"The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Interreg V-A "Greece-Bulgaria 2014-2020" Cooperation Programme
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Preven-T

PREVEN-T DELIVERABLE 1.Del.5.2.1_Upgraded Information Center and Development of a Laboratory

Authors:	Military Academy General Mihailo Aapostolski [MAGMA]
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PREVEN-T Project Profile

Grant Agreement No.: PREVEN-T – CN2 – SO2.4 – SC049

Acronym:	PREVEN-T
Title:	PREVEN-T – Modern Tools for wildfires' and Floods' Risk punctual forecast and monitoring and innovative techniques for citizens' safeguard awareness and preparedness
URL:	http://www.preven-t.eu/ - http://prevent.the.ihu.gr/ (NOT OFFICIAL - temporal)
Start Date:	03/03/2022
Duration:	18 months

Partners

INTERNATIONAL HELLENIC UNIVERSITY	International Hellenic University (IHU)	Greece
	Military Academy "General Mihailo Apostolski" (MAGMA)	RNM
	National Park Pelister	RNM

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Abbreviations and acronyms

Deliverable	D
Expected Outcomes	EO
International Hellenic University	IHU
Non-governmental organization	NGO
Military Academy General Mihailo Apostolski	MAGMA

Executive Summary

PREVEN-T is a 18 month duration project funding from the Interreg IPA Cross-border Cooperation Programme: PREVEN-T – CN2 – SO2.4 – SC049.

The overarching objective of the PREVEN-T project is to improve the operational efficiency and the administrative capacity of relevant services in natural disasters management. At the same time project's goal is to enable education, awareness, and sensitization of the local population, so that in cooperation with the competent authorities to have a coordinated action to deal with Natural and Technological Disasters and Risks. In particular, the project focuses on using innovative ICT tools and models aims at developing actions at four levels of natural disasters management:1. Planning level: Development of rapid-response forecasting models (Information System for monitoring of fire detection and early warning, surface water and fragile vegetation pollution model, high-resolution weather model, hydrological model) 2. Prevention level: Organizing Educational and Training Seminars (e-learning platform) for students, Citizens and Civil Protection Authorities staff.

The main purpose of this document is to a report the progress of the PREVEN-T project during the deliverable D 5.2.1

Table of Contents

1 Introduction

1.1 Purpose of the document

The purpose of this document is to present the progress of the project during the eighteen (18) months regarding the implemented research activities as they are reported in the grant agreement.

1.2 Intended audience

The intended audience of this document consists of the following target groups:

- PREVEN-T project partners and the Project Officer at the Managing Authority

1.3 Work Package Objective

The current deliverable D 5.2.1 is related to the development of a Laboratory for educational and research purposes in MAGMA's premises in continuous connection with the information center of P3 (NP Pelister). MAGMA is responsible for providing adequate facilities for establishing the laboratory, procuring the envisaged equipment, and making all installation actions for its effective use.

1.4 Structure of the document

In Chapter 2, this report presents the activities related to establishing a Laboratory for educational and research purposes at MAGMA's premises in the reporting period.

In Chapter 3, this report describes the actions that were taken to fully integrate the Laboratory for educational and research purposes at MAGMA's premises with the Information Center in NP Pelister.

2 Research aims and methodology

2.1 Research aims

The findings presented in this report are based on the detailed planning and research made by MAGMA's team for the establishing a Laboratory for educational and research purposes. This laboratory is planned to be utilized for conducting educational and research activities, i.e., at all levels of education for the first, second and third cycle of studies at MAGMA, including cadets, MSc and doctoral level students. Moreover, the laboratory's aim is directly related to the implementation of the MSc curricula which are to be developed at a later stage of the project. It is important to mention that this laboratory also has the role of serving as an operational center in which part of the data regarding forest fires would be processed and sent to the server located at NP Pelister.

