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Energy Management Using IoT

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Abstract— Energy is a very important aspect for any household, industries, agriculture and so. Managing the energy efficiently and conserving it intelligently for appliances is very much important. The energy usage is directly affected with Coal, oil and so towards power generation. Towards this, there has been lot of research work carried out in developing some smart lighting system pertaining to classroom for conserving the energy. So with the upcoming of machine to machine communication where devices can be connected wirelessly leading to IoT, we here have developed an IoT based Smart Energy Management system where appliances like Fan and Bulb to start with are controlled wirelessly based on user input. These inputs are used towards controlling the appliances intelligently rather than just switching on or off. In addition, the system also keeps computing throughput the day power consumption of the appliances which gives the user knowledge on power being consumed over a period of time. These details are updated in Cloud server. This prototype system developed have achieved energy conservation at every household.

***Keywords*:-** IoT, KVA HT, LDR, RFID.

I. INTRODUCTION

Increasing economic growth and consumption patterns are leading to ever growing demand for energy. Since most of the energy supply is from fossil fuels, the resource is depleting thus increasing cost of energy. Burning fossil fuels has also increased concentration of carbon-di-oxide in the environment leading to extreme weather patterns. Hence it is imperative that Industries and commercial enterprises take steps to reduce energy wastage, become energy efficient and reduce costs. Industry in India consumes 45% of the 900 billion Units of power produced. 35% of electric power produced is lost, and the losses are due to Transmission & Distribution (16%), theft (10%), Inefficiencies among users (10%). The 10% inefficiencies are largely among the industrial and commercial users who have high KVA HT connections.

Inefficiency can also arise due to harmonic problems, faulty wiring, feedback from sub systems, and neighbouring electrical systems. This leads to a drop-in power factor and higher utilization of energy leading to higher rate slabs and penalties. Some organizations like Data centres measure Power Usage effectiveness where units consumed per annum is much higher than that required to power their total equipment. All these are applicable to industries like SMEs, cement, steel, auto, heat treatment/cooling, food processing, chemicals, plastics, textiles, commercial.

II. METHODOLOGY

- **An intelligent lighting and Energy management for residential and commercial buildings.**

This paper focuses on the process of consuming energy ineffectively by switching and dimming systems of energy consumption. The device is turned off automatically when there is no need. Various sensors are used so that it becomes easy to identify the need of energy .The switch on or switch off of the device is decided automatically when the outside environment conditions changes automatically. The sensors use dare generally LDR, temperature sensors, humidity sensors , motion sensors, cameras.[1]

- **IOT based monitoring and control system for home automation.**

This paper says about the process of controlling the devices of home appliances via Wi-Fi. In which Wi-Fi as a communication protocol and raspberry pi as a server system. Raspberry pi communicates with the corresponding relays. The user must be connected to the internet so that he/she can access the internet any- time when he/she wants. The stat of relays is changed according to the signal coming over the internet from the user. There lays control the power supply given to the devices. One relay is interfaced with every device in the system.[2]

- **Home automation using raspberry pi through Sir enabled mobile devices.**

The main idea of this system is that controlling the devices via voice recognition. The proxy server use dis Siri which is installed in raspberry pi. A set of commands are used for controlling the home appliances. Siri is basically a voice-controlled system. Using this we can control the appliances by using the pre-defined voice commands. The voice recognition system can be used so that only the authenticated users can access the appliances.[3]

- **A low cost smart irrigation control system.**

An approach to build a low-cost irrigation system. It can be controlled through moisture sensor. The controlling of water motor automatically. When the moisture near the soil of plant gets low then the water is supplied automatically. The moisture level is predefined already if the moisture of soil goes below the pre defined level then the water pumps will start automatically. This is basically feedback based system.[4]

- **Smart drip irrigation system using raspberry pi and Arduino.**

This system focus on the conservation of energy in which do**ne** automatically ac- cording to the parameters like humidity like soil parameters. Use of ultrasonic sensors and valves provide a smart drip irrigation. The condition of soil is first analyzed using different sensors. Different environmental parameters like humidity, moisture, temperature, sunlight are observed. This data is then analyzed using the Arduino and raspberry pi .By connecting GSM module the farmer can get the message when the water valves are turned on or off.[5]

III. RESULTS AND DISCUSSION

Light system was designed using HTML coding. A webpage was developed to control the lights in the home automatically from an internet using a computer, tablet or even a cell phone. This system uses a server address hosted by the Raspberry Pi itself, each button on the webpage is click able. Buttons on the input section senses signals from the controller. According to which input button will pressed respective that device will turn on and off.

