INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATION & MANAGEMENT

A Monthly Double-Blind Peer Reviewed (Refereed/Juried) Open Access International e-Journal - Included in the International Serial Directories

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CONTENTS

Sr. No.	TITLE & NAME OF THE AUTHOR (S)	Page No.
1.	**IMPACT OF THE URBAN INFORMAL SECTOR IN THE URBAN RESIDENTIAL PROPERTY MARKET** *MOHAMMED YAHAYA UBALE, DAVID MARTIN & DR. SEOW TA WEE*	1
2.	**COMPARISON OF PCA AND LDA BASED FACE RECOGNITION TECHNIQUE IN NOISY ENVIRONMENT** *MEETA DUBEY & PRASHANT JAIN*	9
3.	**A STUDY ON WORKER'S EMOTIONAL INTELLIGENCE IN SIPCOT INDUSTRIAL ESTATE, RANIPET** *REV. FR. ANGELO JOSEPH, SDB, R. VEERAPPAN, A. STEPHENRAJ, L. MARY EZHILARASI & A. ANTONY MUTHU*	14
4.	**TERRORISM: A BIG THREAT FOR TELECOM AND INTERNET BASED COMMUNICATION** *VISHAL KAUSHIK, DR. AVINASH GAUR & DR. ASHISH MANOHAR URKUDE*	18
5.	**STUDY OF PERCEPTIONS OF INDIVIDUAL INVESTORS TOWARDS INVESTMENT** *DR. KANCHAN NAIDU & HETAL GAGLANI*	23
6.	**A STUDY ON TRAINING NEEDS FOR EXECUTIVES IN SMALL AND MEDIUM ENTERPRISES AT SALEM DISTRICT** *S. SUSENDIRAN, DR. T. VETRIVEL & M. CHRISTOPHER*	28
7.	**NONFINANCIAL REWARD SYSTEM IN NIGERIAN PUBLIC AND PRIVATE ORGANISATIONS** *DR. A. M. ABU-ABDISSAMAD*	32
8.	**WORKING CAPITAL EFFICIENCY AND CORPORATE PROFITABILITY: EMPIRICAL EVIDENCE FROM INDIAN AUTOMOBILE INDUSTRY** *DR. A. VIJAYAKUMAR*	35
9.	**EFFECTIVENESS OF RESPONSIBILITY ACCOUNTING SYSTEM OF THE ORGANIZATIONAL STRUCTURE AND MANAGER'S AUTHORITY** *ALI AMIRI, HOJJATALLAH SALARI, MARYAM OMIDVAR & JACOB THOMAS*	44
10.	**A STUDY ON APPLICATION OF DATA AND WEB MINING TECHNIQUES TO ENRICH USER EXPERIENCE IN LIBRARIES AND ONLINE BOOK STORES** *A. PAPPU RAJAN, DR. G. PRAKASH RAJ & ROSARIO VASANTHA KUMAR.P.J*	47
11.	**IMPACT OF SIX SIGMA IMPLEMENTATION: A CASE STUDY OF A PHARMACEUTICAL COMPANY** *N. VENKATESH & DR. C. SUMANGALA*	51
12.	**A STUDY ON EVALUATING THE EFFECTIVENESS OF TUTORIAL PROGRAMS IN QUANTITATIVE TECHNIQUES** *DR. ROSEMARY VARGHESE & DEEPAK BABU*	54
13.	**PROFITABILITY ANALYSIS OF REGIONAL RURAL BANKS IN INDIA: WITH SPECIAL REFERENCE TO WESTERN REGION** *DR. KAUSHAL A. BHATT*	59