2.2 Methodological framework

For the purpose of providing suitable conditions for establishing a fully functional laboratory meant for education and research, MAGMA first of all designated premises in which it is to be created by installing the equipment procured via the project and also contributing with its own means. In order to carry out educational and research activities in the envisaged Laboratory for the project, MAGMA's team took into consideration the educational needs of eligible candidates from all three cycle of studies offered at the Military Academy, including both cadets and civilian students in the areas of crisis management and protection and rescue with a view of foreseen activities to be conducted both educationally and in terms of research.

Moreover, they paid special attention to the necessary learning environment to be provided to the students who are going to attend the MSc studies according to the curriculum which is to be created at a later stage in the project in cooperation with IHU.

With the procurement of the necessary technological equipment and the precise planning of the connection between MAGMA and the operational center in NP Pelister from key expert from P2, the implementation process is now complete. A seamless flow of wildfire data was achieved, processed at the Military Academy and transmitted to the server located within the operations center. MAGMA has finalized the P3 equipment procurement process to establish the connection, marking the successful deployment of the entire system. Moreover, the information system's functionality is now guaranteed, by the collaborative endeavors of the P3 experts and the dedicated MAGMA team in successfully establishing the system. It is worth mentioning, that the equipment on the part of MAGMA was procured and is being set up in the premises designated for the laboratory according to the mentioned criteria.

3 Integration of the Laboratory with the Operational Center in P3

With the procurement process now finalized and all necessary steps completed, MAGMA has effectively integrated its laboratory with the operational center located in P3 (NP Pelister), ensuring the full functionality of the information system. The equipment, once acquired by NP Pelister for its operational center, is now seamlessly sending data to MAGMA for processing. Subsequently, this processed data is returned for further utilization, perfectly aligning with the project's objectives for efficient forest fire detection.

Moreover, the successful implementation of the information system also relies on the active engagement of experts by P2 (MAGMA) and by P3 (NP Pelister). With the procurement and integration phases accomplished, these experts will work in close collaboration with MAGMA to establish a robust connection, conduct thorough testing for effectiveness, and ultimately render the system fully operational. This joint effort symbolizes the successful realization of our goals in enhancing forest fire prevention and detection.

4 Conclusions and recommendations

During the reporting period, MAGMA diligently prepared for the successful implementation of D5.2.1, laying the foundation for forthcoming collaborative efforts with project partners. MAGMA's team secured suitable premises for the laboratory, procured all necessary equipment, and completed the installation process. In collaboration with the project team from P3, the laboratory has been seamlessly integrated with P3's operational center, enhancing the system's capabilities for data sharing, processing, and its primary objective of forest fire detection, early warning, and prevention.

As a recommendation, it can be said that is necessary to regularly evaluate the system's performance and consider ongoing upgrades and technological advancements. This proactive approach will help maintain the system's effectiveness and ensure its adaptability to changing environmental conditions, preserving its long-term impact on forest fire prevention.

• References

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Preven-T

PREVEN-T DELIVERABLE D.5.3 Development of a Laboratory for educational and research purposes in the premises of MAGMA, and Connecting MAGMA Laboratory with NPP Information Center

Authors:	National Park Pelister / Key expert Goce Stevanoski MAGMA / Key expert Monika Kachurova
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PREVEN-T Project Profile

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	National Park Pelister (NPP)	RNM

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Abbreviations and acronyms

Deliverable	D
Expected Outcomes	EO
International Hellenic University	IHU
Non-governmental organization	NGO
Military Academy General Mihailo Apostolski	MAGMA
National Park Pelister	NPP
Virtual Private Network	VPN
Network Attached Storage	NAS

Executive Summary

PREVEN-T is a 18 month duration project funding from the Interreg IPA Cross-border Cooperation Programme: PREVEN-T – CN2 – SO2.4 – SC049.

The overarching objective of the PREVEN-T project is to is to improve the operational efficiency and the administrative capacity of relevant services in natural disaster management. At the same time the project's goal is to enable education, awareness, and sensitization of the local population so that in cooperation with the competent authorities to have coordinated action to deal with Natural and Technological Disasters and Risks.

