (logical)



ZAPOJENIE PINOV – Arduino Nano

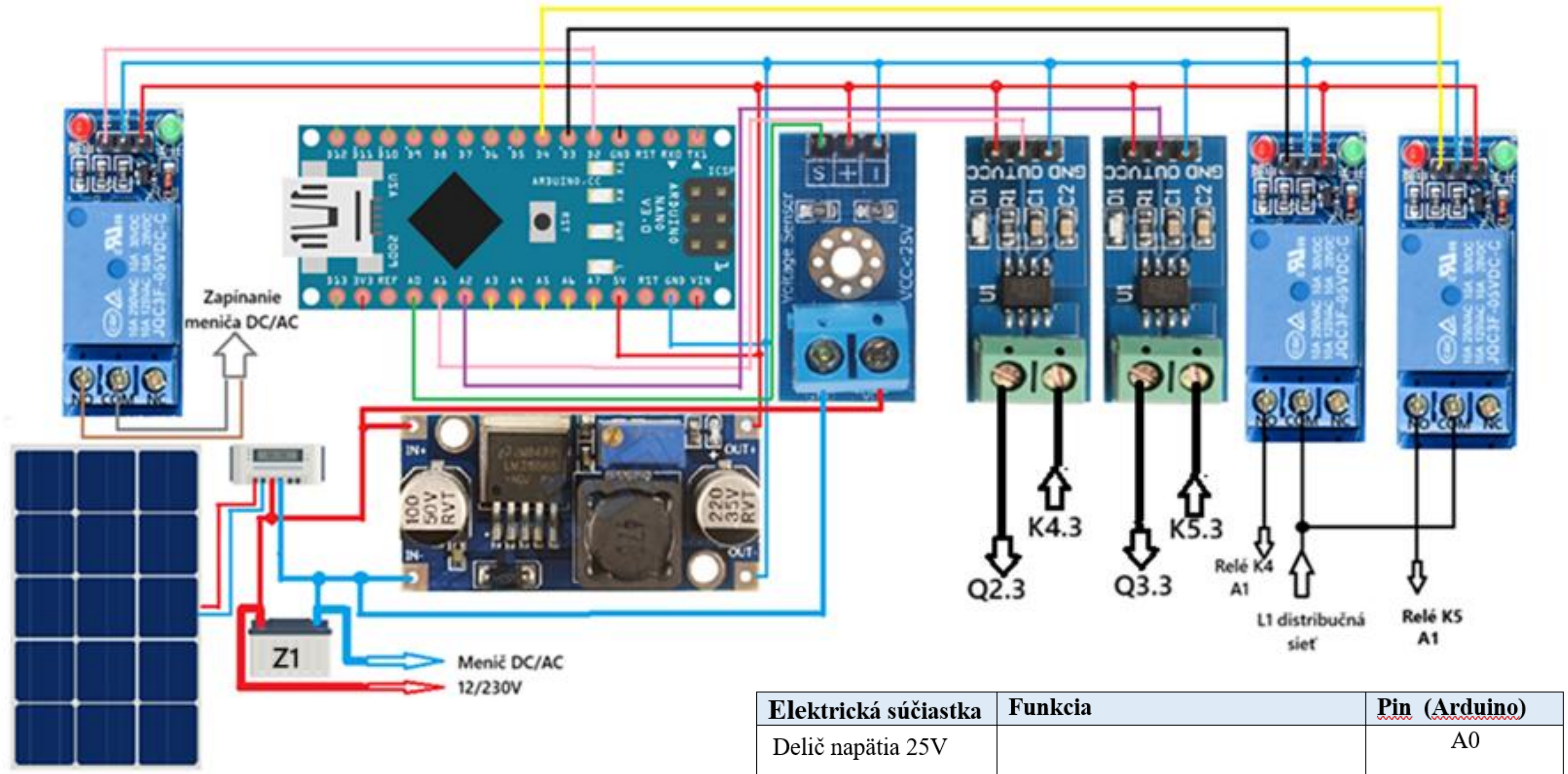
Analógové vstupy

Funkcia	Pin
Delič napätia 25V	A0
ACS712 – zásuvky 1	A1
ACS712 – zásuvky 2	A2

Digitálne výstupy (relé)

