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Intelligent Power Economy System (Ipes)

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Abstract: - T This paper discusses an Intelligent Power Economy System which is an intelligent way of saving energy and it allows the user to allocate desired electrical power consumption and it also take care of the comfort level of the user. Intelligent Power Economy System (IPES) is very intelligent, compact, cost effective, and user-friendly device. IPES is truly intelligent because it has the ability to learn and can create a behavioural model of habitants of dwelling. It has a fully functional inference engine and knowledge base with 15 minute resolution and 14 days cycle is embedded into low end 8 bit microcontroller. IPES will provide a mean to move and work according to requirements and needs of the consumer. This system will take required input from the user and then regulates the power according to the mode selected i.e. Economy mode, Medium mode, Lavish mode. In this particular system user will be able to decide how much electricity he needs and it will be set by the user itself. Such system will be beneficial and conducive as we can set a required amount of power to be used at specific times.

Keywords: - *Compact, Intelligent, Cost Effective, User-Friendly, Controllers*

I. INTRODUCTION

Shortage of electricity is the major issue all over the world. This is the major motivation behind this research or project. Our Intelligent Power Economy System helps the individuals to control economy with no effects on comfort level. An individual using this system not only reduces the loss of energy but also make use of electrical power in economic way. Due to the instability in electrical power sector all over the world, we made efforts at grass root level to control this havoc and provide sufficient energy as is required. If this system saves 100 units a month from a house or industry etc then we can save many mega watts of electrical energy in a month and hence making shortfall of energy controllable and feasible.

Our proposed device is very intelligent and compact. IPES is intelligent in a way that it has the ability to learn and can capture behaviours and it can create a 14 days behavioural model and after 14 days it wil start repeating. This projects works on three modes and this system will take input from the user and then regulates the power according to the mode selected. Mode 1 will be Economy Mode and in this state less power will be consumed. Mode 2 will be Moderate Mode and this will give medium power. Mode 3 will be lavish mode and this will provide maximum or large amount of power when needed. Another feature of this device is that if it is not being used on regular basis then if mistakenly we forget to put the switch off, it will go off automatically after a preset interval of time. This enables us to keep record of consumption in our daily lives, participates in, or provides demand response solutions and services. By having information, customers could be assisted in to have knowledge of changes in energy usage from normal consumption patterns, either in response to changes in price or as incentives designed to encourage lower energy usage at times of peak demand periods or higher wholesale prices or during periods of low operational systems reliability. This system is not intended for hotels. This infrastructure includes software and hardware implementations to get the required work done. This system must be beneficial to use as it sets required amount of power to be used at specific times.

II. EXISTING SOLUTIONS

Shanty towns of South Africa have tough neighbourhoods; advance sensitive systems might not function in such towns. Specialized coins which are purchased from the market by the users to put their

electrical power on. The users insert their coins inside the machine kind of boxes that are placed outside their homes and as soon as the coin is placed inside the electricity is provided to their homes.

2. Smart Buildings In Rich Gulf States By LG:

These buildings are so intelligent that they are aware of the presence and needs of the habitants. Smart Building system allows operational monitoring and control of machinery, lighting, power equipment and provides facilities control from an alarm to responding according to the preset schedule in case of an event occurrence. It also provides analysis of energy consumption patterns and analyzes the collected information about various resources such as equipment, manpower, energy, supplies, etc which is needed for building management to improve the efficiency of maintenance and management tasks.

3. Project Oxygen: Pervasive, Human-Centric Computing – An Initial Experience:

[1]Project Oxygen is an intellectual efforts involving many research activities throughout the Laboratory for Computer Science (LCS) and the Artificial Intelligence Laboratory (AIL) at The Oxygen project's vision is to bring an abundance of computation and communication within easy reach of humans through natural perceptual interfaces of speech and vision so computation blends into peoples' lives enabling them to easily do tasks they want to do – collaborate, access knowledge, automate routine tasks and their environment. This project has a three-pronged approach by dividing the space into three broad categories: the H21, a hand-held device, the N21, an advanced network, and the E21, a sensor-rich environment (Figure 1).