The main purpose of this document is to report the progress of the PREVEN-T project during deliverable 5.1 that is focused on the development of a laboratory at the Military Academy - Skopje focused on fire detection monitoring, modeling, training, and research and connecting MAGMA Laboratory with NPP Information Centre for enabling of real-time communication and collaboration between researchers and experts from MAGMA and NPP, fostering a collaborative environment for joint projects, knowledge sharing, and expertise utilization.

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List of Figures & Tables

1 Introduction

1.1 Purpose of the document

The purpose of this document is to present the progress in delivering D5.3 which is a development of a laboratory at the Military Academy - Skopje, focused on fire detection monitoring, modeling, training, and research and creation of connection between MAGMA Laboratory with NPP Information Center. The deliverable aims to leveraging advanced technologies and cooperation between MAGMA and NPP to achieve the following objective:

Development of a Laboratory for educational and research purposes in the premises of P2, which will be in continuous connection with P3' s information center. (defined as a deliverable D5.3.2 in the project).

Connecting MAGMA Laboratory with NPP Information Center (defined as a deliverable D5.3.1 in the project). Establish a secure and reliable connection between the MAGMA laboratory and the information center of NPP to facilitate seamless data exchange and collaboration between the two entities.

1.2 Intended audience.

The intended audience of this document consists of the following target audience PREVEN-T project partners and the Project Officer at the Managing Authority.

1.3 Work Package Objective

The current technical report refers to WP5 where it's main objective is an upgrade of the existing Information Center in Pelister and connecting it to MAGMA laboratory for educational and research purposes.

1.4 Structure of the document

The document presents the progress in deliverable D5.3.1 and D5.3.2 in the following sections: Methodology, System Architecture, Technology stack and tools, System Features and Functionality.

2 Methodology

2.1 Description of the Research/Design Methodology Used:

The development of the Early Forest Fire Detection and Early Warning Information System, that is connecting MAGMA laboratory and NPP employed a combination of prototyping and experimental research methodologies. The process started on 1st of March 2023 lasted until 31st March 2023, and allowed iterative design improvements and the validation of system components through various testing. The following steps outline the methodology used:

a. Prototyping: The development process began with creating preliminary prototypes of the information system. These prototypes acted as proof-of-concept models, which helped in understanding the system's basic functionalities and identifying potential design flaws.
b. Experimental Research: Based on the initial prototypes, various experiments were conducted to test the data processing techniques and communication protocols.
c. Feedback Loop: The experimental results and user feedback from field experts were continually incorporated into the system's design to refine its capabilities further.

3 System Architecture

The Early Forest Fire Detection and Early Warning Information System's high-level architecture, outlined in figure 1, plays a pivotal role in achieving the system's objectives. The architecture has been meticulously designed to provide on-demand access to visual imagery, process real-time sensor data, enable early fire detection, and issue prompt alerts to authorized personnel. Additionally, it emphasizes scalability, security, and compliance with relevant regulations and standards.

The architecture diagram in Figure 1 visually represents the interconnected modules, data pathways, and communication channels that underpin the system's seamless operations. Each component's role and functionality are detailed in the appendix, providing stakeholders, technical experts, and interested parties with a clear understanding of the system's operations.

