

INTERNATIONAL CONFERENCE ON TECHNOLOGY, ENGINEERING AND SCIENCE

November 12-15

Antalya/Turkiye

PROCEEDINGS BOOK

EDITOR
DR. MEHMET ÖZASLAN

 **ISRES**
Publishing

www.icontes.net

IConTES 2025

8th International Conference on Technology, Engineering and Science (IConTES)

Proceedings Book

Editor

Mehmet Ozaslan
Gaziantep University, Türkiye

ISBN: 978-625-6959-83-5

Copyright 2025

Published by the ISRES Publishing

Address: Askan Mah. Akinbey Sok. No: 5-A/Konya/Türkiye

Web: www.isres.org

Contact: isrespublishing@gmail.com

<https://2025.icontes.net>

Dates: November 12-15, 2025

Location: Antalya, Türkiye



This work is licensed under a [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-nc-sa/4.0/).

About Editor

Prof Dr. Mehmet Ozaslan

Department of Biology, Gaziantep University, Türkiye

Website: mehmetozaslan.com

E-mail: ozaslanmd@gantep.edu.tr

Language Editor

Lecturer Ceren Dogan

School of Foreign Languages, Necmettin Erbakan University, Türkiye

Email: cerendogan@erbakan.edu.tr

CONFERENCE PRESIDENTS

Mehmet Ozaslan - Gaziantep University, Türkiye

SCIENTIFIC BOARD

Bogdan Patrut - Alexandru Ioan Cuza Üniversitesi , Romania
Chalavadi Sulochana - Gulbarga University, India
Dariusz Jacek Jakóbczak - Technical University of Koszalin, Poland
Dehini Rachid -University of Bechar, Algeria
Eleonora Guseinoviene - Klaipeda University, Lithuania
Elena Krelja Kurelovic - Polytechnic of Rijeka, Croatia
Eva Trnova - Masaryk University, Czech Republic
Farhad Balash - Kharazmi University, Iran
Fundime Miri - University of Tirana, Albania
Gabriel Delgado-Toral - Universidad Nacional Autónoma de México, Mexico
Gordana Savic - University of Belgrade, Serbia
Grzegorz Woroniak,- Bialystok University of Technology, Poland
Irina Andreeva - Peter The Great St. Petersburg Polytechnic University, Russia
Isti Hidayah - Semarang State University, Indonesia
Joanna Piotrowska - Woroniak - Bialystok University of Technology, Poland
Jose Manuel Lopez Guede - University of Basque Country, Spain
Kamil Yurtkan - Cyprus International University, Cyprus
Katsina Christopher Bala - Federal University of Technology, Minna, Nigeria
Khitam Shraim - Palestine Technical University, Palestine
Marija Stanić - University of Kragujevac, Serbia
M. Hanefi Calp - Karadeniz Technical University, Türkiye
Mohamed Ahmed - Mansoura University, Egypt
Mousa Attom- American University of Sharjah, U.A.E.
Nicu Bizon - Pitesti University, Romania
Pandian Vasant - Teknology Petronas University, Romania
Rajnalkar Laxman - Gulbarga University, India
Sanaa Al-Delaimy - Mosul University, Iraq
Shadi Aljawarneh - Jordan University of Science and Technology, Jordan
Shynar Baimaganbetova - Nazarbayev University, Kazakhstan
Svetlana Khan - Almaty University of Power Engineering and Telecommunications, Kazakhstan
Yiyang Chen - Soochow University (CN), China
Zairi Ismael Rizman - MARA University of Technology, Malaysia
Zipporah Pawat Duguryil - Federal College of Education, Nigeria

ORGANIZING COMMITTEE

Aynur Aliyeva - Institute of Dendrology of Anas, Azerbaijan
Besnik Hajdari - University "Isa Boletini" Mitrovica, Kosovo
Cemil Aydogdu - Hacettepe University, Türkiye
Danielle Gonçalves de Oliveira Prado-Federal Technological University of Paraná, Brazil
Elman Iskender - Central Botanical Garden of Anas, Azerbaijan
Grzegorz Woroniak,- Bialystok University of Technology, Poland
Halil Snopce - South East European University, Macedonia
Ishtar Imad - Uruk University, Iraq
Joanna Piotrowska - Woroniak - Bialystok University of Technology, Poland
Jaya Bishnu Pradhan-Tribhuvan University, Mahendra Ratna Campus, Nepal

Mehmet Özaslan - Gaziantep University, Türkiye
Mohammad Sarwar - Scialert, Dubai, United Arab Emirates
Murat Beytur - Kafkas University, Türkiye
Samire Bagirova - Institute of Dendrology of Anas, Azerbaijan
Shafag Bagirova - Baku State University, Azerbaijan
Suhail Bayati - Hadi University College, Iraq
Zairi Ismael Rizman - MARA University of Technology, Malaysia

Editorial Policies

ISRES Publishing follows the steps below in the proceedings book publishing process.

In the first stage, the papers sent to the conferences organized by ISRES are subject to editorial oversight. In the second stage, the papers that pass the first step are reviewed by at least two international field experts in the conference committee in terms of suitability for the content and subject area. In the third stage, it is reviewed by at least one member of the organizing committee for the suitability of references. In the fourth step, the language editor reviews the language for clarity.

Review Process

Abstracts and full-text reports uploaded to the conference system undergo a review procedure. Abstracts will be evaluated on the basis of abstracts/proposals. The conference system allows the full text to be sent if the abstract is accepted. Participants must wait for the evaluation results after uploading their article abstracts to the conference system. If their abstracts are accepted, they can upload their full texts to the conference system. The full texts are then sent to at least two reviewers for review. The conference has a double-blind peer-review process. Any paper submitted for the conference is reviewed by at least two international reviewers with expertise in the relevant subject area. Based on the reviewers' comments, papers are accepted, rejected or accepted with revision. If the comments are not addressed well in the improved paper, then the paper is sent back to the authors to make further revisions. The accepted papers are formatted by the conference for publication in the proceedings.

Aims & Scope

In the 21st century, developments in science and technology have led to significant changes in the field of engineering. Creativity and design skills are at the center of studies in the field of engineering today. The main focus of this conference is original studies in the field of engineering. In addition, technology and basic science studies that are directly or indirectly related to engineering are also accepted at the conference.

The aim of the conference is to bring together researchers and administrators from different countries, and to discuss theoretical and practical issues in all fields of Engineering.

Articles: 1- 108

CONTENTS

Recycling of Ceramic Tile Waste in the Formulation of Self-Compacting Concrete/Pages: 1-11
Rabehi Bahia, Ghernouti Youcef, Mansour Sabria Malika, Boumchedda Khaled (Author)

Electromagnetic Interference (EMI) in Variable-Speed AC Electric Drives: Mechanisms and Solutions/Pages: 12-19
Houcine Miloudi, Mohamed Miloudi, Mohammed Hamza Bermaki, Kheira Mendaz, Abdelkader Gourbi, Abdelber Bendaoud (Author)

Stock Price Forecasting Model Using Short Cross Association of Logical Fuzzy Relations in Fuzzy Time Series/Pages: 20-29
Fitri Cahyani, Akhmad Sultoni, Chyntia Meininda Anjanni (Author)

Numerical Modeling Creep of Two Piles Under Constant Static Loading Using ANSYS/Pages: 30-39
Ghouilem Kamel, Belmihoub Hacene (Author)

Sliding Neural Artificial Controller of Induction Motor Combined with NPC Five Level Inverter/Pages: 40-46
Mendaz Kheira, Miloudi Houcine, Khadraoua Narimene (Author)

Development of High-Frequency Power Source Utilizing Electronic Ballast by Employing a Half-Bridge Inverter for Water Purification/Pages: 47-55
Aicha Aissa-Bokhtache, Maamar Latroch, Taieb Bessaad, Alla Eddine Toubal-Maamar, Lemya Djafer, Amina Merini (Author)

Robust Nonlinear Control of a 3×2 Stacked Multicellular Inverter Using Neural Network-Based Regulation/Pages: 56-68
Salah Hanafi, Mohammed Karim Fellah, Youcef Djeriri, Mohamed Fouad Benkhoris, Abdelhakim Saim, Djamel Ziane, Patrice Wira (Author)

Development of a Relation Model for Damage Categorization/Pages: 69-80
Akkouche Karim, Khelil Nacim, Nekmouche Aghiles, Kahil Amar, Hamizi Mohand, Bouzid Leyla, Atlaoui Djamel (Author)

Investigation of Conducted Electromagnetic Disturbances in Power Electronics: A Case Study on DC/DC Choppers/Pages: 81-89
Mohammed Elamine Lahlaci, Mohamed Miloudi, Houcine Miloudi, Mohammed Hamza Bermaki, Kheira Mendaz, Abdelkader Gourbi (Author)

Fire Risk Simulation of Photovoltaic Panels Installed in Green Buildings/Pages: 90-101
Miloua Hadj, Hassan Sandous, Miloua Farid (Author)

Development and Optimization of a Mathematical Model for Predicting Tensile Strength in Friction Stir Welded Joints of 6082-T6 Aluminum Alloy/Pages: 102-108
Ben Messaoud Mohammed Abdelghani, Cherief Mohammed Nadhir Djamel Eddine, Miloudi Abdelkader, Belaribi Amina (Author)

Study of the Thermomechanical Properties of Bimaterials (Metal/Ceramic) /Pages: 109-114
Liamani Samira, Ghermaoui Ilass Mohamed Amine (Author)