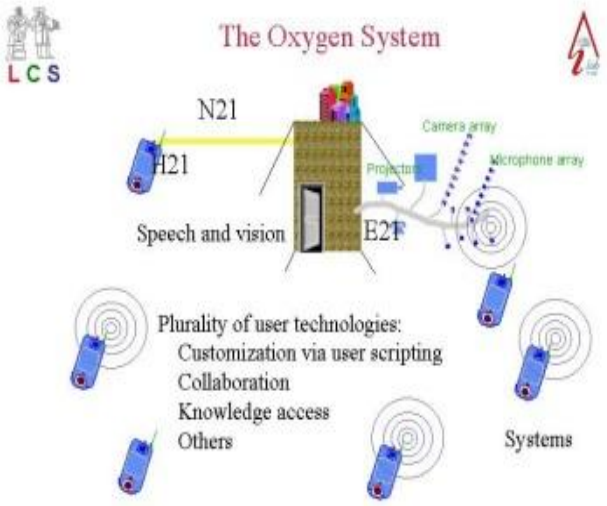

Figure 1: An overview of the Oxygen Infrastructure, showing the division into three parts: H21, a handheld digital device, N21, the network infrastructure, and E21, the environment infrastructure.

4. Honeywell Technology Solution Lab:

[2]HTSL Research group works with Honeywell product R&D groups and Honeywell Research Labs globally develops key technologies that enhance Honeywell products to benefit its customers. The computation and communication systems (CCS) lab concentrates on core research in the fields of computation systems with a primary focus on wireless system design. The Intelligence Vehicle Technologies group works on autonomous vehicle systems for various applications like Unmanned Air Vehicles, Mining, Agriculture, Smart transportation systems, Robot vehicles, Marine vessels, etc. The focus areas include navigation, perception sensing, guidance, x-by-wire controls, multi-sensor fusion, fault tolerance and reconfiguration, Smart communication and computing platforms with competencies ranging from multi-sensor fusion algorithms, Pattern Recognition, Machine Learning to Vision sensor processing techniques, etc. The Computer Vision and Image Analysis Group are dedicated to conducting basic and applied research in computer vision and image processing.

III. ARCHITECTURE OF THE SYSTEM

The basic knowledge used behind the whole architecture of Intelligent Power Economy System (IPES) is Learning and Automation. The basic technologies are Microcontroller Automation Design and Artificial Intelligence. Figure 2 and 3 shows the flow chart that gives a complete scenario of how the system will work, complete structure of learning and automation process.