14.	**A SMALL TRIBUTE TO COMPUTER LEGENDS WHO MADE AN IMPACT ON THE COMPUTER INDUSTRY AND PASSED AWAY IN THE YEAR 2011** *PRITIKA MEHRA*	65
15.	**A STUDY ON MANAGERIAL EFFECTIVENESS** *ANITHA R & M.P.SARAVANAN*	68
16.	**COMPARATIVE STUDY ON TALENT MANAGEMENT PRACTICES** *DR. D. N. VENKATESH*	76
17.	**REVIEW AND CLASSIFICATION OF LITERATURE ON RURAL CONSUMERS' BUYING BEHAVIOUR FOR MOBILE PHONE IN INDIA** *CHIRAG V. ERDA*	87
18.	**MOBILE BANKING IN INDIA: OPPORTUNITIES & CHALLENGES** *DR. P. AMARAVENI & K. PRASAD*	92
19.	**THE STUDY OF RELATIONSHIP BETWEEN REFINED ECONOMIC VALUE ADDED (REVA) AND DIFFERENT CRITERIA OF THE RISK ADJUSTED RETURN** *MOHAMMAD NOROUZI & MAHMOUD SAMADI*	97
20.	**ONLINE SHOPPING: A NEW TREND OF SHOPPING BEHAVIOUR** *SANTHOSH J & ANU VARGHESE*	101
21.	**IMPLEMENTATION OF PCA WITH SVD TO REDUCE PRECISION LOSS** *AMITPREET KOUR & RAMANDEEP KAUR*	104
22.	**AN ASSESSMENT OF UNIVERSITY-INDUSTRY RELATIONS FOR COLLABORATIVE TECHNOLOGY TRANSFER: THE CASE OF INSTITUTE OF TECHNOLOGY OF BAHIR DAR AND TECHNOLOGY FACULTY OF GONDAR UNIVERSITY** *TADESSE MENGISTIE*	108
23.	**DEMARKETING: A CREATIVE THINKING** *ANITA KUMARI PANIGRAHI*	113
24.	**A REVIEW OF ISLAMIC BANKING AND CURRENT ISSUES AND CHALLENGES FACED BY ISLAMIC BANKS ON THE WAY TO GLOBALIZATION** *UZMA FAZAL, SALMA TARIQ, MUHAMMAD MUMTAZ, MUHAMMAD NAEEM, JUNAID ABBAS & MADIHA LATIF*	118
25.	**THE IMPACTS OF PRODUCTIVE MARKETING COMMUNICATION ON EMERGING MARKET** *LOO LAE SYEE, TAN KAI HUN, VIVIAN LEONG & RASHAD YAZDANIFARD*	124
26.	**HP SUSTAINABILITY AS COMPETITIVE ADVANTAGE** *RIDHI GUPTA*	129
27.	**ELECTRONIC HEALTH RECORD IMPLEMENTATIONS AROUND THE WORLD** *DIANA LÓPEZ-ROBLEDO & SANDRA SANTOS-NIEVES*	132
28.	**FOREIGN DIRECT INVESTMENT (FDI): AN OBSERVATION ABOUT TOURISM INDUSTRY IN INDIA** *SANDEEP KUMAR, RAJEEV SHARMA & NAVEEN AGGARWAL*	137
29.	**A SYSTEMATIC APPROACH FOR DETECTION AND COST ESTIMATION OF CLONING IN VARIOUS PROGRAMMING LANGUAGES** *ANUPAM MITTAL*	142
30.	**INTELLIGENT SCADA FOR HOME APPLICATION** *S. R. KATKAR*	147
	REQUEST FOR FEEDBACK	151