Numerical Analysis of Weld Spot Spacing Effects on Shear Tensile Behavior of TRIP 800 Steel/Pages: 115-120

Cherfi Mohamed, Reffas Sid Ahmad, Sahli Abderahmane, Moulgada Abdelmajid, Ghermaoui Mohammed Ilyes (Author)

Performance Improvement of Predictive Direct Power Control of a Unified Power Quality Conditioner/Pages: 121-134

Nouredine Khenfar, Abdelhafid Semmah (Author)

Experimental Study of a Cylindrical Electrostatic Precipitator with Real-Time Monitoring Applied to Simulated Smoke/Pages: 135-142

Miloua Farid, Redjala Majda, Miloua Hadj, Rezoug Mohammed (Author)

Aeolian Sands in Self-Consolidating Mortar Formulations: Study of the Mechanical Impacts/Pages: 143-150

Nacim Khelil, Said Boukais, Karim Akkouché, Amar Kahil, Djamal Atlaoui, Randa Makkeb (Author)

On LDPC Codes and Their Construction/Pages: 151-158

Mohammed Amine Tehami, Malika Tehami, Boucif Beddad, Ahmed Hadji (Author)

Magnetic, Structural and Morphological Properties of Mechanically Alloyed FeSi and FeSiO₂ Nanocomposites/Pages: 159-165

Abderrahmane Younes, Rachid Amraoui, Abderahim Abada, Djilali Allou (Author)

Optimizing Cost and Performance of Hybrid Photovoltaic-Diesel Systems for Off-Grid Energy Solutions/Pages: 166-171

Samir Hadjeri, Halima Boubekour, Salah Hanafi, Mokhtaria Jbilou, Sid Ahmed Zidi, Rihab Belhabri (Author)

EOQ Based Inventory Optimization with Partial Backordering and Demand Uncertainty in Manufacturing/Pages: 172-179

Chyntia Meininda Anjanni, Fitri Cahyani, Akhmad Sultoni (Author)

Potential Use of Recycled Brick and Demolition Concrete Aggregates in the Self-Compacting Concrete/Pages: 180-188

Ghernouti Youcef, Rabehi Bahia, Mansour Sabria Malika (Author)

Experimental Analysis of the Punching Shear Behavior of Concrete Slabs Reinforced with Metal and Polypropylene Fibers/Pages: 189-199

Atlaoui Djamal, Bouafia Youcef, Khelil Nacim, Akkouché Karim, Aliche Amar (Author)

Probabilistic Fracture Mechanics Analysis of Crack Propagation in Composites Under Tensile Loading/Pages: 200-209

Sid Ahmed Reffas, Belaid Mechab, Mohamed Cherfi (Author)

Magnetic and Structural Behavior of Nanocrystalline Iron-Silicon and Iron-Tin Produced via Mechanical Milling/Pages: 210-216

Abderahim Abada, Abderrahmane Younes, Rachid Amraoui, Djilali Allou (Author)

Development and Characterization of Epoxy-Based Laminated Composites: Experimental Characterization and Numerical Simulation/Pages: 217-225

Ghermaoui Ilias Mohammed Amine, Ezzine Mohammed Chams Eddine, Mokhtari Mohammed, Cherief Mohammed Nadhir Djamel Eddine, Cherfi Mohamed, Sahli Abderrahmane (Author)

Computational Materials Design: Tuning Optoelectronic Response in $GaxIn_{1-x}Bi_yP_{1-y}$ Alloys via Structural Matching to InP/Pages: 226-243

Malika Tehami, Miloud Benchehima, Hamza Abid (Author)

Swarm Intelligence-Based Energy Optimization for UAV Mission Efficiency/Pages: 244-256

Mustafa Cosar (Author)

Study and Design of a Plasma Reactor Using a Porous Dielectric Barrier/Pages: 257-263

Fatha Tounsi, Rabah Ouiddir, Houcine Miloudi, Mohamed Miloudi, Abdelber Bendaoud (Author)

Effect of the Strain Rate and Temperature on the Shape Memory Behavior of PMMA/Pages: 264-275

Cherief Mohammed Nadhir Djamel Eddine, Ghermaoui Ilias Mohammed Amine (Author)

Deterministic Assessment of the Seismic Behavior of Cylindrical Steel Storage Tanks: A

Methodological Framework Based on the New Algerian Seismic Code/Pages: 276-282

Amar Aliche, Ourdia Ider, Mouloud Guemmoun, Hocine Hammoum, Karima Bouzelha, Djamel Atllaoui (Author)

Investigation of the Possibility of Introducing Dispersed Boron Carbide Particles into the Melt of Austenitic Steel 12X18H10T During Centrifugal Casting/Pages: 283-288

Abdrakhman Naizabekov, Sergey Kuzmin, Ilya Chumanov, Andrey Anikeev, Vadim Sedukhin, Evgeniy Panin, Andrey Marukov (Author)

Modelling of Distribution of Ultradisperse Particles of Titanium, Tungsten and Zirconium Carbide During Centrifugal Casting/Pages: 289-295

Ilya Chumanov, Andrey Anikeev, Abdrakhman Naizabekov, Sergey Lezhnev, Pavel Tsyba, Dmitry Kuis (Author)

An AI-Based Method for Sorting and Separation of Semiconductor Waste: An Environmentally Friendly Method for Implementing a Circular Economy in the Semiconductor Industry/Pages: 296-306

Gharib Hadj (Author)

Studying the Temperature Effect on Lengthwise Fracture of Inhomogeneous Beam Subjected to Impact Loading/Pages: 307-315

Victor Rizov (Author)

Effects of Elastic Deformation on the Corrosion of 316l in 3.5% NaCl/Pages: 316-322

Allou Djilali, Amraoui Rachid, Djemmah Sarra, Benmohamed Manel, Younes Abderahman, Abada Abderahim (Author)

Best-Fitting Ellipsoid and Surface Disturbance Adjustment of GNSS-Derived Sea Surface Heights/Pages: 323-329

Konstantinos Kalimeris, Sotiris Lycourghiotis (Author)

Computer Modeling and Investigation of the Rolling Process of Thick Strips in Relief Rolls Under Conditions of Kinematic Asymmetric Interaction/Pages: 330-336

Yevgeniy Panin, Valery Chigirinsky (Author)

Eco-Friendly Recovery Method for Manufacturing Flexible Paver's Tile Construction from Waste Plastics/Pages: 337-348

Roua'a K. Al-Ojar, Yonis Ahmed Ismael, Akram. W. Nayyef, Ghadeer Amer Muhamed, Fawzi Habeeb Jabrail (Author)

Adaptive Hybrid Reduction for Facial Recognition/Pages: 349-353

Djamel Berrabah, Yacine Gafour (Author)

Enhancing OFDM Performance Using Wavelet Transform Techniques in Wireless Systems/Pages: 354-360

Zohra Zerdoumi, Malika Fodil, Fadila Benmeddour, Nacerddine Bentaleb (Author)

A Multi-Criteria Weighted Clustering Protocol for Energy-Efficient Overlay Wireless Sensor Networks/Pages: 361-373

Taieb Brahim Mohammed, Abbad Houda, Abbad Leila (Author)

Speed Control of the Pentaphase Asynchronous Machine: Comparative Study Between Vector Control with Conventional PI and Fuzzy PI/Pages: 374-381

Fodil Malika, Zerdoumi Zohra, Zemouri Nahed, Benmeddour Fadila (Author)

Research Trends in the Heat Transfer Simulation of Al_2O_3/AlN Granular Composites for Thermal Interface Materials/Pages: 382-392

Senlau Sudarminto (Author)

Influence of Boundary Conditions of a Contact Problem on the Stress Distribution in a Semi-Infinite Space/Pages: 393-400

Valery Chigirinsky, Sergey Lezhnev, Sergey Kuzmin, Abdrakhman Naizabekov, Yevgeniy Panin (Author)

Impact of Printing Orientation on the Mechanical Properties of Selectively Laser Sintered PA12/Pages: 401-414

Boukhoulda Farouk Benallel, Djellal Kouider, Bendine Kouider, Boukhoulda Abdelaziz (Author)

Performance and Efficiency of Redesign Induction Motor Using Asymmetric Windings/Pages: 415-422

Hussein G. Abdulkareem, Ennam A. Ali (Author)

Synthesis and Characterization of Biochar and Nano-Biochar Composites Derived from Biomass (*Colutea cilicica*) for the Removal of Cationic Dyes from Aqueous Solutions/Pages: 423-432

Erol Pehlivan, Busra Ozkok (Author)

Factors Affecting the Sliding Stability of a Gravity Retaining Wall/Pages: 433-443

Karim Baziz, Amar Kahil (Author)

A Decade of Research on Biomass Materials in Residential Building Construction: A Bibliometric Analysis/Pages: 444-458

Yudith Arunika C. Wella (Author)

Application of Ultrasonic Spectral Analysis for the Study of Steels/Pages: 459-469

Yonka Ivanova, Todor Partalin, Boris Veleev (Author)

Evaluation of Robust Controllers in Photovoltaic Systems: A Comparative Analysis/Pages: 470-479
Zerroug Nadjat, Behih Khalissa, Bouchama Ziyad (Author)

Nano Ideal Semi Alpha Generalized Continuous and Irresolute Mappings in Nano Ideal Topological Spaces/Pages: 480-501
Raja Mohammad Latif (Author)

Synthesis of Stoichiometric Cordierite Ceramics from Chemically Modified Kaolin by a Controlled Acid Leaching/Pages: 502-511
Boumchedda Khaled, Djafar Rabah, Rabehi Bahia, Bououdina Mohamed (Author)