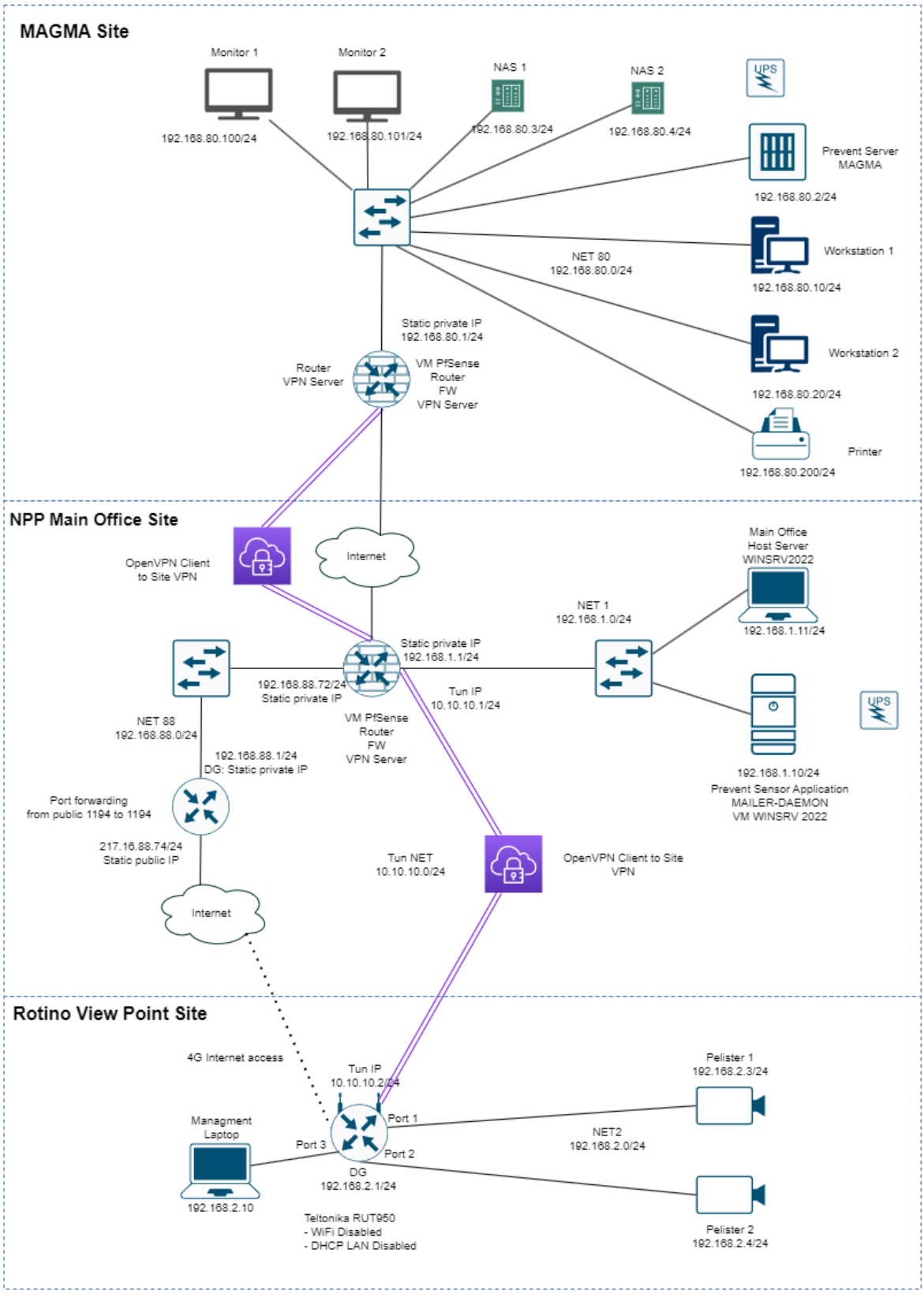

Figure 2 System Architecture

4 Technology stack and tools used

The successful connection between MAGMA laboratory and NPP Information Center was made possible by an integrating technology stack comprising a wide range of tools. This comprehensive technology stack enabled seamless data processing, real-time monitoring, secure communication, and efficient collaboration. The key components of the technology stack include:

4.1 Hardware components

DELL servers Installation:

Characteristics: The servers possesse high-performance attributes, redundant power supply, multiple network connections, and storage capacity.

Purpose: The servers assume the role of the laboratory's digital nucleus. It hosts and powers fire detection algorithms, modeling software, and data analysis tools, effectively supporting real-time processing and efficient data storage.