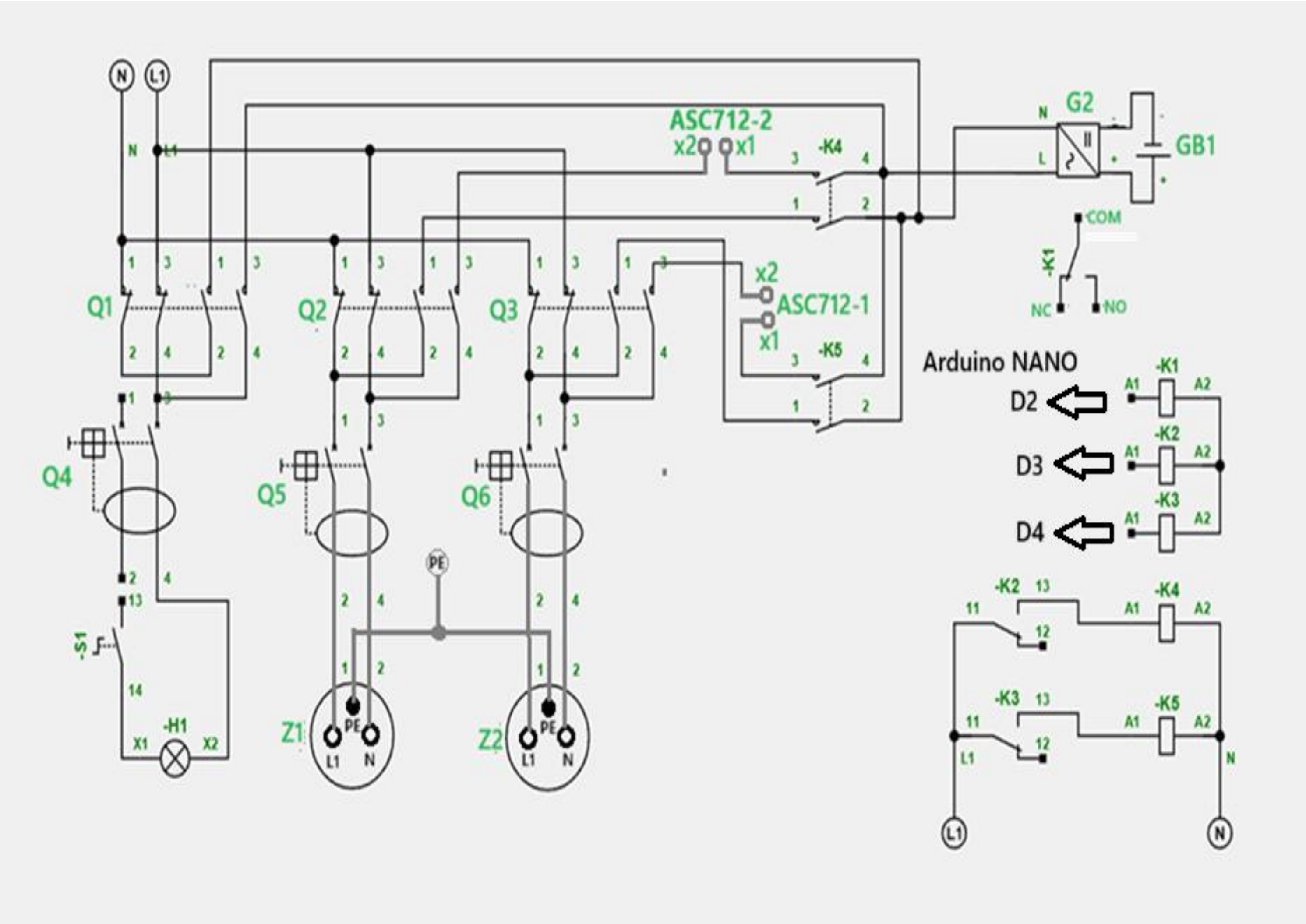
Relé	Funkcia	Pin
K1	zapnutie meniča	D2
K2	zásuvkový okruh č.1 (prepínanie)	D3
K3	zásuvkový okruh č.2 (prepínanie)	D4
K4	osvetlenie	D5

APPENDIX B - PHOTOVOLTAIC POWER PLANT CONNECTION DIAGRAM



Elektrická súčiastka	Funkcia	Pin (Arduino)
Delič napätia 25V		A0
ACS712-1	zásuvky 1	A1
ACS712-2	zásuvky 2	A2
Relé K1	zapnutie a vypnutie meniča DC/AC	D2
Relé K2	zásuvkový okruh č.1	D3
Relé K3	zásuvkový okruh č.2	D4

APPENDIX C - DIAGRAM OF CONNECTION OF RESIDENTIAL DISTRIBUTION SYSTEMS WITH CONTROL AND PHOTOVOLTAIC POWER PLANT



Názov súčiastky	označenie
ATS	Q1,Q2,Q3
RCBO	Q4,Q5,Q6
Spínač č.1	S1
Svietidlo	H1
Zásuvky	Z1,Z2
Relé 5V vyp. a zap. meniča	K1
Relé 5V	K2
Relé 5V	K3
1P stýkač-riadi zásuvkový okruh 1	K4
1P stýkač-riadi zásuvkový okruh 2	K5
ASC 7812-1 snímač prúdu	X1-X2
ASC7812-2 snímač prúdu	X1-X2