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   RESEARCH METHODOLOGY

   RESULTS & DISCUSSION

   FINDINGS

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- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

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- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

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- Garg, Sambhav (2011): "Business Ethics" Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–22 June.

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INTELLIGENT SCADA FOR HOME APPLICATION

S. R. KATKAR
STUDENT
ELECTRICAL ENGINEERING DEPARTMENT
G. H. RAISONI COLLEGE OF ENGINEERING
NAGPUR

ABSTRACT
A supervisory control data acquisition system (SCADA) is an integrated platform that incorporates several components and it has been applied in the field power system and several engineering applications to monitor, operate and control a lot of processes. In the future electrical network, SCADA system are essential for an intelligent home automation resources like HVAC centralized control of lighting appliances, Air Conditioning and Refrigeration system, water reservoir system, etc. This paper present a SCADA system for typical household application which is implemented on iFIX4.0 software. The main objective is to manage residential consumption, reducing or curtailing loads to keep the power consumption in or below a specified set point imposed by the customer and generation availability.

KEYWORDS
Human machine Interface, Intelligent control, PLC and SCADA.

INTRODUCTION
Home automation is the residential extension of "building automation". It is automation of the home, housework or household activity. Home automation may include centralized control of lighting, HVAC (heating, ventilation and air conditioning), appliances, and other systems, to provide improved convenience, comfort, energy efficiency and security. *Home automation for* the elderly and disabled can provide increased quality of life for persons who might otherwise require caregivers or institutional care. Devices may be connected through a computer network to allow control by a personal computer, and may allow remote access from the internet. Through the integration of information technologies with the home environment, systems and appliances are able to *communicate* in an integrated manner which results in convenience, energy efficiency, and safety benefits.

Although automated *homes of the future* have been staple exhibits for World's Fairs and popular backgrounds in science fiction, complexity, competition between vendors, multiple incompatible standards[a] and the resulting expense have limited the penetration of home automation to homes of the wealthy or ambitious hobbyists. As the number of controllable devices in the home rises, interconnection and communication becomes a useful and desirable feature. For example, a refrigerator can send an alert message when it needs cleaning and service. Rooms will become "intelligent" and will send signals to the controller when someone enters. If no one is supposed to be home and the alarm system is set, the system could call the owner, or the neighbors, or an emergency number.

Other automated tasks may include setting the air conditioning to an energy saving setting when the house is unoccupied, and restoring the normal setting when an occupant is about to return. Home automation can also provide a remote interface to home appliances or the automation system itself, via telephone line, wireless transmission or the internet, to provide control and monitoring via a Smartphone or web browser. In terms of Lighting Home Automation, it is possible to save energy when installing various products. Simple functions such as motion sensors and detectors integrated into a relatively simple home automation system can save hours of wasted energy in both residential and commercial applications. For example imagine an auto on/off at night time in all major city office blocks, say after 10pm, when no motion is detected, lights shut down, the company could save kilowatts of wasted over night energy[b].

After this introduction section, this paper is organized as follows: Section II deals with Basic structure of SCADA systems; Section III describes intelligent SCADA system for industrial purpose; Section IV presents case study; V Simulations; and finally, Section VII presents the conclusions.

BASIC STRUCTURE OF A SCADA SYSTEM
In order to increase the flexibility of the SCADA systems, it is important to isolate subsystems which are influenced by changes of environments. Therefore, programs in electric power systems falls into three hierarchical layers as shown in Figure 1. Interfaces between different layers encapsulate the inner-structure of each layer; therefore, the modification of programs and data in one layer does not affect other layers [c].

FIG.1: THREE LAYERS OF SCADA SYSTEM

Task dependent part
Power system dependent part
Computer system dependent part

Monitoring of nowadays complex power systems and enable operators to accomplish their tasks. The traditional power system structure is changing with more and a more competitive business environment. In face of these challenges the operators need to change their control/operation strategies adopting more flexible methodologies and the SCADA system.

Task Dependent Part: Programs and data in this part are independent of the configuration of both power systems and computer systems. Since the programs in this layer become general package software independent of system configuration, they can be used in all offices with minimum modification. Namely, their modifications are needed only when application specification is changed.

Power System Dependent Part: This part encapsulates the hardware configuration and operational organization of real power system, and provides two abstract data models. One corresponds to hardware of power systems, such as a topology of transmission lines, circuit-breakers and transformers. The other corresponds to operational organization of power system, such as office configuration, control areas and ordering authority. These models make programs of the task dependent part independent of real power system Configuration.

Computer Dependent Part: This part hides a computer system configuration. It encapsulates network topology of computer system, computer architecture, location of resources etc., and the programs and data of upper two layers can be developed without awareness of computer environments.

