KSCST SYNOPSIS

Project Reference Number: 46S_BE_2022

TITLE OF THE PROJECT: IOT BASED SMART HOME SYSTEMS FOR SPECIALLY ABLED AND AGED USERS.

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Introduction / background:

Smart devices are the most popular devices in recent days and the concept of smart homes has become progressively popular in recent days. The availability of devices like MI home, Google home and Alexa devices have made these devices even smarter. In this project report a “IoT Based Smart Home Systems for Specially Abled and Aged Users”, we are going to see how these smart devices can be built. The proposed SHS consists of Four Smart Devices, one of them being the “Alexa Device”, the second one is the “Smart Energy Meter Pv2”, the third one is “Smart Health Tracker Pv2” and the last one is the “Air Quality Device Pv2”.

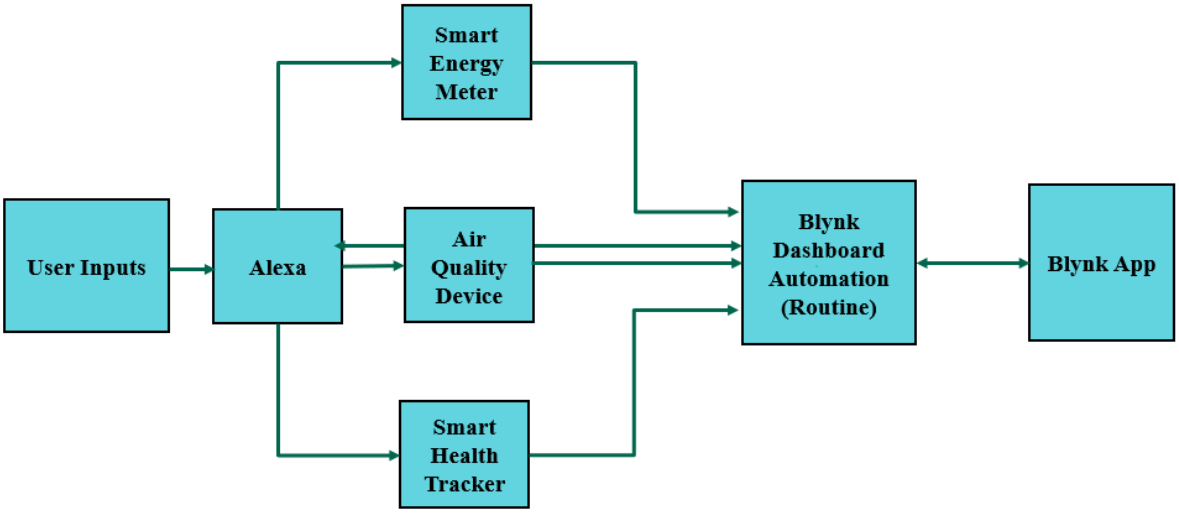
The concept of “Smart Home” is becoming increasingly popular in recent times. Technological advances in IoT have brought “Smart” Devices capable of much more than just sensing physical parameters. In this project report a “IOT Based Smart Home Systems For Specially Abled and Aged Users.” is designed and implemented. The proposed system consists of four Smart Devices out of which one is an Alexa Smart Speaker. Smart Energy Meter Pv2 (Hereafter referred as SEM Pv2), Smart Health Tracker Pv2 (Hereafter referred as SHT Pv2) and Air quality device Pv2(Hereafter referred as AQD Pv2). SEM Pv2 is a Smart Energy Meter which can measure the parameters w.r.t Power (Voltage, Current and Energy Consumed). It also has as subsystem which can detect Gas Leakage or Earthquake and automatically trigger a Power Shutdown to prevent any potential damage. SHT Pv2 is a Smart Health Tracker which can measure parameters w.r.t Health (Heart Rate, SpO2%, Body Temperature). It can also measure Ambient Temperature and Humidity. It is equipped with a Buzzer-LED Warning system to alert the user when the Vitals fall or increase beyond a standard threshold (depending on the Health Parameter considered). AQD Pv2 is a device used to detect the quality of the air present in our environment. This device also measures the environmental temperature and humidity of the surroundings.

All the devices are connected to Blynk Cloud, where the user data generated from both the devices is stored. The user can view the Parameters being measured by the devices on the respective Blynk Dashboards. Alexa Smart Speaker is used to interact with the devices.