AI-Driven Molecular Design: Synergizing Deep Generative Models with Evolutionary Optimization/Pages: 512-524
Abbad Houda, Taieb Brahim Mohammed, Oulladji Latefa, Abbad Leila (Author)

Performance of LTO/rGO Composite Anode in Lithium Ion Battery/Pages: 525-529
Meltem Cayirli, Busra Yilmaz-Donmez, Mustafa Anik (Author)

Effect of Friction Stir Welding Parameters on the Evolution of the Welding Temperature/Pages: 530-537
Belaribi Amina, Miloudi Abdelkader, Chekalil Ismail, Benmessaoud Mohammed Abdelghani (Author)

From Data to Emotion: A Multimodal Approach to Real-Time Emotion-Aware Marketing/Pages: 538-550
Alper Bozkurt, Furkan Ekici, Hatice Yetiskul, Hüseyin Oktay Altun, Emre Fisne (Author)

Effect of Fiber Orientation on Tensile Property of Basalt Reinforced Epoxy Composite/Pages: 551-558
Yusuf Sahin, Selahettin Selek (Author)

Punch Geometry and Burr Height on Blanking Process for Garbage Container Wheel Parts/Pages: 559-566
Ilyas Uygur, Halit Kocasungur, Sitki Akincioglu, Hasan Oktem (Author)

Effect of Cryogenic Treatment on the Microstructure of AlSi10Mg Alloy Produced by Selective Laser Melting/Pages: 567-574
Pelin Sezer, Gamze Ertas, Hakan Gasan (Author)

Investigation of Borophene Synthesized via a Scalable Approach as an Anode Material for Lithium-Ion Batteries/Pages: 575-579
Suleyman Can, Cihan Kuru (Author)

Geological and Geotechnical Perspectives on Seismic Hazard Assessment of Landslides/Pages: 580-589
Liliana-Irina Stoian, Elena Aurelia Tudor, Antonio Ulmeanu, Avram Ovidiu, Ioan Scutelnicu, Adrian Tataru (Author)

Compact Single-Switch Reconfigurable Patch Antenna with Multi-Band Operation for Wireless Systems/Pages: 590-596
Frouda Nour El Houda, Berkati Abdellatif, Azzaz Rahmani Salima (Author)

Influence of Site Class on the Dynamic Response of Regular Buildings Considering Soil-Structure Interaction/Pages: 597-609

Mohamadi Saddika, Boumaïza Malika, Berzane Sid-Ali, Bouamrène Abdelhafid (Author)

Bearing Fault Detection and Severity Classification Using a Two-Step Neural Network Model/Pages: 610-616

Smail Haroun (Author)

RLS Filter Optimization for Non-Invasive Fetal Electrocardiogram Extraction Using the PSO Algorithm/Pages: 617-624

Mourad Benziane, Mohamed Rezki, Issam Griche, Kamel Saoudi, Abderrazak Arabi (Author)

Performance Evaluation of the Andasol-1 Solar Power Plant in Algerian Climatic Conditions/Pages: 625-629

Hicham Kadraoui (Author)

Engineering Next Generation Hole Transport Layers for Lead Free Perovskite Solar Cells Exceeding 23% Power Conversion Efficiency/Pages: 630-640

Souheyla Mamoun, Abdelkrim Elhasnaine Merad, Feryel Saidi (Author)

Energy Audit of a Community Center/Pages: 641-654

Slav Valchev, Nikola Valchanov (Author)

Generation Algorithms of Invertible Linear and Nonlinear Finite Automata with Memory/Pages: 655-666

Gulmira Shakhmetova, Khasenov Altay, Zhanat Saukhanova, Altynbek Sharipbay, Alibek Barlybayev, Raykul Sayat (Author)

Investigation of Corrosion Properties of Lead-Free Solder Alloys in 3.5% NaCl Solution/Pages: 667-671

Resat Can Ozden (Author)

Evaluation of Nonlinear Fracture Quantities in Lime-Pumice Mixtures/Pages: 672-681

Erkin Eren, Ragip Ince (Author)

Electrical Resistivity Tomography as a Tool for Geological-Engineering Assessment of the Benkovski-2 Tailings Storage Facility/Pages: 682-687

Maya Tomova, Atanas Kisyov (Author)

Voltage Total Harmonic Distortion Reduction in Multi-level Single-Phase Inverters using the SHE-PWM Technique with a TLBO Algorithm/Pages: 688-698

Smail Toufik, Boulouma Sabri, Seddaoui Naoual, Rahmani Hachemi (Author)

Measurement and Transmission of Process Parameters in GSM and IoT Network/Pages: 699-711

Goce Stefanov, Marija Cekerovska, Elena Zafirov, Todor Cekerovski (Author)

Experimental Development and Performance Analysis of a Parabolic Solar Concentrator for Desalination and Treatment of Complex Wastewaters/Pages: 712-720

Souad Khedache, Said Makhoul, Gilles Lefebvre, Bilel Seddi, Abdellah Haddadi (Author)

Factors Affecting Corrosion of Steel in Pipe Lines/Pages: 721-730

Haddad Abdelouahab, Zerroug Nadjat (Author)

Performance of NMC622 Cathode - LTO Anode Full Cell Lithium Ion Battery/Pages: 731-736
Meltem Cayirli, Ersu Lokcu, Resat Can Ozden, Mustafa Anik (Author)

Power System Stability Including Wind Farm with Statcom Based Pi Fractional Controller/Pages: 737-747
Issam Griche, Kamel Saoudi, Mourad Benziane, Abderrazak Arabi (Author)

LogSense: A Comparative Anomaly Detection Platform on Web Server Access Logs Using Multiple Algorithms/Pages: 748-756
Arda Ata Turkoglu (Author)

Enhancing Wireless Sensor Networks Performance by Integrating Particle Swarm Optimization with Intelligent Clustering Techniques/Pages: 757-770
Rafa Sami Braiber, Mussab Riyadh (Author)

B-Smart: A Robust Reputation Based Blockchain Scheme in Wireless Sensor Networks/Pages: 771-790
Farah Khedim, Nabila Labraoui, Ado Adamou Abba-Ari (Author)

Carbon Fabric-Reinforced Polymeric Composites Produced by Hand Lay-Up and Investigation of the Tensile Behavior/Pages: 791-797
Ozhan Sirin, Yusuf Sahin, Emir Can Omer (Author)

Dynamic Analysis of Vertical and Horizontal Irregular Reinforced Concrete Structure Considering Soil Structure Interaction/Pages: 798-806
Boumaiza Malika, Mohamadi Saddika, Sellam Mustapha, Tiliouine Wail (Author)

Effect of Variable Mass Density on Lengthwise Fracture in Functionally Graded Beams Moving in Horizontal Direction/Pages: 807-815
Victor Rizov (Author)

Retrofit Kit Design That Converts Industrial Locks into Electromechanical Smart Locks/Pages: 816-823
Selahattin Mert Aydin, Engin Gunes (Author)

Assessing Translation Quality in Large Language Models and Machine Translation Systems: The BLEU Metric and Language Pair Effects/Pages: 824-829
Philipp Rosenberger, Natallia Kolchanka (Author)

A Multi-Criteria Decision-Making Model for Performance Evaluation Based on PSI-PF-COBRA/Pages: 830-841
Canan Sen, Kubra Onder, Halil Sen (Author)

Evaluation of Composite Method Repair of a Cracked Plate/Pages: 842-848
Aida Achour, Belabbes Bachir Boudjra, Hafida Driz, Sadek Bahar (Author)

A Bio-Inspired Path to Fake Profile Detection: Revisiting Linear Models through Grasshopper Optimization/Pages: 849-860
Nadir Mahammed, Imene Saidi, Mahmoud Fahsi, Souad Bennabi (Author)

Deep Learning-Based Crop Recommendation Using Soil and Environmental Parameters/Pages: 861-870

Fatma Ozge Ozkok (Author)

Development of a Computational Interface for the Thermal Behavior Analysis of Metallic Plates Using the Finite Volume Method/Pages: 871-880

Imene Bennia, Narimen Hamidi (Author)

Fabrication Process of Nano and Optoelectronic Devices Based on Nitrided Gaas: XPS Analysis and Electrical Measurements/Pages: 881-890

Arslane Hatem Kacha, Ahmed Hichem Yah, Boudali Akkal, Zineb Benamara (Author)

A Novel Triple-Band Band-Pass Metamaterial Filter based on Modified Square Split Ring Resonators for Microwave Applications: Design and Analysis/Pages: 891-898

Zoubir Mahdjoub, Mohammed Berka (Author)

Analysis of the Aerodynamic Characteristics of Wing Profiles/Pages: 899-904

Brahim Rostane (Author)

Study of the Effect of InP (100) Nitridation Time by XPS Analysis and Electrical Characterisation/Pages: 905-911

Talbi Abbassia, Benamara Mekki Abdelkader, Chami Nadir, Zineb Benamara (Author)

Smart Control of Vibrations in Functionally Graded Porous Wind Turbine Blades via Piezoelectric Materials/Pages: 912-920

Khalid El Harti, Mohamed Touil, Rachid Saadani, Rahmoune Miloud (Author)

Elaboration and Characterization of Transparent Conductive Oxide Thin Films and the Effect of Doping/Pages: 921-927

Ahmed Hichem Yah, Arslane Hatem Kacha (Author)

C-V and G-V Characteristics of Nitridated GaAs (100) Structures as Function of Frequency-Effect of Series Resistance/Pages: 928-934