INTELLIGENT SCADA
Making the new paradigm possible requires decision decentralization and the adequate means to implement it. This is certainly not the case of current SCADA systems. These are intended for the monitoring and supervision of equipments owned (or at least operated) by a very limited number of entities (one in most cases). It is assumed that there is a fixed entity to operate each piece of equipment (there is of course flexibility to operate at different levels, such as locally or remotely, but in the scope of the same entity such as a distribution or transmission company). In the future DER owned by a large set of diverse entities will represent a significant part of the overall resources. It is not possible to adequately plan and operate the system if DER are not considered as taking part in the solution of power system problems. For this, it is required to have decentralized intelligence and decision ability. It is equally important to have SCADA based on

a power system model which is based on the new paradigm. This imposes to consider both the physical part of each power system component and its cyber dimension, which requires a SCADA based on a cyber-physical model of the power system. Power system components are important because of:
a) the relevance of their physical existence and operation features (P);
b) the availability of relevant information we may have about them in decision centers (I);
c) the permission to operate them (O).

The relevance of one specific component for the solution of a particular problem must be evaluated considering simultaneously a), b) and c). In fact, it is not at all relevant to have a component with the adequate characteristics to in the current state of art; SCADA systems consider these three conditions in a very limited way, using the logic of serving a single entity that uses each SCADA. In the future, SCADA will have to consider the same three conditions in the scope of competitive environments where each entity SCADA has direct access to its own components. When negotiated, each SCADA can also have access to information and operation of other players owned components. Moreover, in many cases, once these permissions, and the conditions under which they should become active, are define are, the permission should be automatic and transparent to the users. Like this, real-time operation is guaranteed and market and ownership issues are respected. solve a problem if one does not have access to the required information about it in due time to take a decision. None of these is of any value if one does not have the permission to operate this component. Some characteristics of SCADA systems presently Commercialized can be pointed out [d]:

• Today's SCADA systems are able to take advantage of the evolution from mainframe based to client/server architectures. These systems use common communications protocols like Ethernet and TCP/IP to transmit data from the field to the central master control unit;
• SCADA protocols have evolved from closed proprietary systems to an open system, allowing designers to choose equipment that can help them monitor their system using equipments from a variety of vendors;
• SCADA systems are widely used to monitor and control critical infrastructure utilities;
• While SCADA protocols are more open today, there is not yet a clear consensus of which protocol is the best.

The main advantages of using SCADA systems in a company are [e]:
-Real-time monitoring,
-System modifications,
-Increased equipment life,
-Automatic report generating,
-Troubleshooting, etc.