Figure 2: Servers

Smart Board Installation:

Equipment: 1 Smart Board with Portable Stand

Characteristics: The smart board boasts a 55'' 4K UHD display with interactive touch capabilities, along with versatile connectivity options, built-in speakers, and wireless screen mirroring.

Purpose: The smart board metamorphoses into an engaging platform for training sessions, collaborative workshops, and visually dynamic presentations. Its tactile interaction capabilities facilitate immersive learning and sharing experiences.

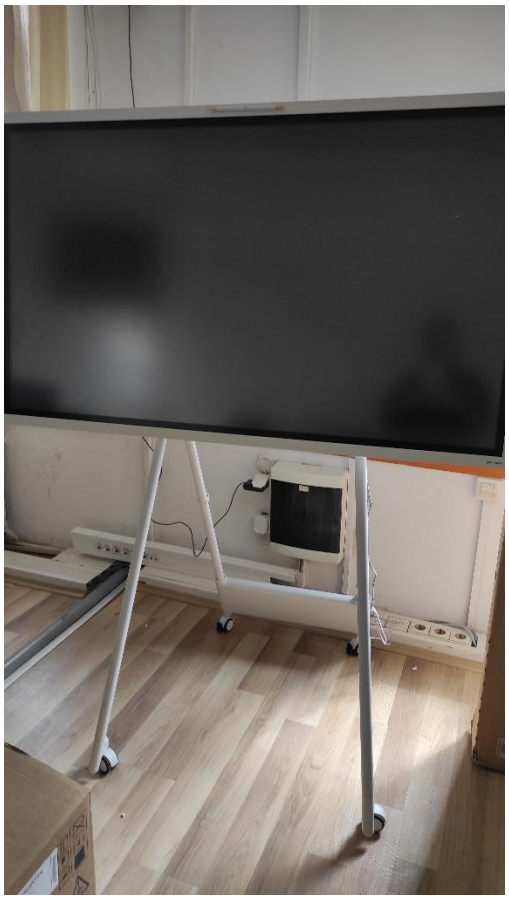

Figure 3: Smartboard

Projector Installation:

Equipment: 4 Projectors with Mounts

Characteristics: The projectors are equipped with Full HD resolution, integrated media players, multiple connectivity alternatives (Wi-Fi, USB, HDMI), and built-in stereo speakers.

Figure 4: Projectors

Colour Printer Installation:

Equipment: 1 Colour Multifunctional Printer

Characteristics: The printer, tailored for A4 format, features high-resolution color printing, scanning, and copying capabilities.

Purpose: The printer takes on the vital role of producing training materials, research documents, and informative content about fire detection, management, and training.

Figure 5: Colour Printer

TV Installation:

Equipment: 2 LED TVs

Characteristics: With 65" 4K Ultra HD resolution, the TVs embrace the Smart TV platform and host a plethora of connectivity options (HDMI, USB, Wi-Fi). An integrated tuner adds to their functionality.

Purpose: The TVs metamorphose into dynamic visual platforms, rendering real-time fire detection data, training materials, and research presentations with astounding clarity and impact.