Objectives:

Design and develop a IoT based Smart Home System that is reliable, customizable, easy to use and interactive and user friendly for all types of users (especially, for the aged and specially abled). It must also have emergency protocols to alert the end-user. Perform analytics on the data generated by the Smart Devices to gain insights that can be used to implement energy saving practices and promote efficiency. Ensure that the proposed system is not easily exploited, and the data is stored in servers within the geographical location (Country). Ensure that the individual failure or exploitation of a device does not bring the whole System Down. The devices can preserve and execute their core-functionalities even in the advent of a network failure. Even though internet connectivity is lost the devices must work as expected. It should be very easy to handle for aged users and physically challenged users.

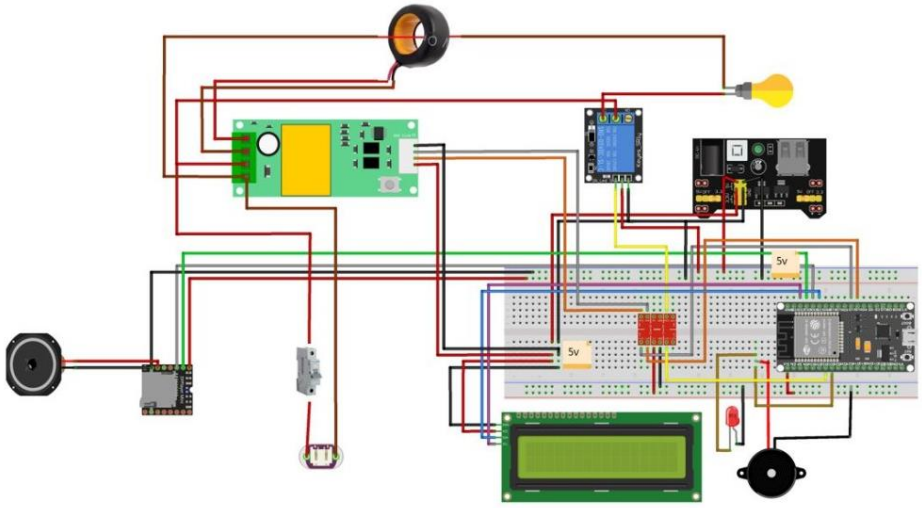
Methodology:



The first system is the Smart energy Meter:

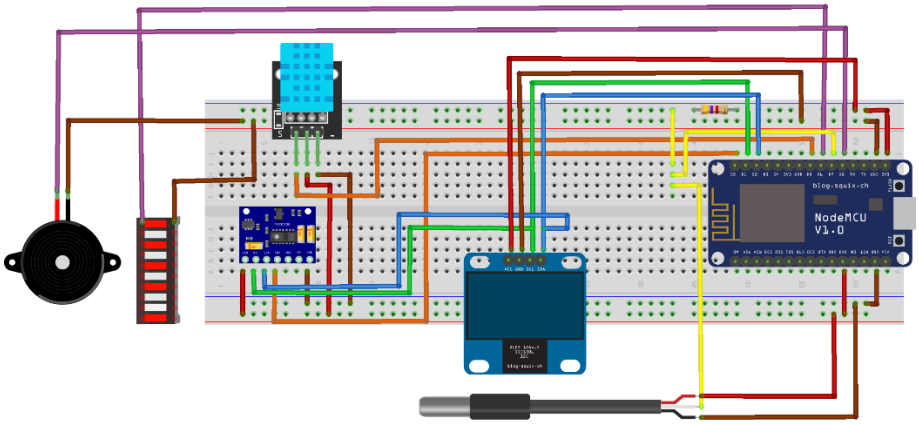
The proposed system is a “Smart Energy Meter”. The proposed system includes a current voltage and power (PZEM-004T) sensor in the main circuit to measure the total units of electricity used. It is measured by a combination of two microcontrollers, ESP32. It also consists of an LCD screen to display all the instantaneous values. There is a secondary circuit which has Gas sensor and Accelerometer sensor (which can be used to detect earthquake) and this secondary circuit is controlled by ESP8266. Both the circuits are programmed to be monitored remotely, the instantaneous values detected by both the circuits are updated on Blynk Cloud platform and it is reflected in their respective dashboards. At any given point of time, we can even view the outstanding amount of the bill for the electricity we have used.