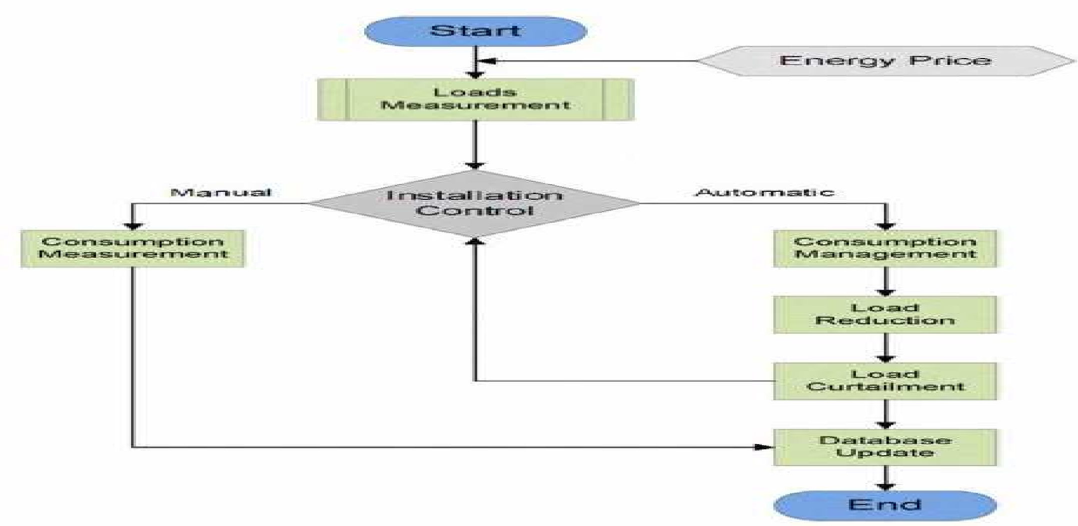
CASE STUDY

This section presents a case study to illustrate the implemented energy management methodology. Sub-section A describes the methodology used to undertake load management. Sub-section B describes the equipment used for the case study. Sub-section C describes the developed human-machine interface. Finally, sub-section D presents the results obtained for this case study.

A. DECISION METHODOLOGY

The main objective of the decision methodology is to manage loads when there is a shortage in the available power to supply the load. This can happen due to a shortage in power generation or to user defined consumption limits. When, for instance, in night periods, generation is higher than load, no action in the load side is performed. The surplus energy is stored in batteries; if batteries are full-charged, some generation resources are automatically disabled. This is a real-time control system that evaluates at each moment the energy consumption and, if necessary, makes changes to the connected loads. Fig. 2 presents a schematic representation of the implemented decision strategy.

FIG. 2: SCHEMATIC REPRESENTATION OF IMPLEMENTED STRATEGY

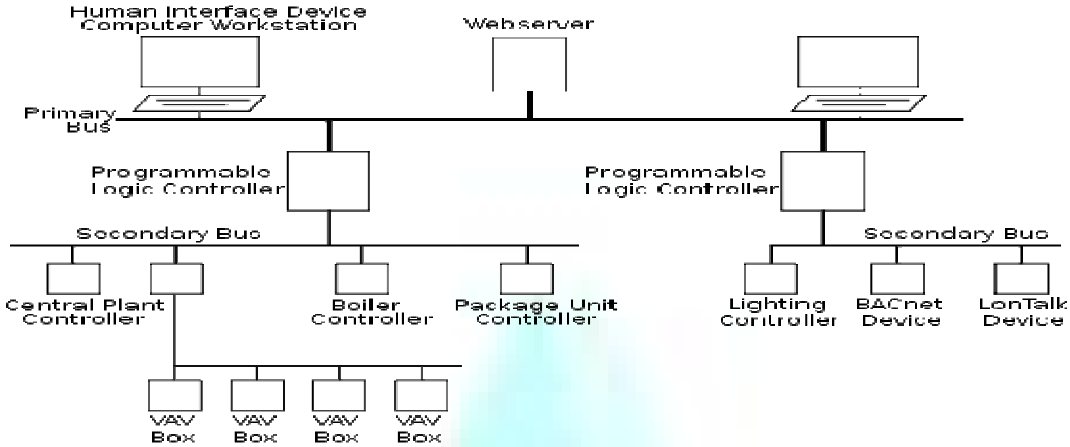


The controlled installation can operate two load types: controllable and non-controllable loads. Non-controllable loads can only be operated manually. Controllable loads can be operated both in manual and automatic modes. Load management is performed taking into account a reestablished order of merit that orders the loads by priority of supply as determined by the user. Rules concerning reducible and curtail able loads are taken into account by the decision methodology. As a reference for load management, a set point is required to define the maximum load to be supplied. This set point can be defined by the user, but if the power provided by the installed generation is not sufficient to supply the whole load, the set point is automatically adjusted to the value of generated power.

B. EQUIPMENT CHARACTERIZATION

For the present case study, the energy provided by generation units and storage is managed by the SCADA system and delivered to a set of loads.

FIG. 3: INTELLIGENT BUILDING SYSTEM OR SMART HOME



The SCADA system is composed by several hardware components for data acquisition and resources management such as energy meters, switches, electronic ballasts, and drivers for motor control. The central operation of SCADA is undertaken by a tactile industrial computer that provides users with the human machine interface and runs iFIX4.0 software. This software is able to communicate with a PLC that is connected with all the components of the system. Since it is able to communicate in several protocols, it can be used to communicate with a large diversity of appliances and fig. 8 presents the control panel of the test bed used for this case study. The non-controllable portion of load is implemented with a set of variable resistive loads.