Benamara Mekki Abdelkader, Talbi Abbassia, Toumi Hayet, Benamara Zineb, Benamara Fatima Yasmine Maroua (Author)

Solar- Powered Water Treatment System/Pages: 935-939

Aissa Bokhtache Aicha, Taieb Bessaad, Latroch Maamar (Author)

Efficient Sizing of a Standalone Photovoltaic Water Pumping System Considering Hydraulic Head Variability/Pages: 940-944

Souheyla Mamoun, Ouafa Zenati, Abdelkrim Elhasnaine Merad (Author)

Integrated Approach for 3D Mapping of Rock Mass Structural Discontinuities in Dimension Stone Quarrying/Pages: 945-949

Nadezhda Stoycheva

Algorithmic Symbolic Violence: From Intersectional Reproduction to Algorithmic Governance/Pages: 950-958

Sandro SERPA

Improving the Mechanical Properties of a Clay Soil by Adding Waste Rubber: Direct Box Shear Tests/Pages: 959-965
Gouilem Kamel, Belmihoub Hacene (Author)

Determining the Probability of Wind Farms Impact on Birds Using the Predictive Analysis by Experts/Pages: 966-973
Andrey Naidysh, Valery Siokhin, Oksana Strokan, Vladimir Yermeev (Author)

A Comparative Assessment of Strategic Policy Approaches to Securing Critical Raw Materials in the European Union and Globally/Pages: 974-982
Vessela Petrova

Application of Ontological Technologies for Developing a Knowledge Base on the Geography of Kazakhstan/Pages: 983-992
Gaziza Yelibayeva, Aigerim Buribayeva, Banu Yergesh, Assel Mukanova (Author)

Bending and Buckling Analysis of Porous Functionally Graded Plates Using a Refined Trigonometric Shear Deformation Theory/Pages: 993-1003
Bekkaye Tahar Hacen LAMINE, Benahmed ABDELILLAH, Fahsi ASMAA, Fahsi BOUAZZA (Author)

The Eurasia Proceedings of Science, Technology, Engineering and Mathematics (EPSTEM), 2025

Volume 38, Pages 699-711

IConTES 2025: International Conference on Technology, Engineering and Science

Measurement and Transmission of Process Parameters in GSM and IoT Network

Goce Stefanov
Goce Delcev University

Marija Cekerovska
Goce Delcev University

Elena Zafirov
Onesky Flight

Todor Cekerovski
Goce Delcev University

Abstract: In modern industrial plants, timely and accurate information about process parameters is essential. For those reasons in modern technological and industrial development, the application of electronics in measuring, processing, storing and transferring process data in industrial facilities is increasing. Guided by the need for measurement, visualization and storage of process parameters, modern electronic systems provide the ability to process and store measurement data on-site and transfer it to the GSM and IoT network. On the other hand, the application of sophisticated electronic systems is noticeable not only in power plants, but also in healthy and quality food industries, such as agriculture. We witness daily tribunes and panel discussions sponsored by companies and even governments for the introduction of the terminology of digital agriculture, i.e. the introduction of smart electronic solutions in agriculture. In addition to the commitment to so-called green energy, i.e. obtaining energy from renewable sources, the development of digitization in agriculture is an area in which an enormous application of smart electronic systems is expected in the future. Guided by these reasons, in this paper an electronic system is designed that provides a solution to a problem in hydro melioration system, i.e. the development, design and practical implementation of the Smart electronic system which enables the measurement of the process parameters of an agro-industrial facility and their transfer to the GSM and IoT network. The solution enables the visualization of process parameters locally on LCD displays and remotely on an mobile device in GSM and IoT network. A data log file is also provided for store the value on the process parameters on a local computer.

Keywords: Electronic system, Hydro melioration system, Process parameters, GSM network, IoT network

Introduction

Modern agricultural production, on the one hand, should provide timely management of the parameters necessary for obtaining a quality product, and on the other hand, it should provide the opportunity to collect and process data on control values in the agricultural plant (Fountas et al., 2020; Nareandra et al., 2019). Therefore, the introduction of a system for monitoring and quality control in modern agricultural production is essential knowledge (Rptz et al., 2019; Saiz-Rubio et al, 2020; Benet et al., 1982). In real industrial agricultural processes there are standalone plants that represent a separate whole. Most often these plants are far from intra and internet network of the agricultural production companies. Therefore there is a need to automate and connect these agricultural plants in the intranet of the company and more widely in the Internet (IoT), as and GSM SIM

- This is an Open Access article distributed under the terms of the Creative Commons Attribution-Noncommercial 4.0 Unported License, permitting all non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

© 2025 Published by ISRES Publishing: www.isres.org

network (Bhuiyan et al., 2023; Eduku et al., 2024). Efforts are being made to ensure safer and simpler work, especially for operators who are directly exposed to the correct functioning of the entire industrial process. This approach to work is enabled by smart electronic devices that, among other things, generate data log files of measurement data (Ariel, 2024). On the other hand, a modern controlled system of an industrial process is fully rounded if it is connected to an IoT or GSM SIM network (Stefanov et al., 2021; Stefanov et al., 2023; Memonova et al., 2025). Such a concept enables process data to be transferred to any location, visualized in real-time, and stored on a personal and cloud computer.

Commonly, some standalone industrial agricultural processes might represent a separate entity. Since these plants are far from the Intra and Internet network of manufacturing companies, the data distribution of analog and digital signals from sensors and actuators of some process quantities (eg soil moisture, soil temperature and air temperature and humidity as and voltage, current, pressure, flow and level water, etc.) must be made from these remote entities to the master station via wireless communication, most likely a radio frequency (RF), IoT as and GSM connection (Stefanov et al., 2023; Memonova et al., 2025).

The choice of remote transmission of measurement process data via RF, IoT or GSM connection depends on the location of the specific industrial (agro) facility, the type and quantity of measurement data. Each of these transmission media has advantages and disadvantages. In the case where an RF connection is used, the transfer is limited in scope and is most often used when an standalone industrial (agro) facility needs to be connected to a master station of a complex industrial facility. The connection in the GSM and IoT network requires a reliable and secure GSM and internet medium and a secure and inexpensive cloud platform.

For these reasons, and guided by the need to improve the security of the transmitted data, the paper presents a solution by which the process data is transmitted in both networks. It is actually is designed an electronic system that provides a solution to a problem in hydro melioration system, i.e. the development, design and practical implementation of the Smart electronic system which enables measurement, storage, visualization and transfer of measured process parameters of an agro-industrial facility in the GSM and IoT network.

Design of an Electronic System

The design of the electronic system uses hardware components: microcontroller, sensors, relays, valves, fan. For the implementation of the control logic, an appropriate program code has been developed and is embedded in the microcomputer. The microcontroller MCU ESP8266, according to the control logic, receives the signals from the sensors and sends them to the SIM 900 module in the GSM network, and with the WI-FI module sends them to the IoT network. Figure 1 shows the block diagram of the control logic.

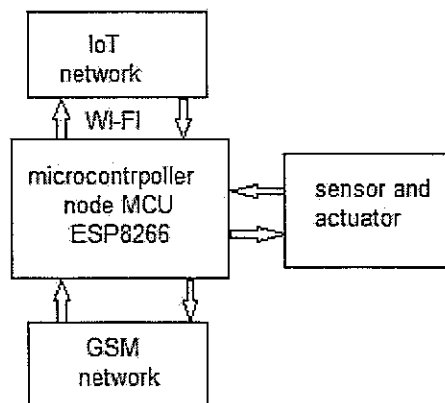


Figure 1. Block diagram on control logic

The design of the prototype electronic system, subject to the paper, includes the design of the system for measurement, monitoring and transfer of the process parameters on mobile device through GSM and IoT network. The detailed block diagram of this electronic system is shown in Figure 2. The task of the electronic system is to manage the agro-industrial facility based on the measured process parameters, temperature, humidity and CO₂ on the air, as and soil temperature and humidity. A case is considered when the agro-industrial facility is of a closed type, i.e. built into a room (greenhouse). The central part of the system is Master station where is build the nodeMCU ESP8266 microcontroller (Arduino, 2021).. The agro-industrial facility is

equipped with: an air temperature and humidity sensor (DHT22), a soil temperature sensor (DS18B20), a soil moisture sensor (V2.0), as and a CO₂ detection sensor (SCD40), (Sensirion SCD40, n.d; Rembor, 2024). These sensors, based on the measured parameter values, send signals to the microcontroller: a digital signal for air temperature and humidity to digital input D8, a digital signal for soil temperature to digital input D7, an analog signal for soil moisture to analog input A0, as well as digital signal for CO₂ on crop to the microcontroller's I2C bus.