System design:-

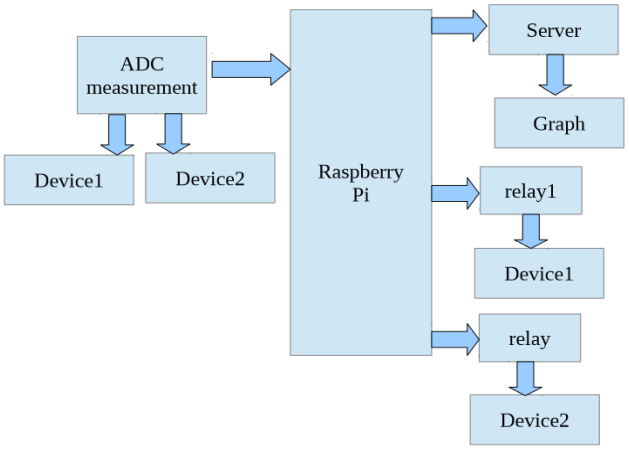

Fig. 1

Flow Chart:-

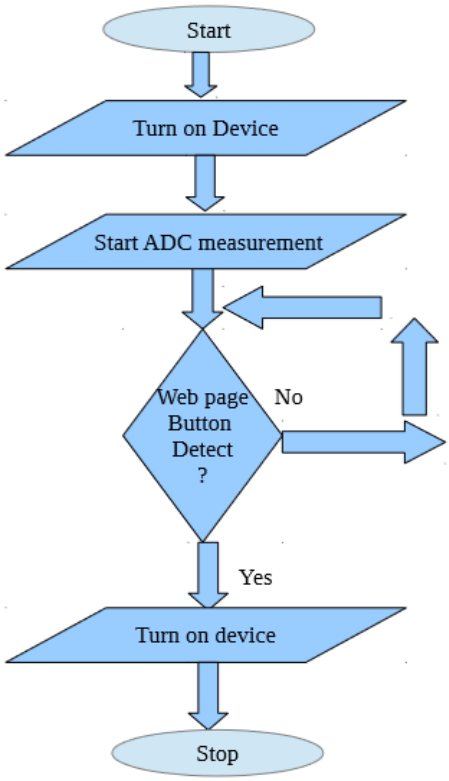

Fig. 2

IV. RESULTS

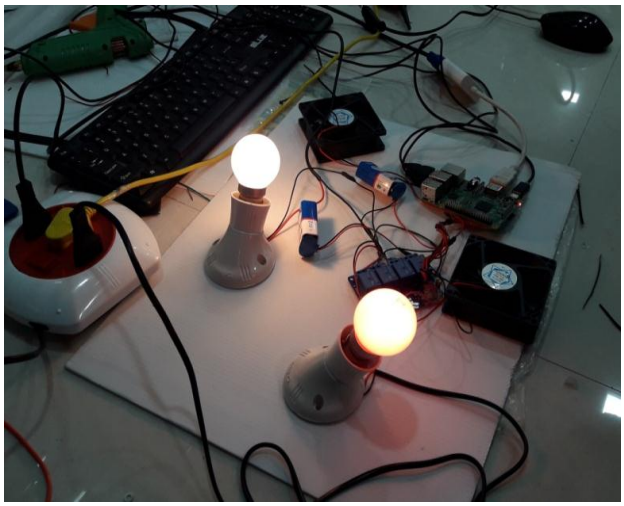

Fig.1 :- Both the devices are ON.

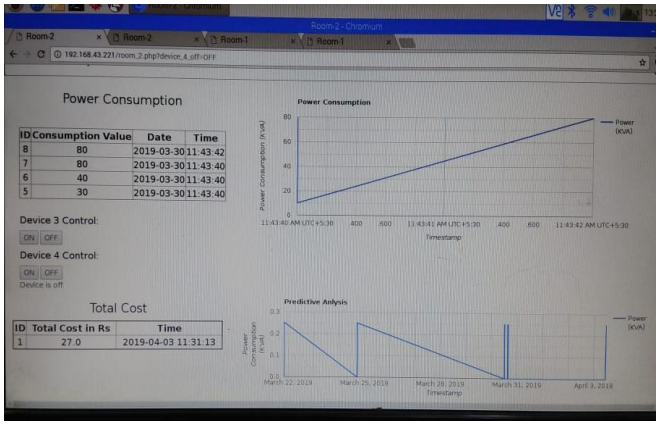

Fig. 2 : Consumption of power in room 2 and respective graph and its predictive analysis.

