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Smart Secure House with Power Surveillance System

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A B S T R A C T

This project is Raspberry Pi and Arduino UNO based Smart secure house with power surveillance system. It presents the idea of monitoring a particular place in a remote area. This project deals with the design approach of an Embedded Real-Time Investigation System Based Raspberry Pi for intruder detection that reinforces surveillance technology to provide essential security to our life and associated control and alert operations. The proposed security solution hinges on our novel integration of cameras and motion detectors into web application. The project also focuses on observing and measuring the power consumed by each section of a house. The power consumption data can be seen through web-based application developed in the form of a dashboard, thus is made sensitive to warning alarms, which can be sent through E-mail or through SMS technology, also Raspberry Pi operates and controls motion detectors and video cameras for remote sensing and surveillance, streams live video and records it for future playback. This project is focused on developing a surveillance system that detects strangers, by also keeping a track on the total power usage in the house, and to response speedily by capturing and relaying images to owner based wireless module.

Keywords: IOT, Raspberry Pi, AWS, Surveillance Technology

1. Introduction

The power meters are one of important aspect in the smart grid concept. They are the devices which measure electricity and also connecting different equipment over the electric grids. The concept that introduces the automation of measurements of electronic meters was called AMR (Automated Meter Reading). AMR is a concept that enables devices to be accessed remotely and collect the electronic data generated by the meter at consumer units. The data then transmitted from the meter to the electric company using radio frequency, telephone, and power line or satellite communication. A smart energy meter (SEM) is electronic device having energy meter chip for electric energy consumed measurement, protocols for data communication, security purposes, interface for data display and other function. The difference of smart meter from traditional energy meter devices is by its communication ability. A smart meter is able to record active power consumption and also other information of an electronic device, such as: voltage and current phasors, reactive power, maximum power demand, frequency, power factor and other information, in real time. The Internet of Things (IoT) is defined by ITU and IERC as a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual "things" have identities, physical attributes and virtual personalities, use intelligent interfaces and are seamlessly integrated into the information network. Following the utilization of IoT, the smart meters need to be developed with the intention of using device and communication technology to attain consumer satisfaction. This design present a smart energy meter, which provide accurate measurement of power consumption and display it to the consumer on a web based dashboard. Experimental data collection method was used in this project. It is data produced by a measurement, test method, experimental design or quasiexperimental design. Also, it is data produced as a result of a clinical trial. Experimental data may be qualitative or quantitative, each being appropriate for different investigations. The data therein used in this project is both qualitative and quantitative where qualitative data is considered more descriptive and can be subjective in comparison to having a continuous measurement scale that produces numbers normally experimentally repeatable. Qualitative information is usually more closely related to phenomenal meaning and is, therefore, subject to interpretation by our observations

1.1. Problem Statement

To design and develop a system that can monitor the movement (surveillance) of any person or house keeper employee, entering and leaving the house. Also to reduce the human efforts by automating the house appliances and keeping a surveillance on the power consumed by a house
To design and develop a smart IOT based Multi-Parameter Health Monitoring System.

2. Literature Survey

- International Journal of Recent Technology and Engineering

Ritvik Iyer, Antara Sharma Volume-8 Issue-2, July 2019. This paper proposes a home automations system which can be effectively used to control and monitor home appliances using the internet. Due to its various advantages, home automation is gaining more and more popularity day by day because of its ability to ensure security and make life much easier. In the system, Arduino will be interfaced with multiple sensors that can measure temperature & humidity, light, motion, and so on. The data collected by the various sensors is stored and a pattern analysis is done on the stored data which tells the user at which time the appliances are usually on or off so that they can be automatically controlled without any human intervention by observing the regular usage pattern. The user can also turn on/off any appliance remotely using the internet.

Home Automation with Raspberry Pi: Projects Using Google Home, Amazon Echo, and Other Intelligent Personal By: Norris Donald A home automation system controls lighting, temperature, multimedia systems, and appliances. Since these devices and sensors are connected to common infrastructure, they form the Internet of Things. A home automation system links multiple controllable devices to a centralized server. These devices have a user interface for controlling and monitoring, which can be accessed by using a tablet or a mobile application, which can be accessed remotely as well. Ideally, anything that can be connected to a network can be automated and controlled remotely. Smart homes must be artificially intelligent systems that need to adapt themselves based on user actions and surroundings. These systems need to carefully analyze the user needs and the conditions of the surroundings in order to predict future actions and also minimizes user interaction. Traditional home automation systems that provide only remote access and control are not that effective in terms of being `smart', so in this paper we put forward the use of concepts of different machine learning algorithms along with computer vision to shape together a smart learning automated system that controls lighting, sound and other devices based on the user's emotion.