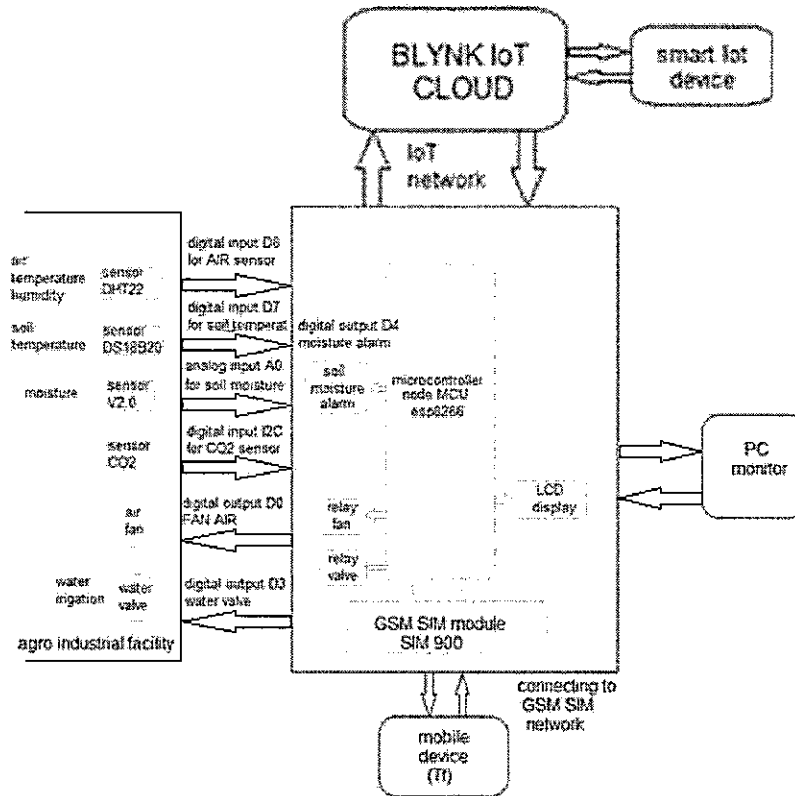


Figure 2. Detailed block diagram on electronic system for measurement, monitoring and transfer of the process parameters in agro industrial facility in mobile device through GSM and IoT network

Based on the measured values of the process parameters, the microcontroller sends control signal (digital output D0) to a fan for supplying fresh air to the agricultural facility and a signal (digital output D3) to turn on a valve for supplying water to the irrigation line of the agricultural crop. The microcontroller on the one hand is connected to the GSM network with the GSM module SIM900, and on the other hand with the WI-FI module built into the microcontroller MCU ESP8266, it is connected to the IoT network (SimCom, 2020). This connection ensures that process parameters are distributed bidirectional in the GSM and IoT network. This concept allows reading the values of process parameters on a mobile device, management of the supply of fresh air and water, as well as an alarm when any of the controlled variables exceeds the critical threshold.

Control Logic

The microcomputer node MCU 8266 via GSM module with the built-in SIM card is a medium (intermediary) for sending instructions from the microcomputer to the mobile phone and receiving them from the mobile device to the microcomputer. Also, microcomputers with build WI-FI module sending and receiving instructions via IoT network to mobile device (tablet, mobile phone). In Figure 3 is shown logical flow diagram on the electronic system.

The GSM module controls the state of the agro-culture by communicating with the microcomputer according to String (text) instructions. These String instructions are received by the SIM900 from the user via a mobile phone. The microcontroller receives the signals for the process parameters of the agro-industrial facility, processes them according to defined logic and sends the them via GSM SIM900 module to mobile phone.

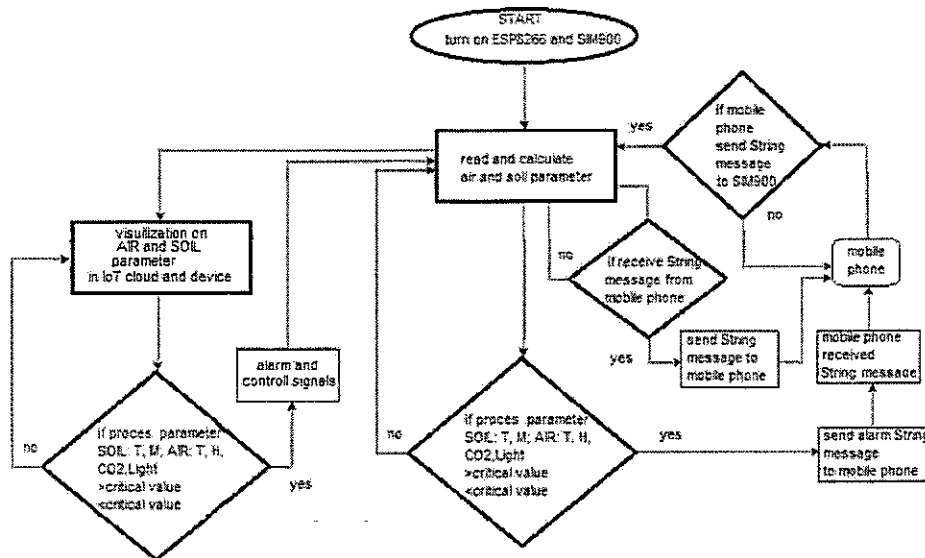


Figure 3. Block diagram on flow diagram on the electronic system

Measurement and Transmission on Process Parameter in GSM Network

These String instructions include:

Instructions on the Condition of Air Parameters

- READ AIR, the SIM900 receive from mobile phone this String message and sends this instruction to the microcontroller for reading air parameters in the agricultural facility; when the microcontroller receives this instruction, he (the microcontroller) reads and calculates the air parameters in the facility and sends a text string SIM message via SIM900 on mobile phone: " AIR: Temperature = " + String(t) + "*C" + ", " + " Humidity = " + String(h) + "% " + ", " + " CO2 = " + String(CO2) + "ppm". The message contains information about temperature, humidity, light and CO2 in the air as well as the brightness of the agricultural crop. Based on the values of the read data, the user concludes whether any of the process parameters has exceeded the critical value and sends the next string instruction for its correction.
- AIR FAN ON, This instruction is sent by the user when, based on previously read parameter values, he concludes that the humidity, temperature, light or CO2 in the facility has exceeded the critical value; when the microcontroller receives this instruction, he (the microcontroller) reads and calculates the air parameters in the facility, turns on the fan to supply fresh air sends a text string SIM message via SIM900 on mobile phone: "AIR: Temperature = " + String(t) + "*C" + ", " + " Humidity = " + String(h) + "% " + ", " + " CO2 = " + String(CO2) + "ppm" + "FAN ON". The message contains information about temperature, humidity and CO2 in the air as well as the brightness of the agricultural crop and confirmation that the user's previous command has been implemented, i.e. the fan is turned on.
- The previous two instructions are for when the user wants to see the air condition in the facility. But the program algorithm has a built-in loop with which the microcontroller automatically monitors the process parameters and when any of them exceeds the critical value, it sends a string alarm message to the user.
- " CO2: " + String(CO2) + "ppm" + ", " + " CO2 is HIGH " ; The user of the mobile device receives an alarm that the CO2 level is high.
- " temperature: " + String(t) + "*C" + ", " + "temperature is HIGH " ;
- " humidity: " + String(h) + "% " + ", " + "humidity is LOW " ;
- " Light: " + String(lux) + "lux" + ", " + "light is LOW " ;
- AIR FAN OFF; This instruction is sent by the user when, based on previously read parameter values, he concludes that the humidity, temperature, light or CO2 in the facility have values within the working limits; when the microcontroller receives this instruction, he (the microcontroller) reads and calculates the air parameters in the facility, turns off the fan to supply fresh air sends a text

string SIM message via SIM900 on mobile phone: "AIR: Temperature = " + String(t) + "*C " + ", " + " Humidity = " + String(h) + "% " + ", " + " CO2 = " + String(CO2) + "ppm" + "FAN OFF".

Instructions on the Condition of Soil Parameters

- READ SOIL; the SIM900 receive from mobile phone this String message and sends this instruction to the microcontroller for reading soil parameters in the agricultural facility; when the microcontroller receives this instruction, he (the microcontroller) reads and calculates the soil parameters in the facility and sends a text string SIM message via SIM900 on mobile phone: "SOIL: Temperature = " + String(tempSoil) + "*C " + ", " + "Moisture = " + String(data1) + "%". The message contains information about temperature and moisture on soil in agricultural facility. Based on the values of the read data, the user concludes whether any of the process parameters on soil has exceeded the critical value and sends the next string instruction for its correction.
- VALVE ON; This instruction is sent by the user when, based on previously read parameter values, he concludes that the temperature and moisture on the soil in facility has exceeded the critical value; when the microcontroller receives this instruction, he (the microcontroller) reads and calculates the soil parameters in the facility, turns on the water valve on irrigation line to supply water and sends a text string SIM message via SIM900 on mobile phone: " SOIL: Temperature = " + String(tempSoil) + "*C " + ", " + "Moisture = " + String(data1) + "% " + ", " + "Valve ON".
- The previous two instructions are for when the user wants to see the soil condition in the facility. But the program algorithm has a built-in loop with which the microcontroller automatically monitors the process parameters and when any of them exceeds the critical value, it sends a string alarm message to the user.
- " SOIL Moistre: " + String(data1) + "% " + ", " + " Moistre is LOW "; The user of the mobile device receives an alarm that the soil moisture level is LOW.
- " SOIL Temperature: " + String(tempSoil) + "*C " + ", " + " Temperature is HIGH "; The user of the mobile device receives an alarm that the soil temperature level is HIGH.
- VALVE OFF; This instruction is sent by the user when, based on previously read parameter values, he concludes that the temperature and moisture on the soil in facility have values within the working limits; when the microcontroller receives this instruction, he (the microcontroller) reads and calculates the soil parameters in the facility, turns off the water valve on irrigation line to supply water and sends a text string SIM message via SIM900 on mobile phone: " SOIL: Temperature = " + String(tempSoil) + "*C " + ", " + "Moisture = " + String(data1) + "% " + ", " + "Valve OFF".

