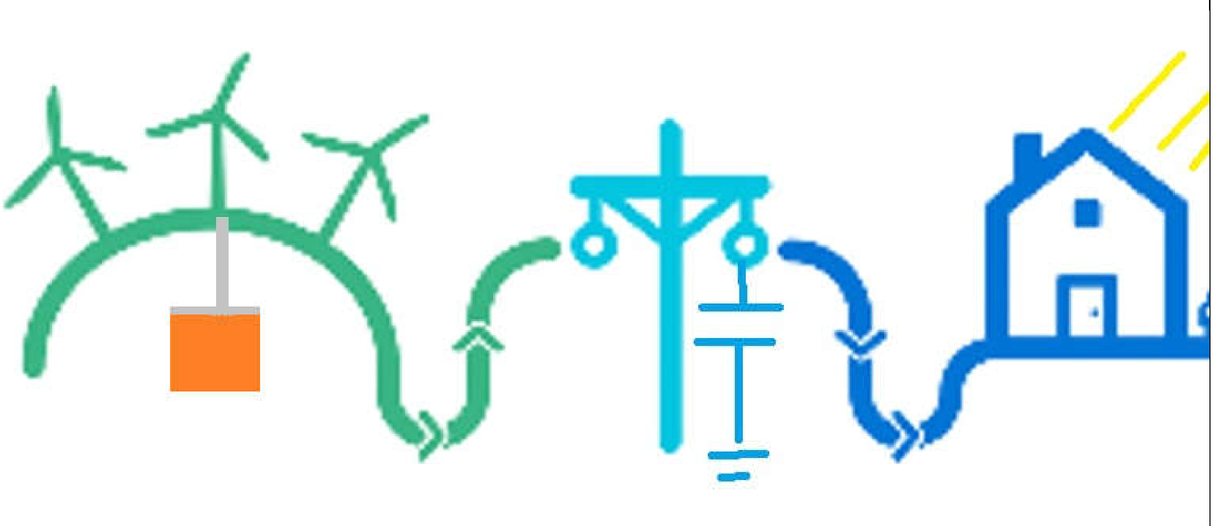
Expert System Rules for Process Control with Python

Raspberry PI Zero Environment

Including Conversion of Relay Ladder Logic
Introduction, Process, Simple Examples
Applications for Renewable Energy Systems



Gerald B. Sheblé, PhD, MBA

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Raspberry PI
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Dedicated to my trapping states: Jason, Laura, Kiyan, Annabeth

Declarations

The author and publisher have used their best efforts in ensuring the correctness of the information contained in this book. They do not assume, or hereby disclaim, any liability to any party for any loss or damage caused by errors or omissions in this book, whether such errors or omissions result from negligence, accident, or any other cause.

The Python programs which furnish the shell for the expert system rules to function are licensed only for the use of education with this text. A provisional patent has been filed for these processes.

Reference software license for commercial use and provisional patent available at: www.gbsepmt.com. The provisional patent application supporting the conversion of RLL to Python includes backward chaining.