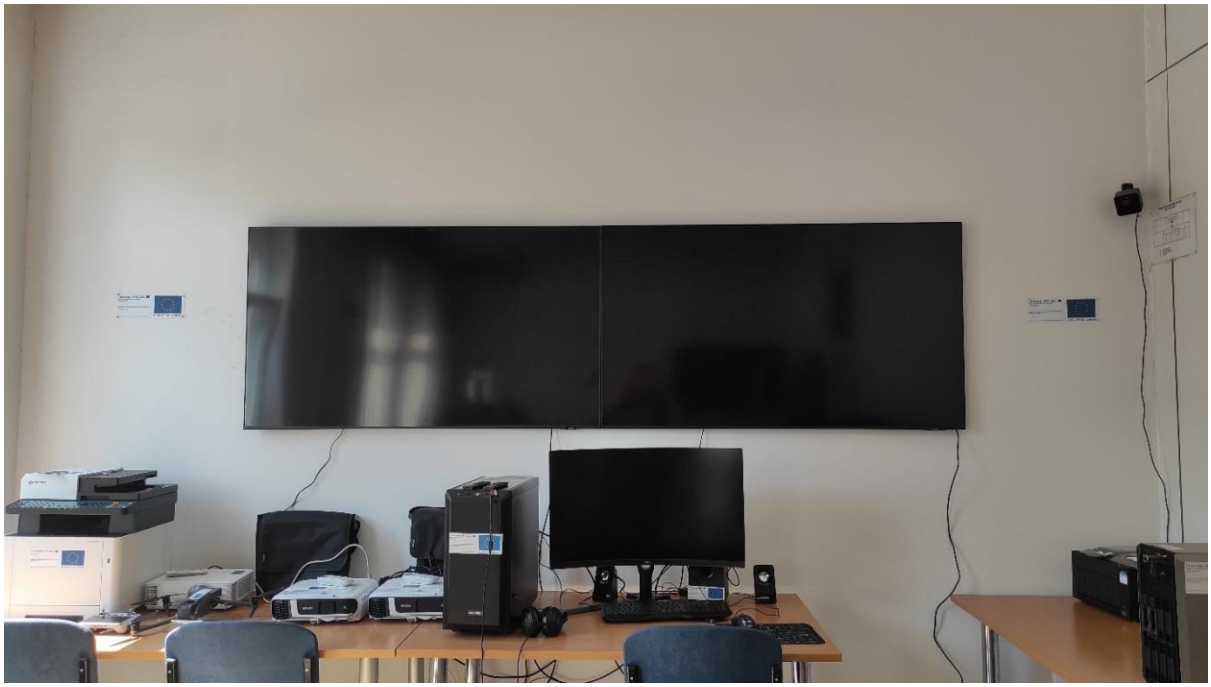

Figure 6: TV displays

Workstations Installation:

Equipment: High-performance Workstations

Characteristics: Boasting robust processors, ample RAM, advanced graphic cards, and diverse connectivity options, the workstations are tailored for high-performance computing, data analysis, modeling, and training simulations.

Purpose: The workstations provide researchers and trainees with the power and resources required to efficiently execute complex tasks, contributing to heightened productivity, and streamlined research endeavors.

Figure 7: Workstation

360° Camera Installation:

Equipment: 1- 360° Camera

Characteristics: This innovative camera captures panoramic 360-degree images and videos, complete with an integrated microphone and high-resolution output.

Purpose: The 360° camera lends itself to the creation of immersive visual content. It becomes an asset for fire incident documentation, virtual tours, and training scenarios, elevating the laboratory's capabilities.

Figure 8: 360° Camera

Uninterruptible Power Supply (UPS) and NAS Storage Installation:

Equipment: 2 UPS and 2 NAS Storage Units

Characteristics: The UPS units offer critical backup power and surge protection. Meanwhile, NAS storage units provide secure, high-capacity data storage solutions.

Purpose: The UPS unit ensures the laboratory's continuous operation during power disruptions, safeguarding against data loss. The NAS storage units enable secure data storage and swift retrieval, fortifying the laboratory's data management capabilities.

Figure 9: Uninterruptible Power Supply (UPS) and NAS Storage

IP Camera Installation:

Equipment: 2 IP Cameras

Characteristics: With Full HD video resolution, integrated microphones, and advanced capabilities such as motion tracking and sound detection, the IP cameras bolster real-time environment monitoring.

Purpose: The IP cameras assume the role of monitoring the laboratory in real-time. They provide a robust foundation for remote surveillance, enhancing overall security measures.

Figure 10: Ip cameras

4.2 Software components

Microsoft Server Infrastructure: The system's backend was powered by Microsoft Server Infrastructure, providing a reliable and scalable foundation for data storage, management, and processing.

pfSense®: PfSense, a powerful open-source firewall and routing platform, played a critical role in securing the system's network infrastructure. It provided advanced firewall capabilities, traffic shaping, and network monitoring, ensuring a high level of network security and performance.