Measurement and Transmission on Process Parameter in IoT Network

The WI-FI module who is built-in ESP8266 card is a medium (intermediary) for sending instructions from the microcomputer to the IoT cloud. The IoT cloud also controls the state of the agro-culture by communicating with the microcomputer according to virtual pin instructions. These instructions are received by the cloud server from the user via a IoT network. The microcontroller receives the signals for the process parameters of the agro-industrial facility, processes them according to defined logic and sends the them via WI-FI module to mobile phone with build cloud platform. On the screen from mobile device in IoT network exist tags with built-in instruments for visualization of measurement parameters.

Figure 4 is shown print screen on IoT cloud screen, which shows the measured values of the process parameters. The measured value is displayed on an analog instrument with a measuring scale and on a digital display. On the screen are shown the following signals:

- AIR TEMP signal for the temperature on air;
- AIR HUM signal for the humidity on air;
- SOIL TEMP signal for temperature on the soil;
- MOISTURE SOIL signal for moisture on the soil.

Also on this screen are shown the button and led diode for management and control of the fan and water valve line:

- BUTTON FAN button for remote on/off of the fan for fresh air supply;
- FAN ON/OFF led diode for visualization of the fan status;

- BUTTON WATER VALVE button for remote on/off of the water valve on irrigation line;
- VALVE OPN/OFF led diode for visualization of water valve status.

The screen also displays alarm blocks when any of the controlled process parameters exceeds a critical value:

- SOIL MOISTURE is LOW a block for indicating when soil moisture is low;
- CO2 is HIGH a block for indicating when CO2 on air is high.

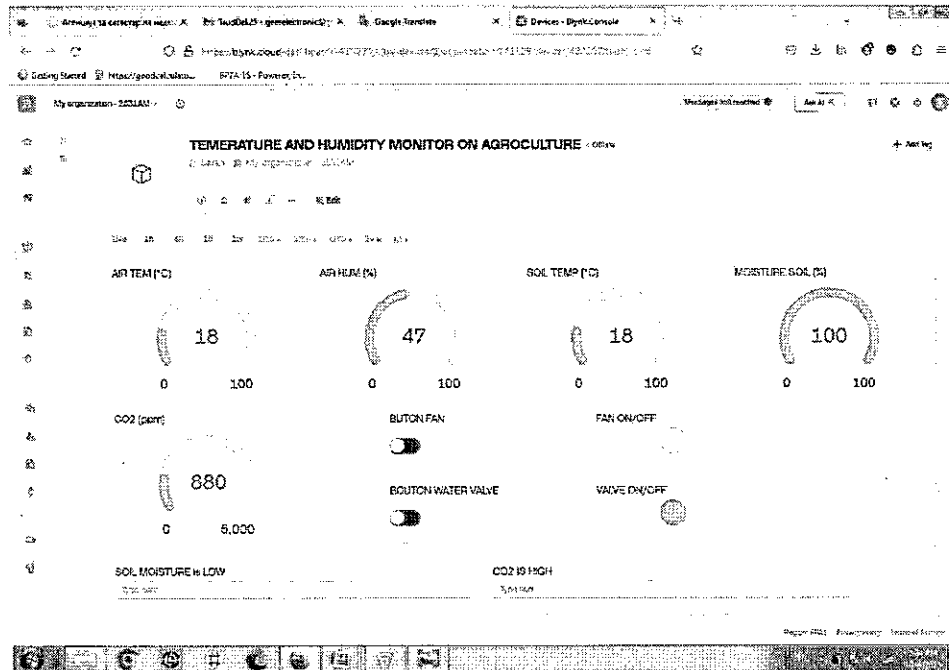


Figure 4. Print screen on IoT cloud screen

Design of Hardware Components on Electronic System

In this part is designed system which accepts the signals from the sensors and after appropriate software processing with nodeMCU8266 visualizes them on the one LCD displays and sends them via SIM900 module to the GSM network, and via WI-FI module in IoT network. Figure Figure 5 shows the electrical connections of the electronic system for managing the process parameters of the agro-industrial facility. The connections between the hardware components are described above, and can also be seen in Figure 5. Now a brief description of the characteristics of the hardware components used will be given here.

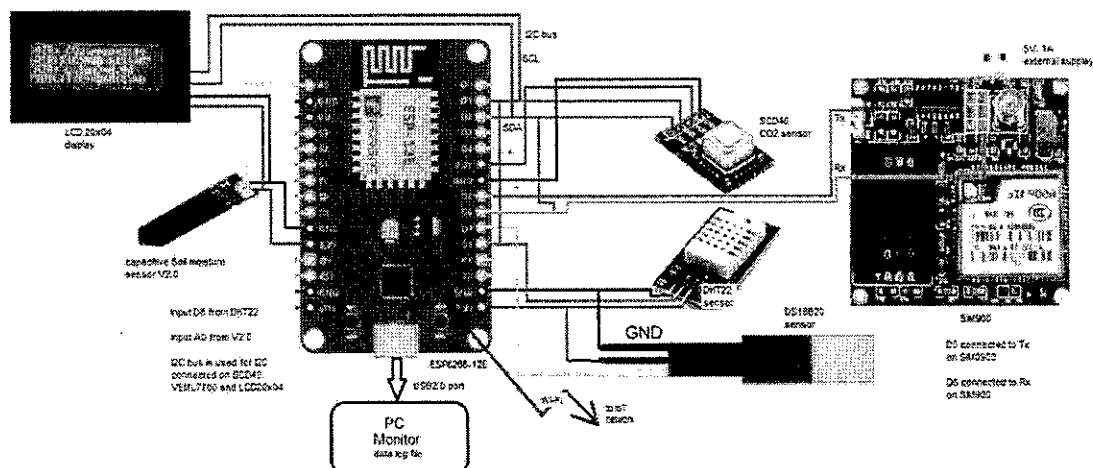


Figure 5. Electrical connections of the electronic system for managing with the process parameters of the agro-industrial facility

Microcomputer NodeMCU ESP8266

The NodeMCU ESP8266 development board comes with the ESP-12E module containing ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor (NodeMCU, n.d). This microprocessor supports RTOS and operates from 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with built-in Wi-Fi / Bluetooth and Deep Sleep Operating features makes it ideal for IoT projects. NodeMCU can be powered using Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interface. In the Figure 4 is shown NodeMCU ESP8266 and his pinout.

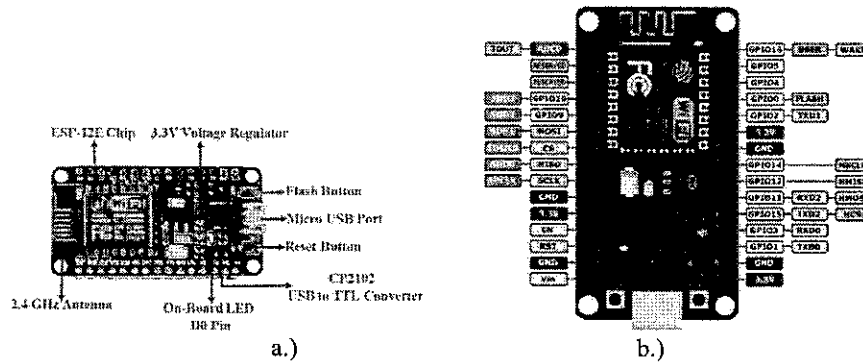


Figure 4. a.) NodeMCU ESP8266 and b.) his pinout

NodeMCU is an open-source based firmware and development board specially targeted for IoT based applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

GSM SIM900 Module

GSM is a global system for mobile communication. Hence, to communicate with the computing devices, the GSM SIM needs a module. SIM900 is considered one of the best modules of today's time. It's a quad-band module that works perfectly with four frequencies, which are 850, 900, 1800, and 1900 MHz. The device is so compact and is compatible with Arduino. It easily allows sending SMS, MMS, etc. Moreover, it also supports audio through UART by using AT commands. Besides, it contains microphones and headphone jacks for phone calls. The sensor needs the 5 V power supply and draws 2 A of current. In the Figure 6 is shown the electronic board on SIM900. SIM900 is connected to the microcontroller with only 4 wires, that is power connection (VCC and GND), and serial communication pin (RX-TX). If used arduino UNO which is use 5V operating voltage and has 5V logic level (TTL). So need to connect arduino to RXD 5V and TXD 5V like in pinout picture above. If a nodeMCU8266-12E is used, which is use 3V operating voltage and has 3V logic level, as in our case, pins used are RXD 3.3V and TXD 3.3V. Then plug in SIM card into SIM card cartridge. Then the SIM900 and node MCU wiring connection.

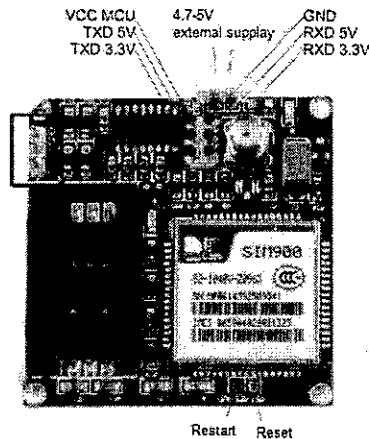


Figure 6. The electronic board on SIM900 module

Wire SIM900A module to node MCU like this:

- node MCU-> SIM900A
- 5V -> VCC
- GND -> GND
- 14 -> TX
- 12 -> RX

Power-on Procedure

First, need to insert your SIM card into the GSM module. Then, connect GSM GPRS Shield with NodeMCUEsp8266-12E. Now, upload the code on an Arduino board. After that, give the external 5V of power supply to the module. Then, press the power key of the GSM Module for 2 seconds. The LED present in the module will start glowing. And, when the sensor finds the networks, it will start blinking every three seconds. Now it is time to send or receive messages and phone calls with Arduino through the code. But, can also receive messages, and send or receive phone calls by using different programming codes.