The test bed includes six controllable loads:

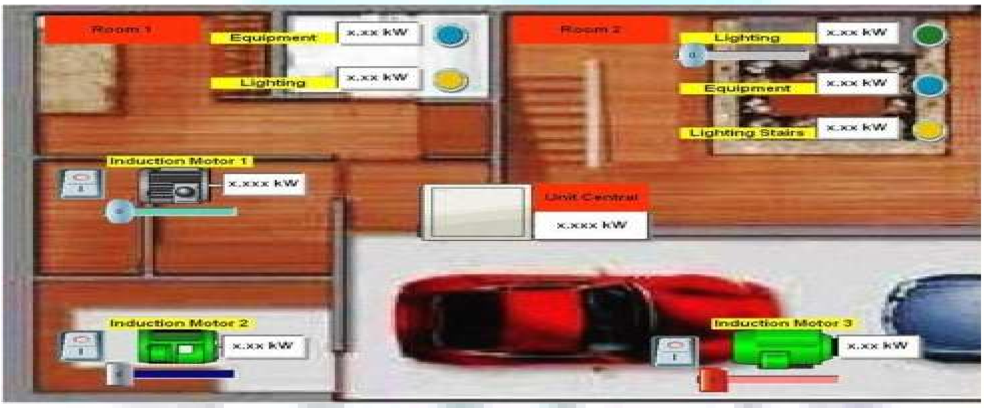
- 0.5 HP induction motor (IMA);
- 1.0 HP induction motor (1MB);
- 2.0 HP induction motor (IMC);
- 40 W incandescent lamp (IL);
- 72 W (2 x 36 W) fluorescent lamps (FL);
- 600 W heat accumulator (HA).

The energy to supply the load is provided by two photo voltaic panels, one wind turbine, one fuel cell and a storage system.

C. HUMAN MACHINE INTERFACE

The test bed installation represents a residential house which control display is presented in Fig. 4. This is the main menu where one can have a general view of the installation and some information about the loads.

FIG. 4: INSTALLATION MAIN CONTROL PANEL



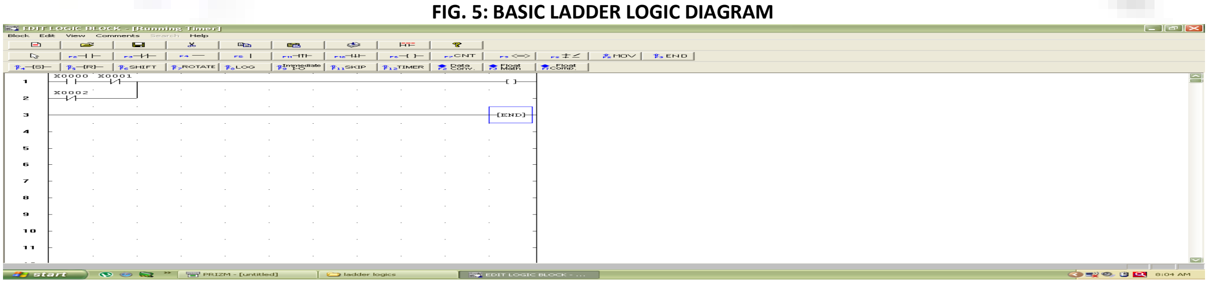
Clicking on each element, accesses a more detailed information menu. Fig. 4 shows a screen where one can see the total active power consumption of the installation and verify the results of the implemented load management. This interface is implemented in iFIX software which provides users with flexibility for both graphical interface and functionality development. Altogether, this implementation has 6 screen menus to control the whole installation.