OpenVPN: The implementation of OpenVPN allowed for secure and encrypted communication between remote devices/sensors and the central information system. This ensured that sensitive data transmitted over the internet remained protected from potential threats.

Networking Tools: Various networking tools, such as Wireshark and Nmap, were employed for network analysis, troubleshooting, and monitoring. These tools offered insights into network performance and helped identify and resolve potential bottlenecks.

5. Implementing measures for information security and business continuity

This task main objective was to establish a comprehensive framework for information security and business continuity, ensuring the safety of critical data, equipment, and operational processes.

Risk Assessment: A comprehensive risk assessment was carried out to identify potential vulnerabilities and threats. This included an analysis of various scenarios, such as cyberattacks, hardware failures, natural disasters, and unauthorized access. This assessment formed the basis for developing targeted security measures and strategies to mitigate risks.

Security Policies and Procedures: Stringent information security policies and procedures were developed, documented, and implemented. These guidelines defined best practices for data protection, access control, incident response, and other security-related aspects. Ensuring compliance with these protocols was crucial for building a resilient security posture.

Access Control Measures: Robust role-based access control mechanisms were deployed to restrict access to sensitive data and systems. By allowing only authorized personnel with relevant roles to access critical information, the laboratory minimized the risk of unauthorized exposure.

Data Encryption: Advanced encryption protocols were integrated to ensure the security of data during transmission and storage. Encryption at rest and in transit rendered data indecipherable to unauthorized individuals, even if accessed.

Firewall and Intrusion Detection Systems: Firewalls and intrusion detection systems were put in place to continuously monitor network traffic for any unusual activities or attempted breaches. These systems provided an immediate response to potential security threats.

Regular Security Audits: Frequent security audits were conducted to evaluate the effectiveness of existing security measures. These audits identified vulnerabilities and weaknesses that might otherwise remain unnoticed, allowing prompt mitigation.

Incident Response Plan: A comprehensive incident response plan was established, outlining well-defined procedures for managing and mitigating security incidents. Roles and responsibilities were clearly defined to ensure a coordinated response during breach incidents.

Data Backup and Recovery: A rigorous data backup strategy was implemented to safeguard against data loss due to hardware failures or corruption. Regular backups of critical data were stored in secure locations, allowing data to be restored in case of an incident.

Physical Security Measures: Physical security measures, including access controls, surveillance cameras, and secure equipment storage, were implemented within the laboratory premises. This ensured the prevention of unauthorized access and tampering.

Business Continuity Planning: A comprehensive business continuity plan was developed, outlining strategies to maintain operations during disruptions. Alternative workflows, backup locations, and communication channels were identified to ensure operational continuity.

6. Testing of the model and ensuring full capacity effectiveness

The primary goal of this task was to ensure the reliability, accuracy, and scalability of the laboratory's equipment, software applications, and systems.

Testing Protocols: A variety of testing protocols were developed and implemented to thoroughly evaluate the functionality of the laboratory's equipment and software applications. These protocols encompass functional testing, performance testing, integration testing, and user acceptance testing.

Functional Testing: Comprehensive functional testing was conducted on each piece of equipment and software application to ensure they performed according to their intended functionalities. This process involved simulated scenarios to verify that systems operated as expected.

Performance Testing: Performance testing assessed the laboratory's resources under varying loads to determine response times, throughput, and resource utilization. This testing identified potential bottlenecks and performance issues, enabling proactive optimizations.

Integration Testing: Integration testing examined the interoperability of different systems and software applications within the laboratory's architecture. This validation ensured seamless data exchange and communication between various components.

Capacity Assessment: An in-depth capacity assessment was conducted to evaluate the laboratory's ability to handle increased workloads and data processing demands. The assessment considered both current usage patterns and anticipated future requirements.