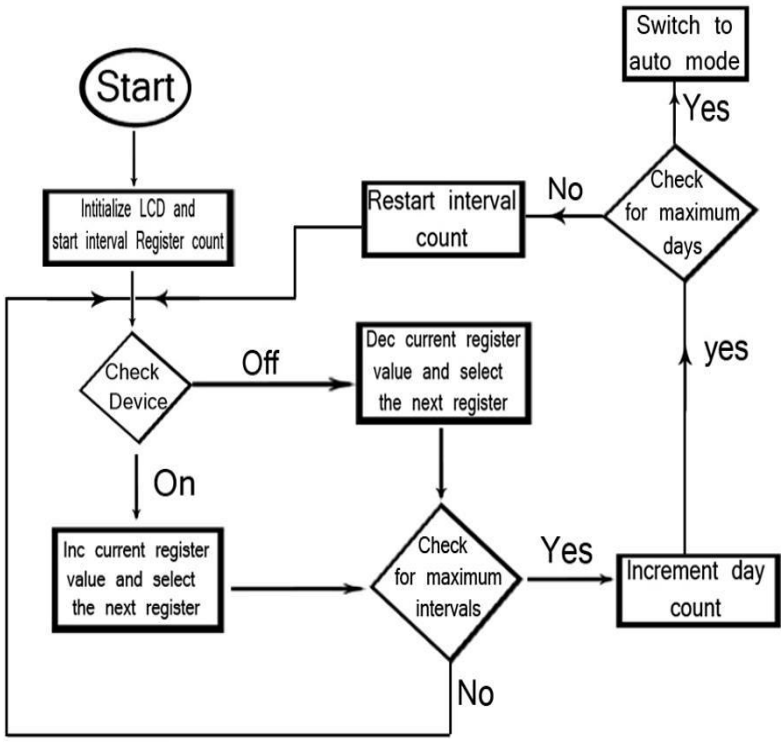

Figure 2: Learning Process

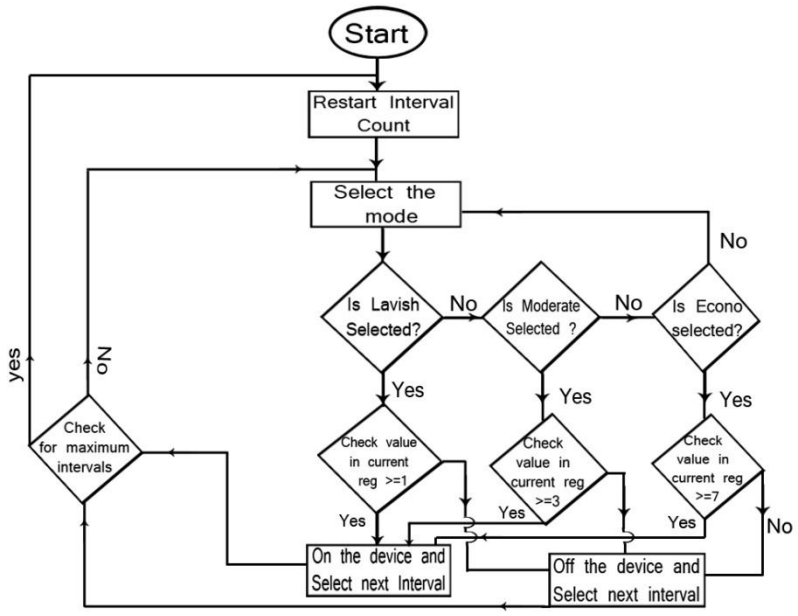

Figure 3: Automation Process

IV. SYSTEM DESIGN

Our proposed Intelligent Power Economy System (IPES) is an intelligent device. This device will get information from the user about his need of electricity at a particular time and place. After getting information it will provide electricity intelligently according to the priorities of the user. Its features are human interfaced, compact, user-friendly and cost effective.

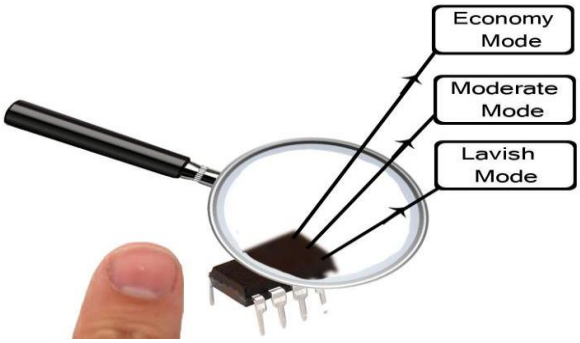

Figure 4: It shows the compactness of IPES device and describes the three modes.

1. Tri or Three State Switch:

This switch is very compact and its size is equivalent to the size of an IC on which all the three modes will be defined and it will be mounted in a room and it will work according to the Mode selected and LED will be attached to these modes which will indicate which mode is selected by the user. Mode 1 is the Economy mode and when it will be selected it will be indicated by red LED. Mode 2 is the Medium mode and is indicated by green LED. Mode 3 is the Lavish mode and is indicated by blue LED. After getting the mode selected from the switch the respective indication will be given by the LED and system will provide the electricity accordingly. This whole system will consist of an LED, Tri-state button and Processing Device. The system will be attached with appliances to regulate the power according to requirement.

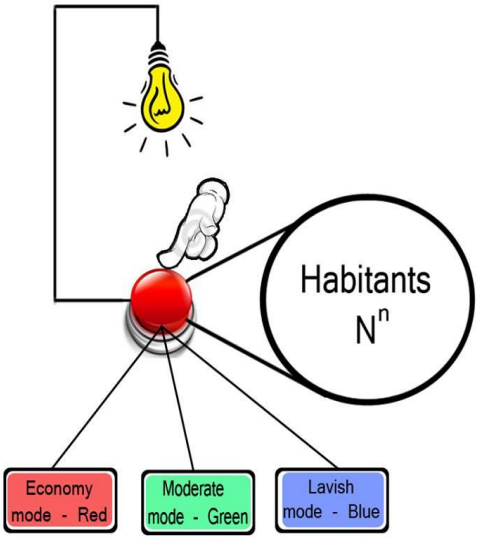

Figure 5: It shows that as soon the user will put this switch on the electricity will be switched on.