SCD40 CO2 Sensor

SCD40 is a photoacoustic true CO2 sensor that will tell you the CO2 PPM (parts-per-million) composition of ambient air (Sensirion SCD40, n.d). Perfect for environmental sensing, scientific experiments, air quality and ventilation studies, and more. this sensor has data read over I2C, so it works very nicely with just about any microcontroller or microcomputer. There's both Arduino and Python/Circuit Python code so you can get started in a jiffy. In the Figure 7 is shown CO2 sensor SCD40.

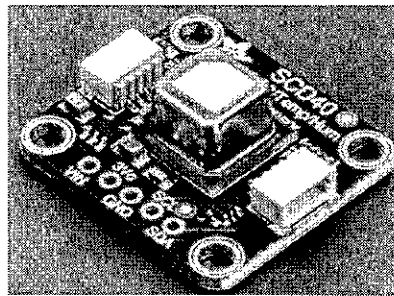


Figure 7. The electronic board on SCD40 CO2 sensor

There are two variants of this sensor - the SCD40 and SCD41

- The SCD40 is lower cost, and is perfect for indoor/outdoor air quality and CO2 measurements. It has a range of 400~2000 ppm with an accuracy of $\pm(50 \text{ ppm} + 5\% \text{ of reading})$
- The SCD41 is more expensive, and while it can definitely be used for air quality, its wide range means its best used for industrial or scientific CO2 measurements where the ppm can get very high. It has a range of 400~5000 ppm with an accuracy of $\pm(40 \text{ ppm} + 5\% \text{ of reading})$.

This sensor can run from 3.3 to 5V but it's more important for it to have a quiet power supply with low ripple, than any particular voltage. For that reason is added a 3.3V regulator and level shifters: when connecting to a 5V microcontroller like an Arduino UNO the 5V supply is often shared with other electronic components that add noise. The onboard regulator will keep the voltage nice and quiet. For advanced hackers, they can cut/solder the back traces to change whether the regulator is enabled and what I2C logic level is desired. Information about the DHT22, DS18B20 and V2.0 sensors is available in (Blynk, 2025; DHT22, n.d; DS18B20, 2019).

Experimental Results of Testing the Prototype Electronic System

This section presents the results of the experimental work on the prototype system for of the electronic system for managing with the process parameters of the agro-industrial facility. Figure 8 shows Prototype on the design electronic system.

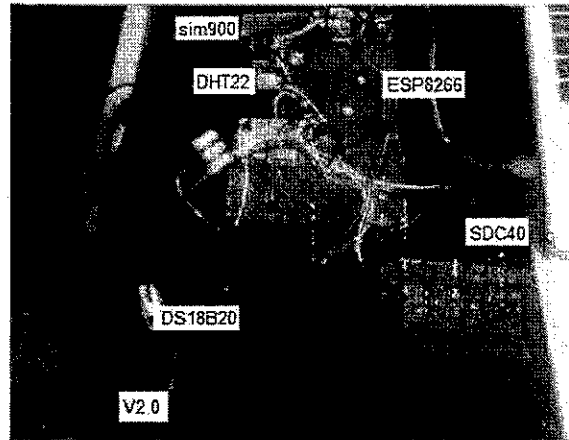


Figure 8. Prototype on the electronic system

Figure 9 shows a print screen of a data log file in Excel for monitoring on the process parameters of the agro-industrial facility obtained with the designed system in the paper.

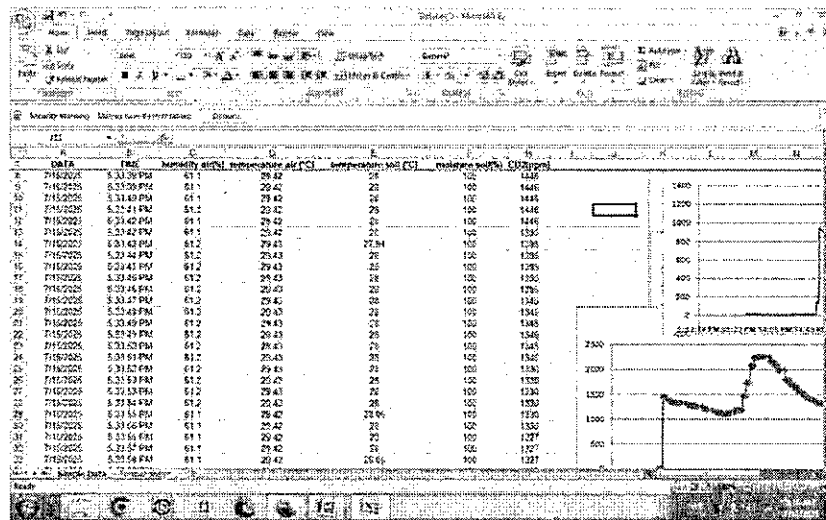


Figure 9. Print screen of a data log file in Excel for monitoring on the process parameters of the agro-industrial facility

Figure 10 shows waveforms of the measured parameters in the agro-industrial facility over a certain time interval. Figure 10a shows the waveform of soil moisture and Figure 10b shows the waveform illustrating the change in CO₂.

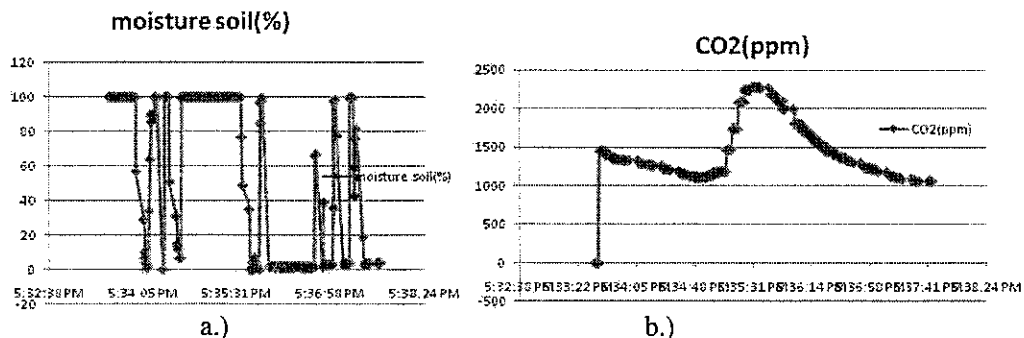


Figure 10. Waveforms of the measured parameters in the agro-industrial facility over a certain time interval: a) waveform of soil moisture, b) waveform of CO₂.

Figure 11 shows a print screen of the mobile phone that illustrates the correct operation of the electronic system.

Figure 11a is print screen on READ AIR, AIR FAN ON, VALVE on instruction; Figure 11b is print screen on READ SOIL and AIR FAN OFF instruction; Figure 11c is print screen on VALVE OFF and READ AIR instruction; Figure 11d is print screen on ALARM from electronic system to mobile phone when level CO2 is HIGH and Figure 11e is print screen on ALARM from electronic system to mobile phone when level soil moisture is LOW

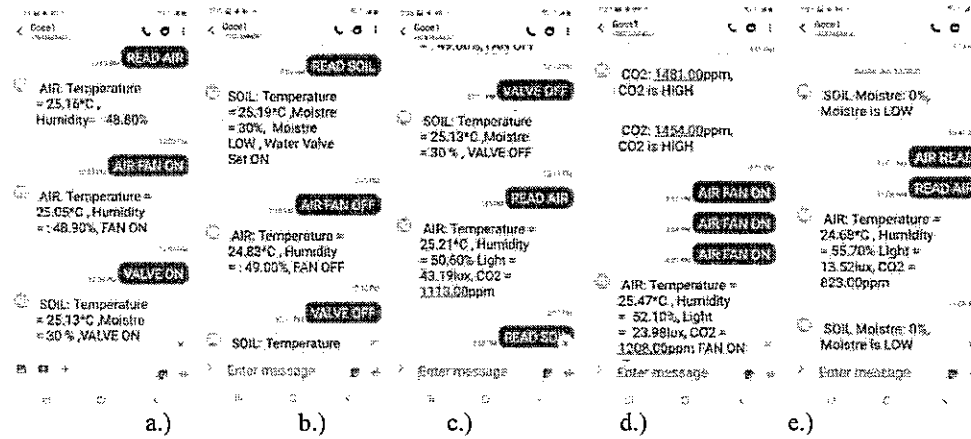


Figure 11. Print screen from a mobile phone

The print screen on the mobile phone on the Figure 11 shows: a.) print screen on READ AIR, AIR FAN ON, VALVE on instruction; b.) print screen on READ SOIL and AIR FAN OFF instruction; c.) print screen on VALVE OFF and READ AIR instruction; d.) print screen on ALARM from electronic system to mobile phone when level CO2 is HIGH and e.) print screen on ALARM from electronic system to mobile phone when level soil moisture is LOW.

