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SMART IOT SOCKET

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ABSTRACT—The project aims on conserving electrical power in household environment by automating electrical sockets to "Smart IoT Sockets". The basic idea revolves around electrical power wastage in household environment due to forgetfulness. Imagine a situation where a person forgets to switch off the electric geyser in the bathroom or forgetting to switch off the television and falling asleep, well not only this but there are other scenarios where people have UPS at home but there are no isolated wiring for heavy loads like – refrigerator, electric iron, electric kettle, electric cooker, microwave oven etc. The smart socket is a programmable and configurable socket wherein we can set and audit –energy consumption, run time, idle run time, power fail run time, and occupancy. With all these features the socket is connected to a central automation hub and is capable of setting everything wirelessly, so there is no need of extra electrical wiring to use the socket. The sockets will communicate with the central HUB via a dedicated long range RF link and various sensors like – occupancy, power fail, energy metering etc., will communicate with the sockets to act accordingly.

INDEX TERMS- Smart socket using Arduino MCU, nRF24L01, HLW8012, Raspberry Pi.

1.INTRODUCTION

The system proposed will provide remote control, automatic control, UPS friendly control, energy saving, usage and use-case analysis etc., utilizing a Raspberry Pi single board computer as the control hub equipped with a wireless transceiver and a touch screen type human machine interface for local operation of the system, the central hub can be connected to a Wi-Fi network which will further connect the central hub to the internet for controlling and configuring the system remotely via a smartphone, tablet, laptop or a desktop computer with a HTML5

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compatible browser and internet connectivity.The switchboards will be equipped with 2.4GHz wireless transceivers for communication with the central hub, energy metering module, Arduino Nano MCU, PIR type occupancy sensor, capacitive touch switch, LED indicators and relay module for power control. Additional mains power sensor and transmitter will be used to send mains power availability status to all switchboards and central hub for UPS friendly operation.The system can also notify users remotely via push notifications on their devices utilizing HTML push features.

2.LITERATURE REVIEW

A short review of "Wi-Fi / Smart Wi-Fi / IoT sockets" was conducted wherein we have reviewed features of similar commercially available products and the same is detailed below.

1.. Amazon Smart Plug is a smart Wi-Fi connected socket capable of driving loads up to 6Amps, and features – local control, remote control, voice control using Amazon Alexa (Echodot devices), and automatic control using Amazon Alexa Routines. The device features easy setup and can be replaced with existing switchboard. It uses the Amazon Alexa App for setup, configuration and usage. [1]

2. Syska Mini Wi-Fi Enabled MWP002 Smart Plug is capable of driving loads up to 10A, and features – local control, remote control, voice control using Amazon Alexa, Google Assistant and also can achieve automatic control using Amazon Alexa Routines and Google Assistant. The device connects to Wi-Fi network for remote control and configuration, and can be plugged to existing switchboards.[2]

3. TP-Link Wi-Fi Smart Plug HS100V1/V3 is capable of driving loads up to 16A, and features – local control, remote control, voice control using Amazon Alexa. The plug can be controlled additionally with manufacturer's KASA app which can be installed on a smartphone. The device is equipped with – power and settings buttons, and can be plugged to existing switchboards.[3]

4. Son off S26 Wi-Fi Smart Plug is capable of driving loads up to 10A, and features – local control, remote control, voice control using Amazon Alexa, Google Assistant and also can achieve automatic control using Amazon Alexa Routines and Google Assistant. The device connects to WiFi network for remote control and configuration, and can be plugged to existing switchboards. The device is equipped with power button. It can also be controlled with the manufacturer's app which can be installed on any smartphone.[4]

5. OAKTER OAKPLUG (Mini and Plus) is capable of driving loads up to 16A, and features – local control, remote control, voice control using Amazon Alexa, Google Assistant and also can achieve automatic control using Amazon Alexa Routines and Google Assistant. The device

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connects to Wi-Fi network for remote control and configuration, and can be plugged to existing switchboards. The manufacturer also provides various control and configuration apps for use on smartphones.[5]

From above survey we analysed that most of the smart plugs available commercially are capable of providing – local, remote and automatic control of sockets and connects to a home WiFi network for internet connectivity and also to connect with other command devices such as the Amazon Echo dot (Alexa) and Google Home / Google Assistant, also some manufacturers provide native apps which can be installed on smart phones for achieving local, remote and automatic control of these smart plugs.

