POWER MANAGEMENT OF THE RECONFIGURABLE PHOTOVOLTAIC ENERGY SYSTEMS

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OUTLINE

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• FOG concept
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INTRODUCTION

- Solar PV has emerged as one of the most promising renewable sources considering its modularity, environmental impact, operational cost and availability.

- The energy demand despite its rising is inconstant and depends of different factors.

- Main challenges related to distributed generation, energy storage and demand side management still remain.

- Implementation of power management of the off-grid photovoltaic system with time-aware processing requirements.
POWER MANAGEMENT

• PV systems need to be managed continuously creating the state where the power demand on them always matches the power they can optimally produce at any time

• Dynamically reconfiguration of the PV array is crucial for the system efficiency

• Method of supplying the power, the active/sleep technique used in energy harvesting systems and Fractional voltage maximum power point tracking (FVMPPT) algorithm
POWER MANAGEMENT

PV array → Control → Inverter → Load

PV system

Battery backup

Utility grid
FOG CONCEPT

• Physical deployment is organized according to tiered architecture

• Particular node functionalities vary based on its role and position in N-tiered fog architecture

• End-to-end device communication is performed through service agents using the configurable middleware components in the form of micro services

• Inter-node communication provides horizontal integration of the distributed application
IMPLEMENTATION

- RAW DATA
- MONITORING & CONTROL (TIER 1)
- OPERATIONAL SUPPORT (TIER 2)
- CORE PROCESSES (TIER 3)
- ANALITICS (TIER 4)
- APPLICATIONS

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RESULTS

• System with high solar PV generation and average inconstant load during the 5-day period in summer time

• It is necessary to keep the balance of the system and to protect the battery operation

• The sensors and actuators are placed at the points of interest through the system
RESULTS

![Graph showing power and battery capacity over time](image-url)

- **Power [W]**
  - Y-axis: 0 to 180
  - X-axis: 0:00 to 6:00 with intervals of 12:00

- **Battery capacity [Wh]**
  - Y-axis: 0 to 1400
  - X-axis: 0:00 to 6:00 with intervals of 12:00

**Time [h]**

- 0:00 to 6:00 with intervals of 12:00
CONCLUSION

• The reconfiguration of the PV array improves PV power management, contributes to the systems flexibility, maintenance and extension of the life span

• Brings the unnecessary balance in the system, either when it is needed to maximize power efficiency or when the system needs to operate in the low-generation

• Fog computing infrastructure enables the further integration of locally generated information and knowledge
Thank you for your attention!!!