LAPORAN PENELITIAN

“Wireless monitoring system for mobile hybrid PV–PICO hydro power plant using nRF24L01 and Arduino”

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Department of Physics and Process Control

24th WORKSHOP ON

ENERGY AND ENVIRONMENT

BOOK OF ABSTRACTS

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December 6-7, 2018

Gödöllő, Hungary

PREFACE

Successful events in the series of the Seminar/Workshop on Energy and Environment (EE) were organised yearly since 1995 under the auspices of the Department of Physics and Process Control, Institute for Environmental Engineering Systems, Szent István University Gödöllő, Hungary including active participation also from foreign institutions working in the field of the application possibilities of renewable energy resources.

The aim of the Workshop is provide a forum for the presentation of new results in research, development and applications in connection with the issues of energy and environment.

This is now a call to take part in the above mentioned event along with to submit one page abstract of potential contributing papers falling into the Workshop topic. The Abstract Volume of the Workshop will be published and distributed among the participants during the event. The language of the Workshop is English, no simultaneous translation will be provided.

The deadline of the abstract submission: November 30, 2018

Further information, please, contact:

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24th WORKSHOP ON ENERGY AND ENVIRONMENT

December 6-7, 2018, Gödöllő, Hungary

Program

December 6 (Thursday)

14.30-17.00 Registration
Visiting the Department of Physics and Process Control
Visiting the solar installations

December 7 (Friday)

09.00-09.10 Opening the Workshop by:

Prof. I. Farkas — Head of Mechanical Engineering PhD School
Institute for Environmental Engineering Systems
Szent István University, Gödöllő, Hungary

Prof. L. Kátai — Dean of Faculty
Faculty of Mechanical Engineering
Szent István University, Gödöllő, Hungary

Session 1 — *Chairmen: Prof. I. Farkas, Dr. D. Rusirawan*

09.10-09.25 I. Farkas: New achievements in solar PV industry

09.25-09.40 D. Rusirawan and I. Farkas: Characteristics comparison of the first and the second generation of photovoltaic module technologies – a perspective for Indonesian weathers

09.40-09.50 L. Szulyovszky and Gy. Ruda: Controlling harmfull building materials and radiation in environmental economy

09.50-10.00 Z. Kapros: Engineering-oriented approach for the general definition of small-scale systems

10.00-10.10 M.A. Al-Neama and I. Farkas: Air mass flow rate effect on the performance of double-pass solar air heater

10.10-10.20 I.R. Nikolényi, Cs. Mészáros and Á. Bálint: Theoretical study of conjugated polymers for solar cell applications

10.20-10.50 COFFE BREAK

Session 2 — *Chairmen: Dr. I. Seres, Dr. L. Hartawan*

10.50-11.05 L. Hartawan, T. Shantika, D. Rusirawan and I. Farkas: Wireless monitoring system for mobile hybrid PV – PICO hydro power plant using nRF24L01 and Arduino

11.05-11.15 I. Seres and I. Kocsány and I. Farkas: Operational experiences with a small-scale transparent photovoltaic system

11.15-11.25 S. Gubán and P. Víg: Heat storage at high temperature with phase change materials

11.25-11.35 B. Bokor, D. Eryener, H. Akhan and L. Kajtár: Cooling load reduction with transpared solar collectors

11.35-11.45 H. Zsiborács, G. Pintér, N. Hegedűsné Baranyai: Photovoltaic capacity change in the future based on EUCO scenarios in EU

11.45-11.55 Sz. Bődi, P. Víg and I. Farkas: Use of paraffin vax and water for heat storage in solar systems

11.55-12.05 G. Bencsik, I. E. Háber and I. Farkas: Preparing climate data and city model for computational fluid dynamics simulation

12.05-13.30 LUNCH BREAK

Session 3 *Chairmen: Prof. I. Farkas*
Dr. P. Víg

13.30-13.40 A. Szilágyi, I. Farkas, I. Seres: Application of evaporation cooling with solar energy