Table of Contents

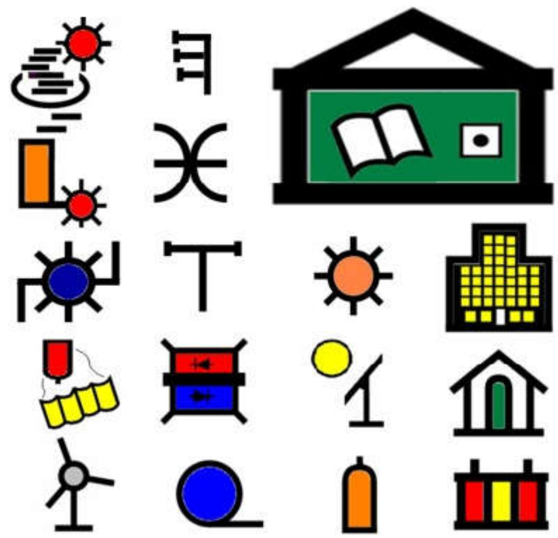
Abstract

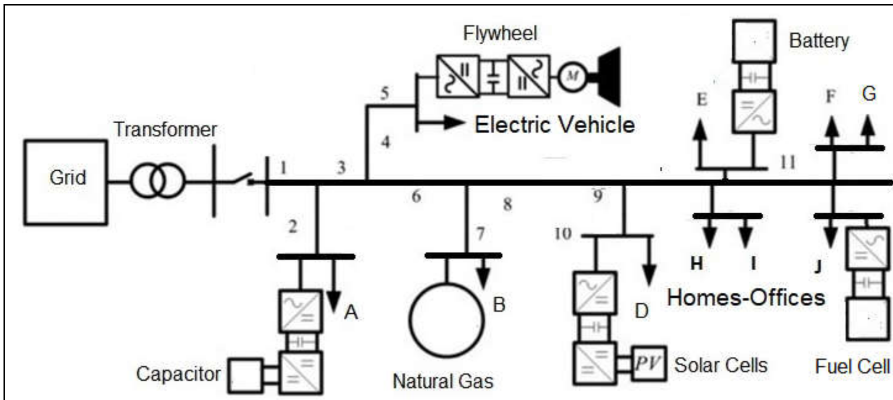
This book reflects a current industrial interest and investment in process control systems. The use of computer systems in process control provides financial benefits. Interest in the Raspberry PI, Android, Micro:Bit, and other MCUs enable the experiments and applications from Smart Homes through Renewable Energy System Microgrids. There have been considerable efforts by system designers and users to introduce and use Expert System Environments. The standard process environments are Expert System Rule processors which are languages not generally used beyond ESRs. The presented approach shows how to use the ESR as an implementation device with Python or Micro Python. Process hardware is integrated into a complete production system using the micro python. Alternatively, Raspberry PI and Python may be used. Technical specialists (e.g., electrical, mechanical, electronics, communication, process engineers, programmers, and makers) are involved in process control. The scope of this book is to assist in the application of computer hardware and software with a standard set of packages. The culminating focus is renewable energy systems, such as micro-grids, which are the future of electric energy structure around the world.

Many of these problems are provided with solutions in Energy Control Centers (ECC) Energy Management Systems (EMS) as described in the textbook “Power Generation, Operation, and Control,” 3rd edition, A. J. Wood, B. W. Wollenberg, and G. B. Sheble, Wiley, 2013, or “Computational Auction Mechanisms for Restructured Power Industry Operation (Power Electronics and Power Systems), Gerald B. Sheblé, Kluwer Academic Publishers, 1999th Edition. The first text will be referenced as PGOC in this text. The second text will be referenced as CAMs in this text.

Dr Sheblé pioneered structure and market definition predicting successful industry reregulation. He has authored over 200 papers and 50 research documents. He is an Board of IEEE PES Magazine. His columns are frequently highlighted in respected trade journals for industry innovations. He has been a premier guest/contributor at over 50 specialized workshops/courses throughout Europe and North America in over 24 countries. He has recently been an expert witness on electrical accidents, deficient project management, grounding, and intellectual property rights. Dr Sheblé has been an expert witness on software engineering, software business planning, and industrial trends.
Dr Sheblé's Academic and Industrial Experience includes: Quanta Technology, Commonwealth Edison, Control Data Corporation, Auburn University, Iowa State University, Portland State University, University of Porto (Portugal), INESC Porto, University of New South Wales, and MAXISYS.
Dr. Sheblé graduated: MBA from The University of Iowa (Henry B. Tippie College of Business), Ph.D. Virginia Technological and State University, MSEE and BSEE from Purdue University. Dr. Sheblé was awarded IEEE Fellow for contributions to the development of Auction Methods as an alternative to power system optimization methods addressing de-regulation of electric utility industry.

Reference: www.gbsepmt.com





Microgrid Controllers

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