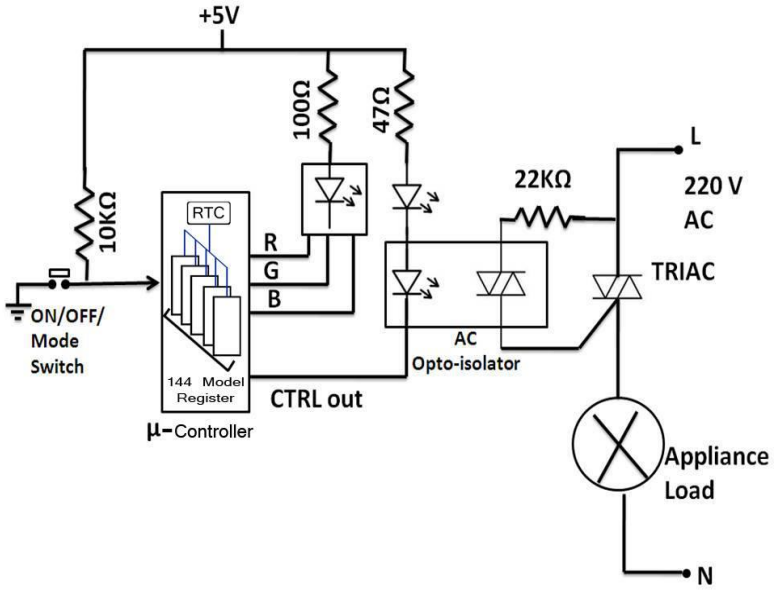

Figure 6: Hardware Implementation of IPES.

Figure 6 explains the complete hardware of IPES. The main components include microcontroller board, Opto-isolator for transfer of electrical signals using light. And a Triode for Alternating Current (TRIAC) that will conduct current, to which the appliances will be connected.

2. Inference Engine:

Inference engine is the branch of knowledge engineering and artificial intelligence; it is basically a computer program that derives answer from a knowledge base (Kb). There is no such thing as pure logic. Life at large is ambiguous and runs in chaos. Inference engine is a small device system that can capture the behaviour of people living in a house. There are two types of recognition techniques one class caters for physical appearance of human beings (bioinformatics) and second class deals with human behaviour (forensic science).

We have to record the different timings of usage of power from the user so it is important to have sequence of these intervals in which electricity will be used. When there will be a proper record of timings then it will be convenient for controller to run the corresponding code. Otherwise it will become troublesome for the system to operate efficiently.

The full mature model extracted by the inference engine is as follow:

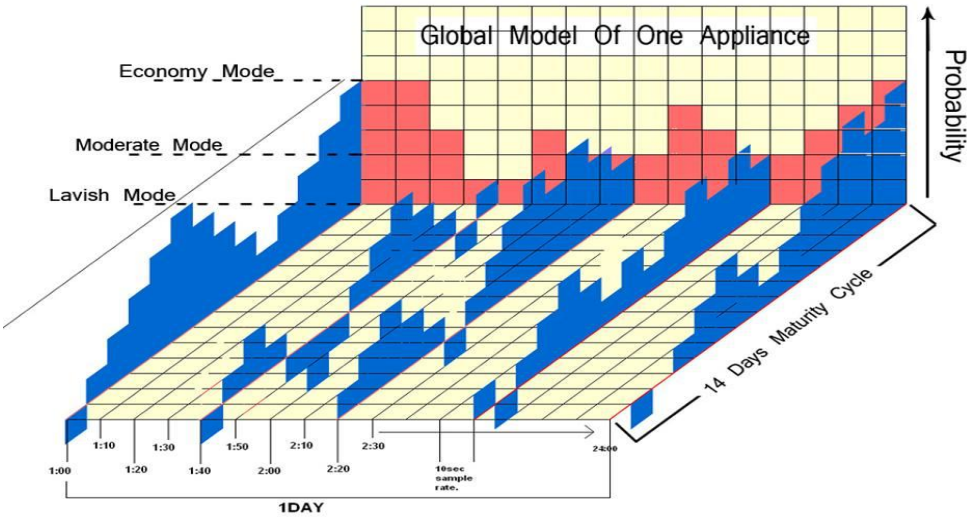

Figure 7: Model Extracted by the Inference Engine.