3. System Requirements

3.1. Transformer

In this wireless electronic notice the transformer, which consists of two winding's primary and secondary is used for converting the 220V to 12V ac because this system is directly connected to the power supply.

3.2. Current and Voltage Sensors

The current measured by the ACS712 Current sensor and multimeter were read and recorded. The values and percentage errors are represented as a graph in Figure 6. The accuracy of ACS712 current sensor's reading is 86 %.Voltage Regulator User interface is design so that user can monitor usage of electricity by the equipment. The user interface also shows the cost spent for the electricity.

3.3. The Pi Camera Module

The Camera Board on the Raspberry Pi is a small printed circuit board with a camera on it. The PCB is connected to a ribbon cable which connects to the Pi itself on its own port. The ribbon can be extendable. The camera on the board is very small (5MP camera). As for now it is the only Camera made specifically for the Pi therefore these specifications cannot be updated. Since it uses 250mA, externally powering the Pi should be sufficient enough for the camera. Specific configuration settings are required to initialize the camera plus Python scripts to enable it take pictures.

3.4. Raspberry Pi

The Raspberry Pi 3 Model B is the third generation Raspberry Pi. This powerful credit-card sized single board computer can be used for many applications and supersedes the original Raspberry Pi Model B+.Whilst maintaining the popular board format the Raspberry Pi 3 Model B brings you a more powerful processor, 10x faster than the first generation Raspberry Pi. Additionally it adds wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs.

Fig. 1- Raspberry Pi

3.5. Smart Energy Meter

There are two basic types of electronic meters, electro-mechanical and electronic. The most common type of electricity meters is the electro-mechanical induction watt-hour meter. It works by counting the revolutions of a non-magnetic metal disc which is made to rotate at a speed proportional to the power passing through the meter. The number of the disk revolutions is proportional to the device's energy usage. The electrical power is the ratio of electric energy per unit time. In other words, it is the amount of power used or absorbed by a device within a given time. The giving unit by the International System of Units is the Watt. The real power calculated from the instantaneous power signal. The instantaneous power signal is generated by a direct multiplication of the current and voltage signals. Electronic power is calculate using equation (2) P= V I (2) SMART SECURE HOME WITH POWER SURVEIL SYSTEM MIT SCHOOL OF ENGINEERING, DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING 17 where: V is the voltage (V); I is the current (A); P is the power (W)

4. Methodology

The power is received from ac mains at a voltage of 240V at the transformer primary side where it is stepped down 12V ac. Output of the transformer is connected to the bridge rectifier circuit where the 12V ac is converted into 12V DC and the electrolytic capacitor connected across is to store charge plus filtration purposes. This voltage is fed to the voltage regulator whose output is 9V dc to charge the battery to provide the backup power supply in case of power outage. 9V dc is supplied to another voltage regulator whose output is 5V dc which is output voltage supply that is needed as an input voltage of the raspberry PI board where the 5V dc and 3.3Vdc are the output voltages of the its board. The cooling fan and the PI camera are supplied with 5Vdc from the Raspberry pi board at the common anode on the strip board. There are two basic types of electronic meters, electro-mechanical and electronic. The most common type of electricity meters are the electro-mechanical induction watt-hour meter. It works by counting the revolutions of a non-magnetic metal disc which is made to rotate at a speed proportional to the power passing through the meter. The number of the disk revolutions is proportional to the device's energy usage. The electrical power is the ratio of electric energy per unit time. In other words, it is the amount of power used or absorbed by a device within a given time. The giving unit by the International System of Units is the Watt. The real power calculated from the instantaneous power signal. The instantaneous power signal is generated by a direct multiplication of the current and voltage signals. Electronic power is calculate using equation (1) P= V I (1) where: V is the voltage (V); I is the current (A); P is the power (W) The system's design for the smart meter using Arduino and Internet of Things (IoT) is shown on Figure 1. In our system, the voltage was measured using ZMPT101B, the current was measured by ACS712, and the estimated power is calculated using the effective value of both voltage and current signal. Arduino is used to read the sensors readings and send the data via ethernet shield to the server. The server will receive the data, calculate the estimated power and display it for user. User can access the data using mobile devices. ZMPT101B is a voltage sensor made from the ZMPT101B voltage transformer. It has high accuracy, good consistency for voltage and power measurement and it can measure up to 250V AC. This sensor has a SMART SECURE HOME WITH POWER SURVEIL SYSTEM MIT SCHOOL OF ENGINEERING, DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING 8 maximum 185 mV/A output sensitivity with extremely stable output offset voltage. Both voltage and current units are isolated, very cheap, and easy to use. Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board and a software or IDE (Integrated Development Environment), used to write and upload computer code to the physical board. After implementing the system design, sample of voltage and current were taken by connecting the sensors to electric source. Afterward, the value from the sensor is compare with data obtained from a multimeter (Heles UX866TR). A bank of 7W, 15W, 18W, 42W, and 100 W light bulb is connected as load.