Scalability Testing: Scalability testing determined how well the laboratory's systems and applications could accommodate increased workloads. The laboratory's resources were stressed to their limits to assess whether they could scale effectively.

Resource Optimization: Based on the findings from testing, adjustments were made to optimize resource utilization and ensure efficient performance. This included hardware upgrades, software fine-tuning, and adjustments to data management processes.

Load Balancing: Load balancing mechanisms were implemented to distribute workloads evenly across systems and prevent resource congestion. This strategy ensured consistent performance even during peak usage.

Reliability Testing: Reliability testing involved subjecting the laboratory's systems to prolonged usage scenarios to assess their stability and resilience over time. The goal was to identify any potential degradation of performance or stability.

Capacity Planning: The capacity assessment findings were used to formulate a comprehensive capacity planning strategy. This strategy outlined how the laboratory would scale its resources and infrastructure to meet future demands.

5 System Features and Functionality

The connected partis are entitled to a comprehensive set of features and functionalities that enable efficient and proactive research, monitoring and detection of forest fires. These features include live streaming capabilities for real-time monitoring, on-demand visual overview of the designated forest area, and autonomous detection of forest fires with immediate alerting to authorized personnel.

5.1 Live Streaming Capabilities for Monitoring:

The system is equipped with live streaming capabilities that enable real-time monitoring of the designated forest area. This feature allows authorized personnel to access a live video feed from strategically placed cameras installed on Rotino Viewpoint. The live stream provides a continuous and up-to-date view of the forested region, allowing stakeholders to monitor the area closely for any signs of fire or potential fire hazards. The real-time video feed is essential for timely decision-making and immediate response to emerging fire incidents.

5.2 On-Demand Visual Overview of the Area:

In addition to live streaming, the system provides on-demand visual overviews of the designated forest area. Authorized users can access high-resolution images and visual data of the forest at any time through the system's user interface. These on-demand visual overviews offer a comprehensive and detailed snapshot of the entire forested region. Users can zoom in and out, pan across the area, and analyze the visual data to assess the forest's condition and identify potential fire risks. This feature allows for a more comprehensive analysis and planning, aiding forest management and emergency preparedness.

6 Conclusion

6.1 Recapitulation of Project's Purpose and Achievements

The primary purpose of the project was to develop and implement an Early Forest Fire Detection and Early Warning Information System. The project aimed to leverage advanced technology to detect forest fires at their early stages, enabling timely response and effective firefighting measures. Throughout the project, various activities were undertaken to achieve this objective in which one is the connection between MAGMA laboratory and NPP Information Center. The following key achievements were accomplished:

1. Comprehensive Project Documentation: The project successfully created and maintained comprehensive project documentation. This included administrative activities, progress reports, and organization and tracking of all project documents. The meticulous documentation ensured clear records of project activities, milestones, and outcomes, facilitating transparency and accountability.

2. Support for Communication Strategy Implementation: The project actively supported the implementation of the communication strategy set by the Contracting Authority. The team followed the Communication Plan, engaged in effective communication with project officers and partners, and ensured widespread dissemination of information about the program, its objectives, and benefits. This communication approach promoted public awareness and engagement, garnering support for the project.

3. Development of Network Physical and Logical Plans: The project successfully designed network physical and logical plans for system communication. This step ensured seamless data exchange and connectivity between remote sensors and the central information system, enabling real-time monitoring and data analysis.

4. Onsite Installation of Detection Equipment and System Infrastructure: The team executed onsite installation of the system infrastructure.

5. Communication with Laboratory System Infrastructure: The team established seamless communication with the laboratory system infrastructure. This integration facilitated data exchange and analysis between the forest fire detection system and the central information system, ensuring a comprehensive approach to fire detection and early warning.

6. Platform Testing and Documentation Preparation: The project conducted thorough testing of the information system platform to verify its performance and functionality. Additionally, the team prepared all necessary documentation for the information system, ensuring a well-documented and structured resource for system maintenance and future enhancements.

References