The inference engine derives the knowledge of usage of device in 14 days. The engine keeps the record of 1day and derives the next ones making the model mature enough to use the appliance accordingly.

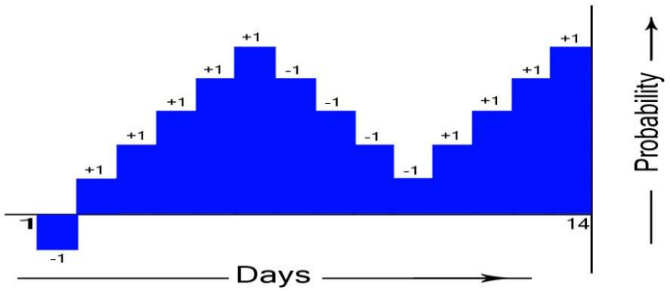

Figure 8: 14 Days maturity cycle graph

Inference engine derives the model by adding and subtracting the value of register if device is on and off respectively. Three modes of usage i.e. Economy, Medium, Lavish are set accordingly as the consumer uses the appliance.

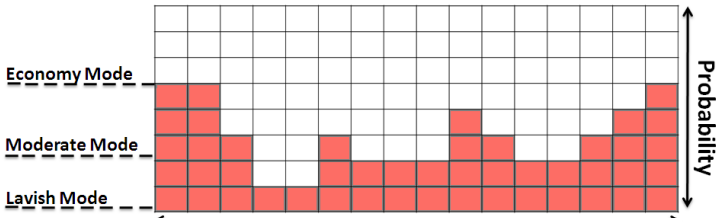

Figure 9: Global Model for One Appliance.

One day status of the appliance used by a consumer is given below. Intervals of 10mins are defined on which status of device is checked i.e. ON or OFF. So for one day we have 144 intervals of 10mins each. (+) sign indicates the ON status while, (-) sign indicates OFF status of device.

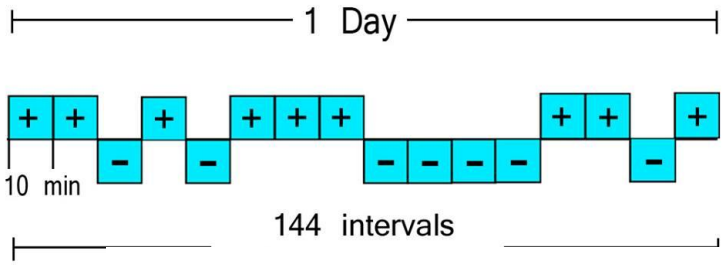

Figure 8: Daily Status (ON/OFF) of Appliance.

In the above diagram there are 144 Registers (Up/Down 8Bit Counters) are being used to accommodate running average of an appliance for each of the 144 segments of time in a day. Hence in 14 days each of the 144 registers holds the running average of an appliance for one of the 144 intervals in a day. And together the 144 registers form the "Global Model of an Appliance".

V. CONCLUSIONS

IPES is a very compact, cost effective, intelligent and user-friendly device. The user needs not to learn or think to use our proposed system (IPES). IPES will save energy intelligently and it will provide a mean to move and work according to the requirements and needs of the consumers. The system has three modes according to the electricity usage and modes are mode 1-economy mode, mode 2-medium mode, mode 3- lavish mode. The device itself has the capability to learn and capture behavior. The device will produce the behavioral model of 14 days and the cycle will repeat after then.

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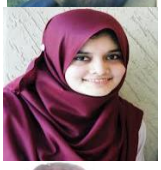

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