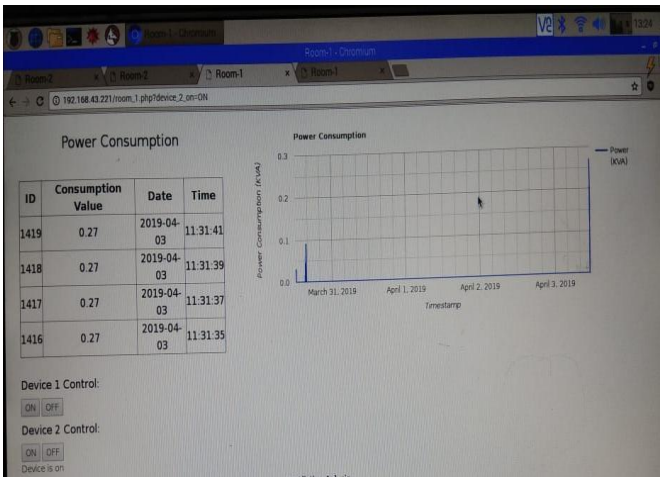

Fig. 3: Consumption of power in room 1 and respective graph.

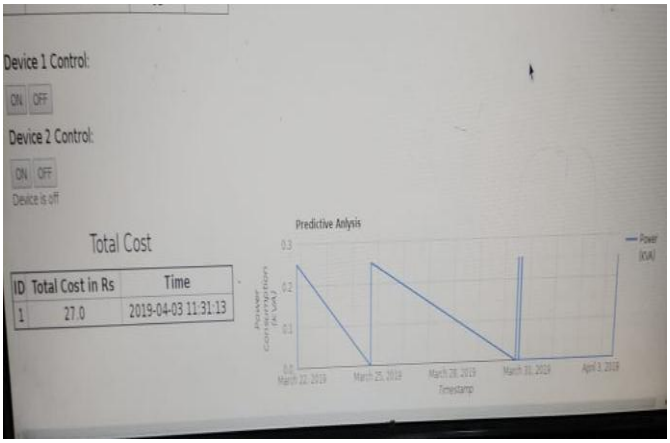

Fig. 4: Predictive analysis of power consumption in room 1

As shown in fig.1 using raspberry pi both the devices are on, while fig. 2 shows power consumption in room 2 with its graph and predictive analysis. Fig.3 shows power consumption in room 1 with its graph and the last fig. 4 shows ppredictive analysis of power consumption in room 1

V. CALCULATIONS

60W bulb

KW hour is unit of energy [60KW =1 hour] [60000W=1min]
60W/per hour = 60/1000 = 0.06 KW / hour

0.06/3600 = 1.666*10^-5 per sec

1.666*10^-5*60 = 0.001 KW

0.001KW*1000 = 1W

0.06KW * 10/unit = 0.6 Rs / hour

Zero bulb

Power consumption of zero bulb = 15W

15W = 15/1000 = 0.015KW

0.015 * 10 = 0.15 Rs / hour

Fan Calculation

KW hour is unit of energy [1KW =1 hour] [60000W=1min]

0.25W/per hour = 0.25/1000 = 0.00025 KW / hour

0.00025*60000 = 15 mill Watt

1 min Fan = 15 mill W Power

0.00025 KW * 10 RS = 0.0025 Rs/hour
0.25 75 hour = 0.01875 Total Power = 0.01875 * 100 RS
= 1.875 Rs

VI. CONCLUSION AND FUTURE SCOPE

Intelligently controlling the appliances rather than just switching on or off. In addition, the system also keeps computing throughput the day power consumption of the appliances which gives the user knowledge on power being consumed over a period of time. These details are updated in Cloud server. Thus we conclude that prototype system developed have achieved energy conservation at every household as compared with the conventional methods.

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