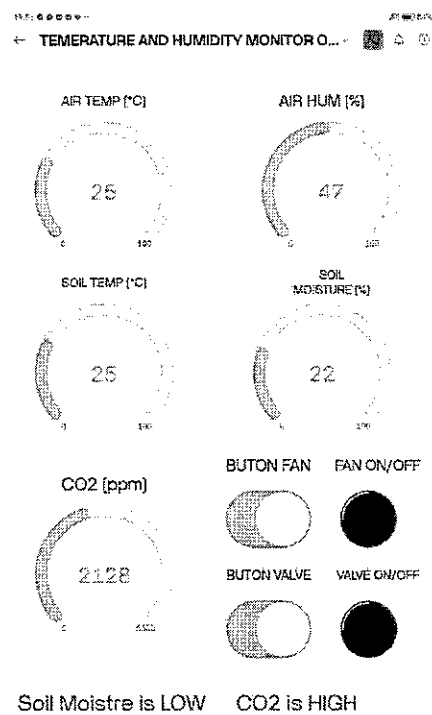


Figure 12. Process parameters screen of mobile device transmission in IoT network

Figure 12 show a data screen on a mobile device showing agriculture process parameters transferred in IoT network.

Analysis of the Results and Discussion

The main task of the paper is to design and implement a prototype electronic system for measuring, monitoring and transferring of the process parameters on agro industrial facility in GSM and IoT network. Verification of the correct operation of the system according to the defined task is illustrated with the Figures 8, 9, 10, 11 and 12.

- In point 2, a prototype of the system for measurement, monitoring and transferring of the process parameters on the agro industrial facility in GSM and IoT network was designed and implemented;
- Section 3 gives the results of the experimental work of the solution in the paper;
- The results show that the system measures, visualizes on LCD screens and stores in a data log file the process parameters of the agro industrial facility and sends them in GSM and IoT network;
- The print screen shown in the Figure 9 is provided to verify that the solution in the paper stores the data in a data log file in Excel;
- Waveforms shows on the Figure 10 illustrating the change of the process parameters in the agro-industrial facility over a certain time interval. They verify that the system measures and monitors the change in process parameters;
- Print screen from a mobile phone given in the Figure 11, verify that the system responds to messages sent from the mobile phone and sends an alarm back to the mobile device as required in point 2.1;
- Print screen from a mobile device given in the Figure 12, verify that the system sending the values of process parameters in IoT network of mobile device and sends an alarm back to the mobile device;
- Figure 12 shows the values of the process parameters during operation of the electronic system. Since the current values of soil moisture and air CO₂ have exceeded the critical points (in this case, the critical point of soil moisture is 55%, and of CO₂ is 1600ppm), the LEDs light up, indicating that in this state the water supply valve and the fresh air supply fan are turned on.

The paper offers a solution that addresses a problem that is currently relevant in the agro-industry. In (Bhuiyan et al., 2023; Eduku et al., 2024; Ariel, 2024), the subject of analysis is industrial processes from different aspects and in all of them the commitment to connecting measurement data remotely is clear. In some solutions, RF connections are used, in some cloud platforms, (Stefanov, 2023). The way in which this is realized is different and depends on the capabilities and approach of the authors. In the case where an RF connection is used, the transfer is limited in scope and is most often used when an standalone industrial (agro) facility needs to be connected to a master station of a complex industrial facility. Starting from the requirement to provide a reliable system that will provide measurement and transfer of process parameters with increased reliability, the paper provides a solution that distributes measurement data across both networks, GSM and IoT.

Conclusion

In this paper prototype of an electronic system is designed that provides a solution to a problem in agriculture facility, i.e. the development, design and practical implementation of the Smart electronic system which enables the measurement of the process parameters of an agro-industrial facility and their transfer to the GSM and IoT network. The solution enables the visualization of process parameters locally on LCD displays and remotely on an mobile device in GSM and IoT network. The solution also provides two-way communication and management of process parameters in the industrial facility. A data log file is also provided for store on the values on the process parameters on a local computer. There is a possibility of storing the values of the process parameters in the IoT cloud platform.

Scientific Ethics Declaration

* The authors declare that the scientific ethical and legal responsibility of this article published in EPSTEM journal belongs to the authors.

Conflict of Interest

* The authors declare that they have no conflicts of interest

Funding

* This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Acknowledgements or Notes

* This article was presented as virtual presentation at the International Conference on Technology, Engineering and Science (www.icontes.net) held in Antalya/Türkiye on November 12-15, 2025.

* The authors would like to thank the conference committee and the reviewers who reviewed the article for their valuable contributions.

References

- Analog Devices. (2019). *DS18B20: Programmable resolution 1-wire digital thermometer* (Data sheet). Retrieved from <https://www.analog.com/media/en/technical-documentation/data-sheets/DS18B20.pdf>
- Ariel, L. I. W. (2024). Design and evaluation of an IoT-based energy meter/power limiter to improve the management of low-voltage electrical subscribers - a case study of SNEL Likasi- DRC. *International Journal of Novel Research in Electrical and Mechanical Engineering*, 11(1), 60-67.
- Bennett, S., & Linken, S. (1982). *Computer control of industrial processes*. Institution of Engineering & Technology.
- Bhuiyan, B. U., Karim, M. M., & Khan, I. (2023). IoT-based three-phase smart meter: Application for power quality monitoring. In *6th International Conference on Electrical Information and Communication Technology (EICT)* (pp. 1–6). IEEE.
- Blynk. (2025). *Blynk IoT platform*. Retrieved from <https://blynk.cloud>
- CircuitsToday. (2021). *Arduino Nano tutorial: Pinout & schematics*. Retrieved from <https://www.circuitstoday.com/arduino-nano-tutorial-pinout-schematics>
- Eduku, S., Sekyi-Ansah, J., Edem, A. E., & Joel, D. (2024). Design and implementation of distribution transformer monitoring system using GSM technology. *International Journal of Electrical and Electronics Engineering*, 11(12), 235-242.
- Espressif Systems. (2020). *ESP8266 technical reference manual* (Version 4.3) (Data sheet). Retrieved from https://www.espressif.com/sites/default/files/documentation/esp8266-technical_reference_en.pdf
- Fountas, S., Espejo-Garcia, B., Kasimati, A., Mylonas, N., & Darra, N. (2020). The future of digital agriculture: Technologies and opportunities. *IT Professional*, 22, 24-28.
- Hor, C. L., & Crossley, P. A. (2005). Knowledge extraction from intelligent electronic devices. In *Lecture Notes in Computer Science* (Vol. 3400, pp. 82–111). Springer.
- HowToMechatronics. (2020). *Arduino wireless communication NRF24L01 tutorial*. Retrieved from <https://howtomechatronics.com/tutorials/arduino/arduino-wireless-communication-nrf24l01-tutorial/>
- Memonova, G., Schmidt, P., Tursunov, J., & Gofurova, G. (2025). Automated groundwater monitoring system with real-time data collection and analysis using LoRa and GSM technologies. *ETR*, 4, 209–215.
- Microchip Technology. (2015). *ATmega328P 8-bit AVR microcontroller with 32K bytes in-system programmable flash* (Data sheet). Retrieved from https://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-7810-Automotive-Microcontrollers-ATmega328P_Datasheet.pdf
- Narendra, V. N., Sahana, S., & Chaithrashree, J. (2019). Digital agriculture. *Bulletin of Environment, Pharmacology and Life Sciences*, 8(6), 164–170.
- Rembor, K. (2024). *Adafruit VEML7700 ambient light sensor*. Adafruit Industries.
- Rotz, S., Duncan, E., Small, M., Botschner, J., Dara, R., Mosby, I., Reed, M., & Fraser, E. D. G. (2019). The politics of digital agricultural technologies: A preliminary review. *Sociologia Ruralis*, 59, 203–229.
- Saiz-Rubio, V., & Rovira-Más, F. (2020). From smart farming towards agriculture 5.0: A review on crop data management. *Agronomy*, 10(2), 207.
- Sensirion. (n.d.). *Sensirion SCD40* (Data sheet). Retrieved from <https://www.manualslib.com/products/Sensirion-Scd40-13071286.html>
- SimCom. (2020). *SIM900: GSM/GPRS module* (Manual). Retrieved from <https://www.manualslib.com/manual/1354053/Simcom-Sim900.html>
- SparkFun Electronics. (n.d.). *DHT22 temperature and humidity sensor* (Data sheet). Retrieved from <https://www.sparkfun.com/datasheets/Sensors/Temperature/DHT22.pdf>

- Stefanov, G., & Kukuseva, M. (2021). RF sensor smart network. In *First International Conference ETIMA* (Vol. 1). Stip.
- Stefanov, G., Kukuseva, M., & Stefanova, E. (2021). Design of an intelligent Wi-Fi sensor network. *Balkan Journal of Applied Mathematics and Informatics*, 4(1), 17-26.
- Stefanov, G., Kukuseva, M., & Stefanova, S. (2023). 3-phase smart power meter implemented in RF network. *Balkan Journal of Applied Mathematics and Informatics*, 6(1), 25-37.

Author(s) Information

Goce Stefanov

Goce Delcev University, Faculty of Electrical Engineering
Krste Misirkov, 10A, 2000 Stip, North Macedonia
Contact e-mail: goce.stefanov@ugd.edu.mk

Marija Cekerovska

Goce Delcev University, Faculty of Mechanical
Engineering, Krste Misirkov, 10A, 2000 Stip
North Macedonia

Elena Zafirov

One Sky Flight, 7777 Lemmon Ave
Dallas, TX 75209, USA

Todor Cekerovski

Goce Delcev University, Faculty of Electrical Engineering
Krste Misirkov, 10A, 2000 Stip, North Macedonia

To cite this article:

Stefanov, G., Cekerovska, M., Zafirov, E., & Cekerovski, T. (2025). Measurement and transmission of process parameters in GSM and IoT network. *The Eurasia Proceedings of Science, Technology, Engineering and Mathematics (EPSTEM)*, 38, 699-711.