5. Result & Discussion

Figure 5.1 Below Shows the simulation result of the Power Meter System of the project that how to measure the current consumed by the device and calculation of power. The following simulation is created in the proteus. Which tells the voltage reading, Current Reading and hence the power reading.Figure below 4.2 is welcome screen of SSHPS which is login screen and there is one brief paragraph about the SSHPS is displayed on it. When System is connected and IP address of system is entered in browser the following welcome screen appears for the log in of user. There is no option for sign up as individual person having hardware only have valid id and password random people are not allowed to check the nature of the systems.

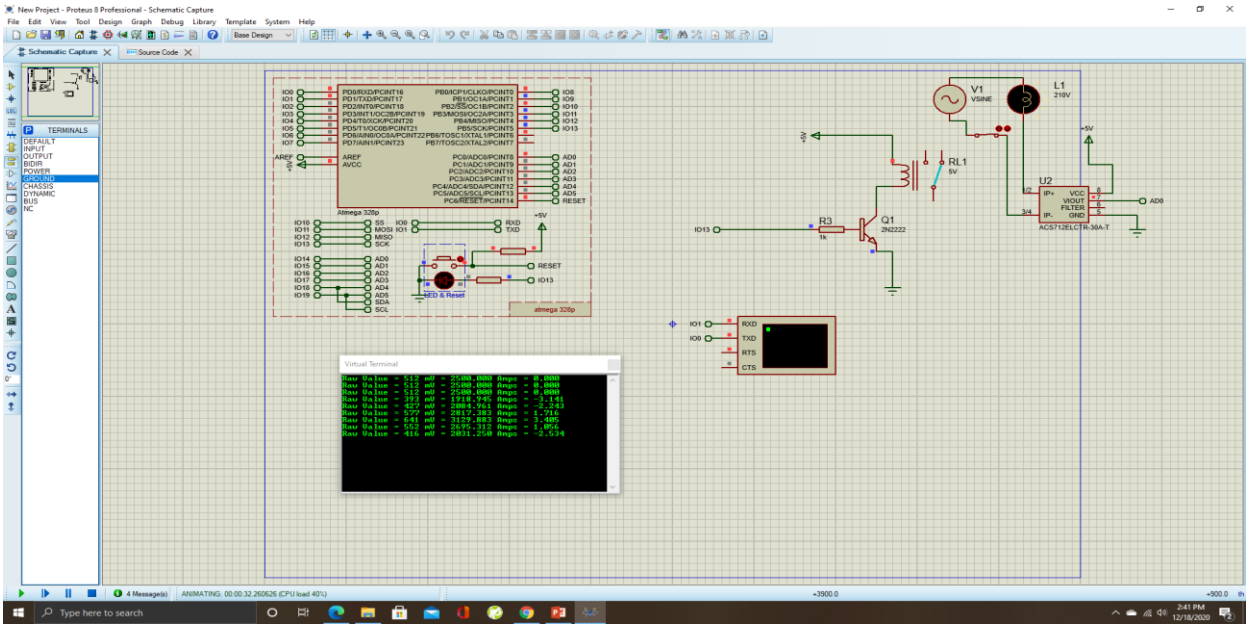

Fig 5.1 Simulation for SSHPS

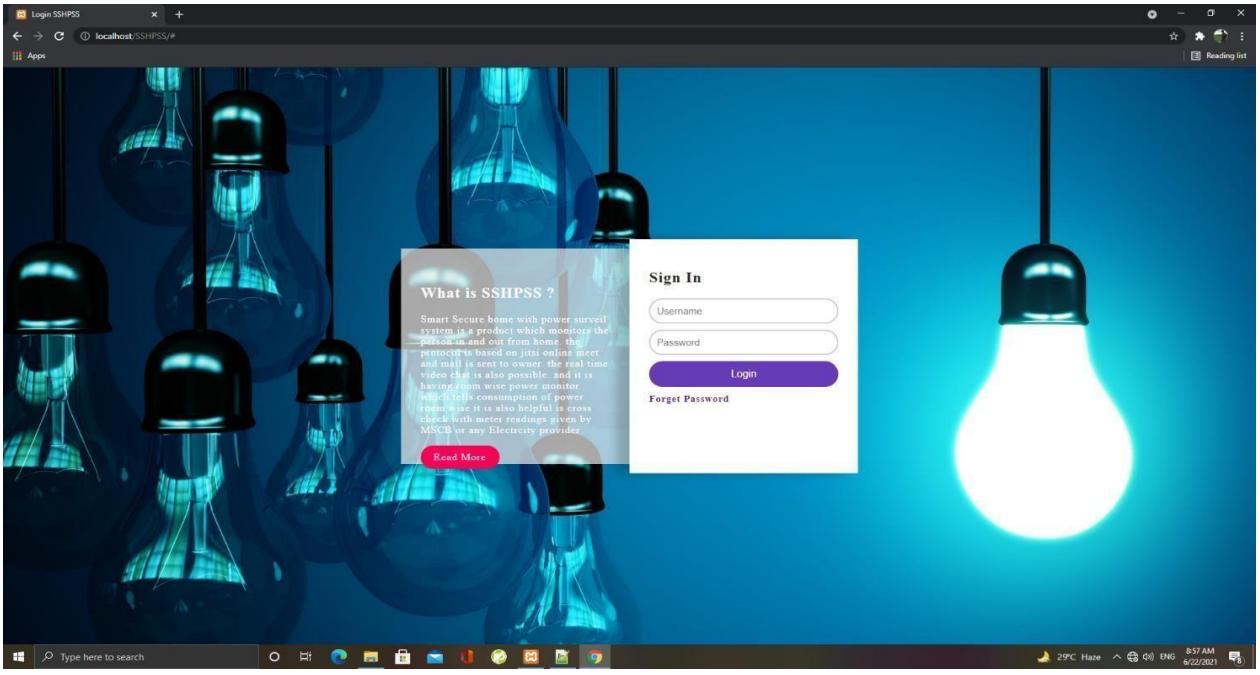

Fig 5.2 Welcome page for SSHPS

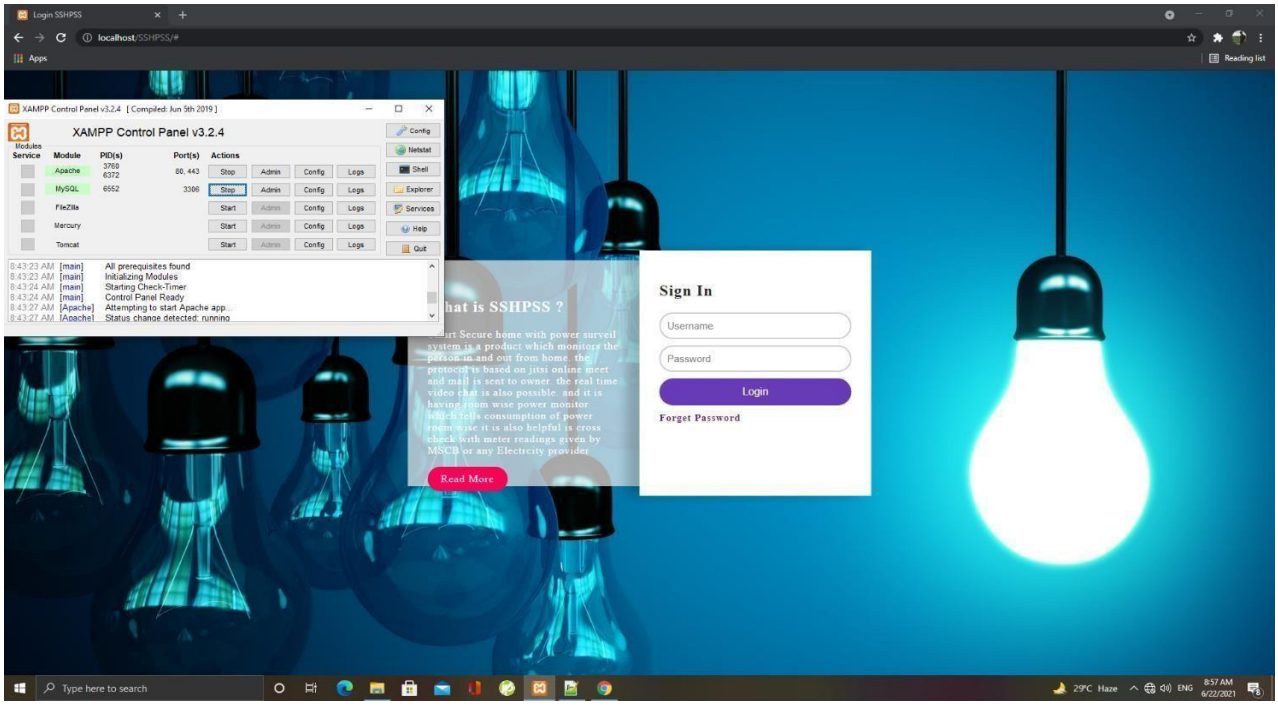

Fig 5.3 Control panel activation of Raspberry Pi

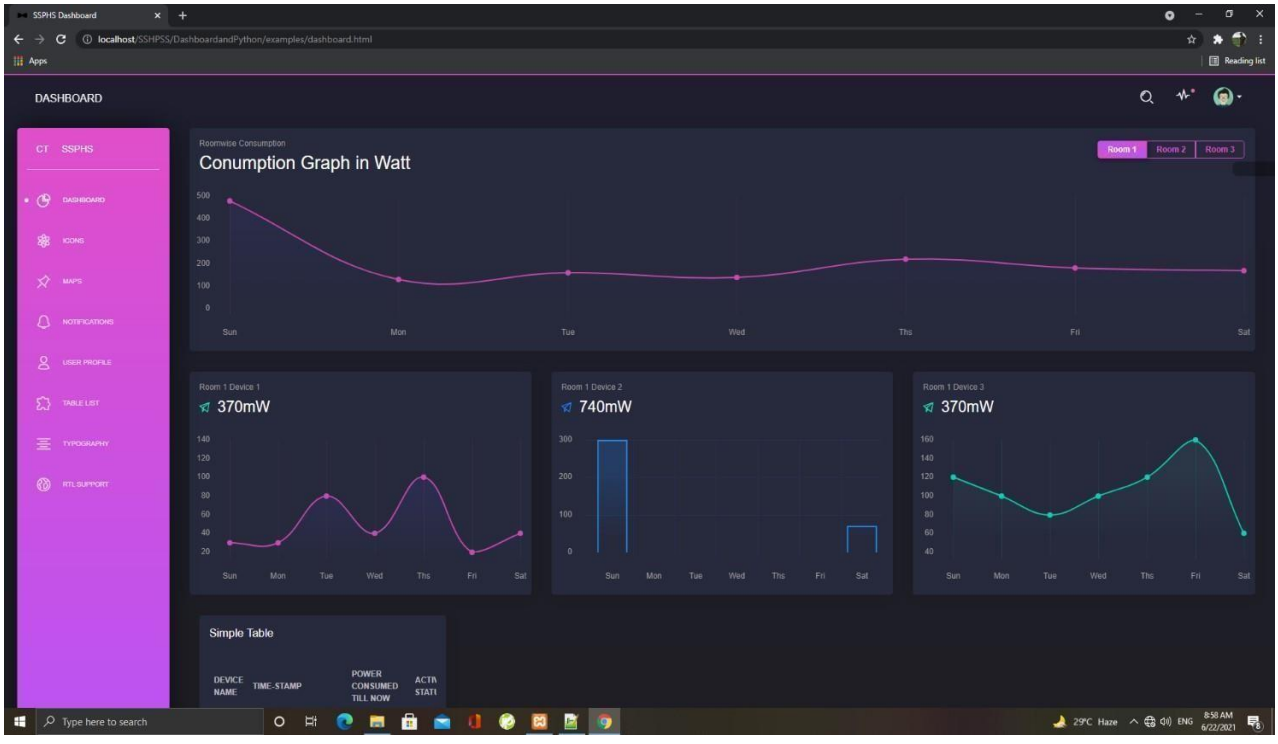

Fig 5.4 Dashboard for SSHPS

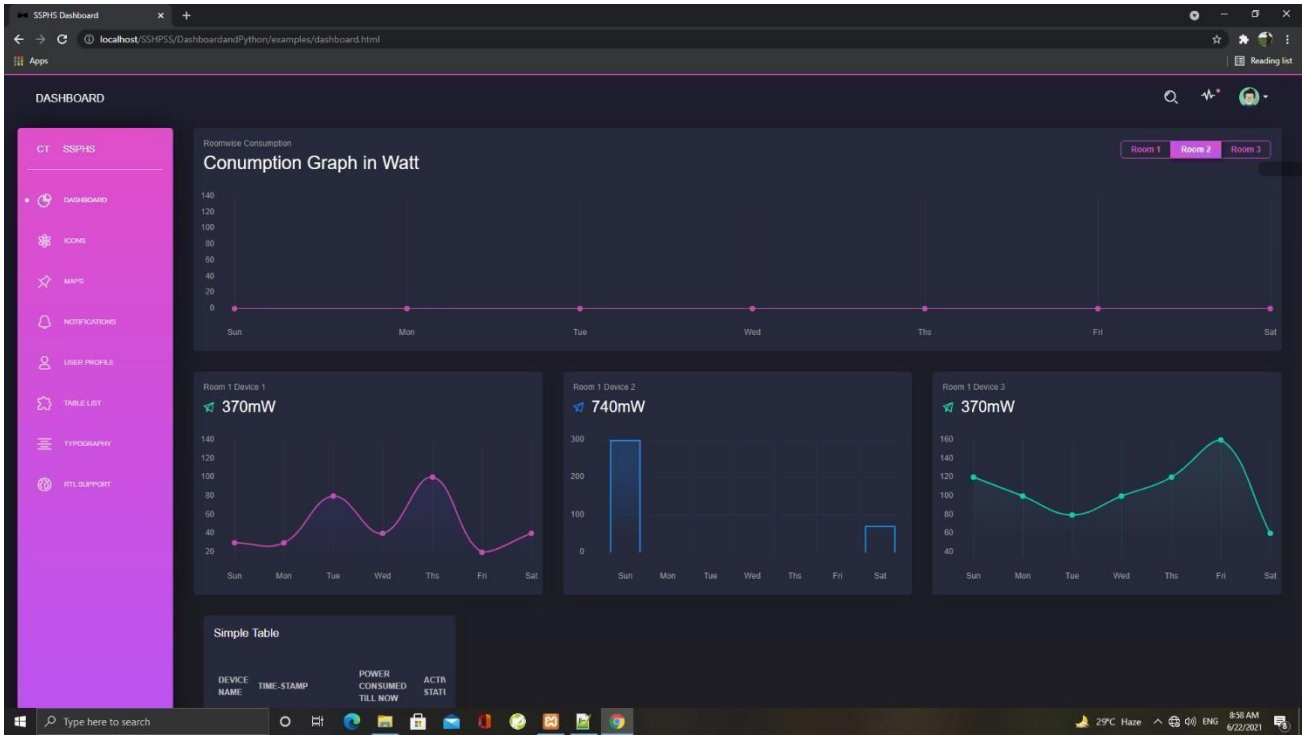

Fig 5.5 Graph for power consumption in the house

6. Conclusion

The project designed and implemented a security system based on the Raspberry Pi. The aspects of the system are: motion detection, video capturing using a Pi Camera and sending out an alert through e-mail. This project system can be successfully use to monitor the places to prevent any intruders access by some an alert mechanism, image processing, emailing or SMS to company's owner and to keep an eye on people enter and leave the premises using the pi camera. The significance of this project can be applied in the various and wide places such as; UMEME ltd, power transmission companies, homes, schools, institutions, government warehouses, hospitals, and some other places where critical security concern is highly demanded. As conclusion, a smart energy meter using Raspberry Pi and IoT has been designed and tested. The meter is design to facilitate electronic consumer to monitoring its electrical utilization. The meter consists of ZMPT101B as voltage sensor, ACS712 as current sensor and Raspberry Pi with ethernet shield. The data from sensor's reading will be sent to server. Server will calculate the electrical power used by the equipment. User can monitor all of this data using mobile devices. The sensor testing shows 77 % accuracy for voltage sensor and 86 % accuracy for current sensor. The future work is to improve the sensor accuracy that the energy reading become more precise.

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