SIMULATION

A. SIMULATION OF LADDER PROGRAMING

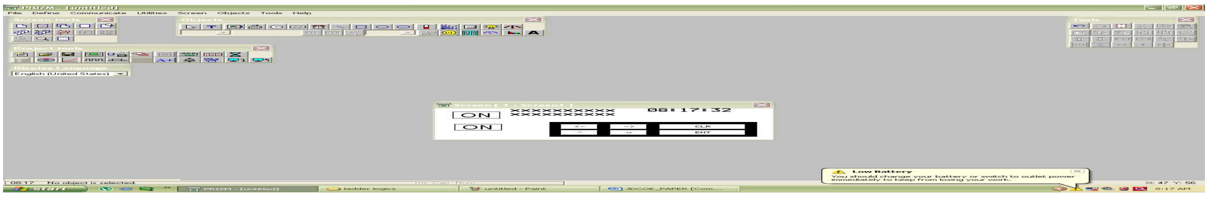
We studied the three types of plc like Siemens, Schneider, and Renu Electronics. After comparatively study we decide to use of Renu Electronics PLC with Prizm3.12 simulator. Because this PLC MODBUS protocol supported and it is easy to communicate with SCADA. Also it required RS 232 or serial cable. Proposed hardware system totally based on automation in which all field devices running according to ladder logic for this using Prizm3.12 simulator.

FIG. 5: BASIC LADDER LOGIC DIAGRAM



The ladder logic see in fig. 5 download in PLC after that all field devices inputs and outputs connected to the PLC. In Prizm3.12 a best feature is it gives a on-line or off-line simulation, if hardware not connected that time we test the ladder logic by off-line simulation mode. The on-line simulation step show in fig. 6.

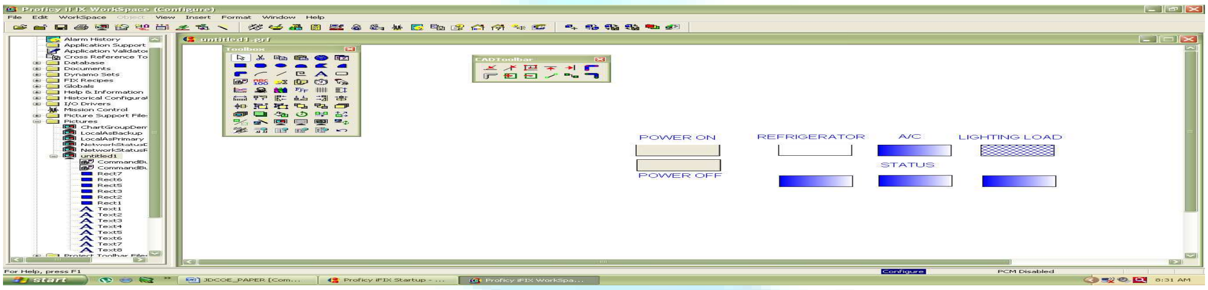
FIG. 6: SELECT SIMULATION USING PRIZM3.12



B. SIMULATION ON iFIX4.0 SOFTWARE

We studied the three types of SCADA like iFIX, InTouch and ICONICS. After comparatively study we decide to use iFIX SCADA software. Because iFIX SCADA is supports different PLC, it does not required particular drivers for communication with PLC. For SCADA use the ICONIC software in which we see the real time information of proposed system even if we observe fault at which place in system occur means monitoring whole system operation at control room. Real time status of field devices shows in fig. 7.

FIG. 7: REAL TIME STATUS OF HOME DEVICES ON SCADA



RESULT

The proposed system is designed for home automation, So that we can save the power of different Heavy Electrical Equipments (e.g. Motors, Refrigerator, Lighting, etc) also controls the operations and monitoring the real time information of home devices in the system.

CONCLUSION

This paper presents a load management application for use in home installations. The presented application is implemented in iFIX and Prizm3.12 simulator software.

- A supervisory control and data acquisition (SCADA) system is an integrated platform that incorporates several components.
- It has been applied in the field of power system and several engineering applications to monitor, operate, and control a lot of processes.
- To study how efficiently we can use SCADA system to control, operate and monitor the Load Distribution Schemes.
- The proposed work having Hardware and software Optimization with the help of PLC Ladder Logic. We are adopting this technique to reach strong Conclusion about their actual impact on the power Consumption.

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