3. BLOCK DIAGRAM

The system proposed will provide remote control, automatic control, ups friendly control, energy saving etc. Utilizing raspberry pi single board computer as a central hub equipped with a wireless transceiver and touch screen type human machine interface for local operation of the system. The central hub can be connected to a Wi-Fi networks which will further connect the central hub to the internet for controlling and configuring the system remotely via smart phone, tablet, laptop or desktop computer with html5 compatible browser and internet connectivity. The switchboards will be equipped with 2.4GHz wireless transceivers for communication with the central hub, energy metering module, Arduino nano MCU, PIR type occupancy sensor, capacitive touch switch, LED indicators and relay module for power control. Additional mains power sensor and transmitter will be used to send mains power availability status to all switchboards and central hub for UPS friendly operation.The system can also notify users remotely via push notifications on their devices utilizing HTML push features

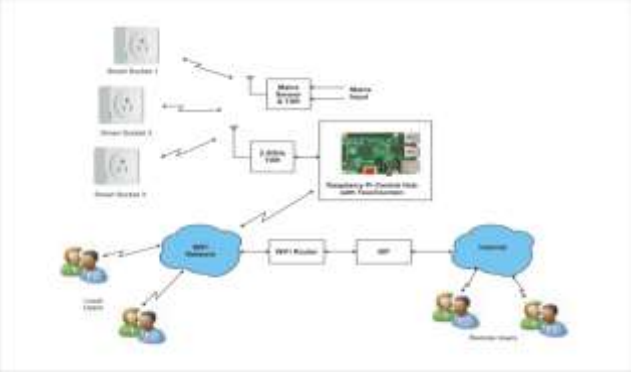

Fig .1 Block Diagram

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4.HARDWARE DESIGN

Design and Fabrication of Mains Presence Detector

The mains presence detector will be used to detect presence of mains power supply and will transmit a packet every second to the master node and all other slave nodes containing mains presence value – 0 or 1 (mains power supply absent / present). The slave nodes will further switch off the connected loads if UPS friendly operation is set on the particular node. The master node will use this information for mains presence display on the Raspberry Pi control hub's user interface

Fig 2: Fabricated and mains presence detector

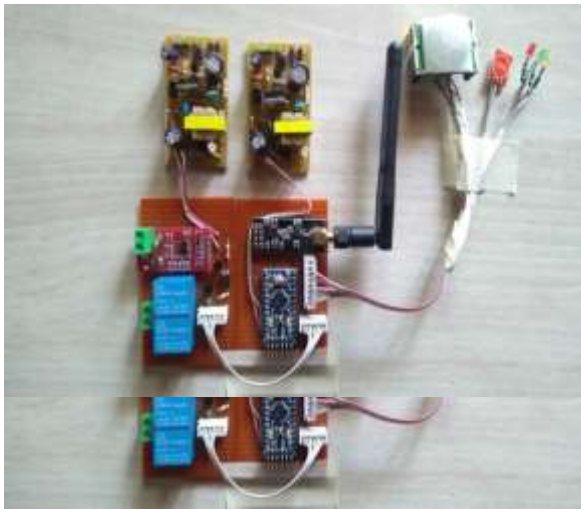

Fig 3: Completely fabricated slave nodes PCB's with JST connectors, PIR, Touch Switch, and LED connections.

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5.SYSTEM SOFTWARE

The system software development can be divided down into following parts, and also the Raspberry Pi computer requires setting up of the operating system, configuration and installation of various software programs for the development and execution of system user interface, monitoring and control programs.

Raspberry Pi Operating System Installation, Raspberry Pi OperartingSsytem Configuration, Installing and Configuring Apache Server, Installing and Configuring PHP5, Installing and Configuring MySQL Server, Installing and Configuring PhpMyAdmin, Configure Apache to work with PhpMyAdmin, Installing and configuring Pure-FTPD, Configuring Raspberry Pi computer system to auto start programs, Installing and configuring FileZilla FTP Client on computer for uploading web pages to Raspberry Pi Computer and Uploading programs to ESP-12E module using Arduino IDE

CONCLUSION

Hence in this paper, we found the importance and fruitful benefits of implementation of IoT in smart sockets. The main ambition of this project is power conservation in household environment. This aim is achieved by the use of the components like arduino, raspberry pi and Panasonic PIR sensors. The project also has met the aim of power monitoring i.e, the amount of power consumed per socket

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[3]https://www.tp-link.com/in/home-networking/smart-plug/hs100/

[4] https://sonoff.tech/product/wifi-smart-plugs/s26

[5]https://oakter.com/smart-plugs/

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