13.40-13.50 J. Tóth and I. Farkas: Implementing database support for SIMULINK applied for solar thermal systems

13.50-14.00 W.M.A Elmagid, I. Keppler and I. Molnár: Blade calculation for turbine working solar chimney updraft tower

14.00-14.10 D. Alok and L. Tóth: A New methodology for solving biomass pyrolysis problem

14.10-14.20 D. Atsu, I. Seres and I. Farkas: Investigation of the thermal behaviour of solar PV modules

14.20-14.30 G. Habtay and I. Farkas: Effect of types of chimney in an indirect passive solar dryer

14.30-14.40 M. Haekal, D. Rusirawan and I. Farkas: Design of wind turbine blade under Indonesian wind conditions

14.40-15.00 COFFE BREAK

Session 4 *Chairmen: Dr. S. Bartha*
Dr. Cs. Mészáros

15.00-15.15 S. Bartha, F. Carvalheiro, P. Moniz, L.C. Duarte: Selective fractionation of energy crops within the biorefinery

15.15-15.25 A. Barczi, G. Géczi: Analysis of energy reed growing on wastewater

15.25-15.35 P. Hermanucz, G. Géczi, I. Barótfi: Analysis of multi resources heat pump

15.35-15.45 Z. Patonai and G. Géczi: Waste management of a temporary facility

15.45-16.00 CLOSING

WIRELESS MONITORING SYSTEM FOR MOBILE HYBRID PV – PICO HYDRO POWER PLANT USING nRF24L01 AND ARDUINO

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Indonesia has target of having renewable energy account for 23% of Indonesia's energy mix for electricity and transportation by 2025. To achieve this target, several regulations have been taken, such as using B20 in fossil fuel for every sector, and the new rule is to use photovoltaic module on roof top, in order to decrease of electricity bills, which have an impact to speed up transfer technology for manufacturing photovoltaic module in Indonesia.

Department of Mechanical Engineering ITENAS which has core of research about new and renewable energy has several research topics in photovoltaic area. One of them is mobile hybrid PV-Pico hydro power plant. This system is still under development, and it is combined low head pico hydro system which can generate about 7 Watt (14 V, 0.52 Amps) at 600 rpm, and two photovoltaic module with specification 100 Wp polycrystalline 5.69 Amps each. The dimension of hybrid system is 160x120x120 cm.

To support this research, wireless monitoring system has been developed to take voltage and current data from photovoltaic and pico hydro generator. This monitoring system will replace wired monitoring system, which have been design before.

The wireless monitoring system using Arduino with nRF24L01 module, because the long distance between hybrid system to monitoring system room is about 30-40 m.

The instrumentation component which is used for this system consisted of:

No	Components	Specifications	Qty
1	Arduino UNO (SMD)	ATmega328. 14 digital input/output pins (of which 6 can be used as PWM outputs), and 6 analog inputs.	2
2	nRF24L01 module & adapter	2.4 GHz RF transceiver Module, Range : 50-200 feet, Baud Rate: 250 kbps - 2 Mbps, Maximum Pipelines/node : 6, Low cost wireless solution	2
3	Voltage Sensor module	Divider ratio: 5:1, Resistor Tolerance: 1%, Max input voltage: 25V, Resistor Value: 30K/7.5K Ohm	2
4	ACS712-30A Currents sensor	Measurement Range -30 to +30 Amps, Voltage at 0A VCC/2 (nominally 2.5 VDC), Scale Factor 66 mV per Amp	1
5	ACS712-5A Currents sensor	Measurement Range -30 to +30 Amps, Voltage at 0A VCC/2 (nominally 2.5VDC), Scale Factor 185 mV per Amp	1

For reading and processing the data is using LabVIEW with VISA software, and for the arduino programming is using Arduino IDE software.

Before implementing this wireless monitoring system to hybrid power system, the series test have been done using power supply and DC motor as load. The result shows that the wireless monitoring system can get the voltage and current data from test equipment.

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