Energy meter is programmed and configured in such a way that it gets switched off whenever a gas leakage or an earthquake is detected, along with sounding an alarm and sending in app as well as mail notifications about the emergency shutdown. The alarm can be deactivated, and the power can be restored using the Blynk Dashboard/App. The circuits of both the Primary and secondary system is given below.



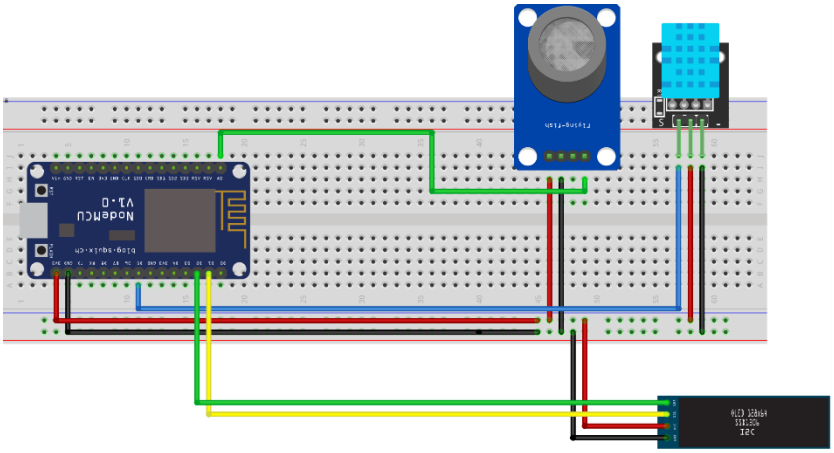
The second system is the Smart Health Tracker:

The proposed system is the Smart health tracker which consists of DS18B20 Temperature sensor probe for the measurement of body temperature, MAX30102 Pulse Oximetry sensor for the measurement of Pulse Rate and Oxygen Saturation level and DHT- 11 sensor for Room Temperature and Relative Humidity measurement. The sensors are connected to a Node MCU module (ESP8266) which is connected to a Wi-Fi network. The Node MCU Module powers the sensors and controls them, it works as a microcontroller. It gets the readings from all the sensors connected to it and displays it on the 1.2” OLED screen connected to it. The circuit is programmed to be monitored remotely, the instantaneous values detected by the circuit is updated on Blynk Cloud platform and it is reflected in the dashboards. At any given point of time we can even view our vitals in the Blynk Dashboard. The circuit of the smart health tracker system is given below.



The third system is the Air Quality Device:

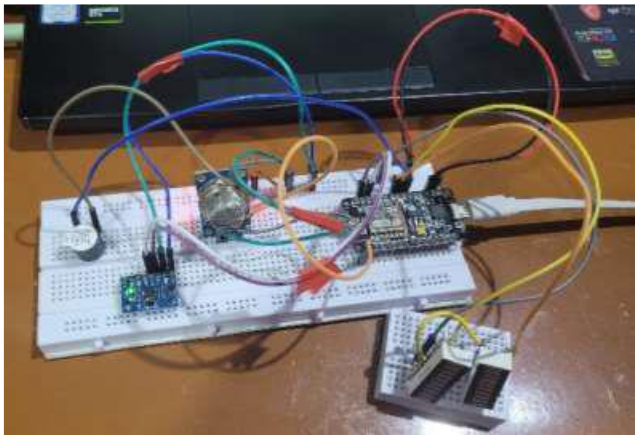
The proposed system is an Air quality device which consists of MQ135 gas sensor to measure the environmental air quality in terms of PPM (Parts Per Million), Typically the AQI of a breathable air is around 0 to 200 beyond which it is considered to be toxic, and the system also consists of a DHT-11 sensor for the measurement of Environmental Temperature and Relative Humidity. The sensors are connected to a Node MCU module (ESP8266) which is connected to a Wi-Fi network. The Node MCU Module powers the sensors and controls them, it works as a microcontroller. It gets the readings from all the sensors connected to it and displays it on the 0.96” OLED screen connected to it. The circuit is programmed to be monitored remotely, the instantaneous values detected by the circuit is updated on Blynk Cloud platform and it is reflected in the dashboards. At any given point of time, we can even view the readings in the Blynk Dashboard. The circuit of the Air Quality Device is given below.



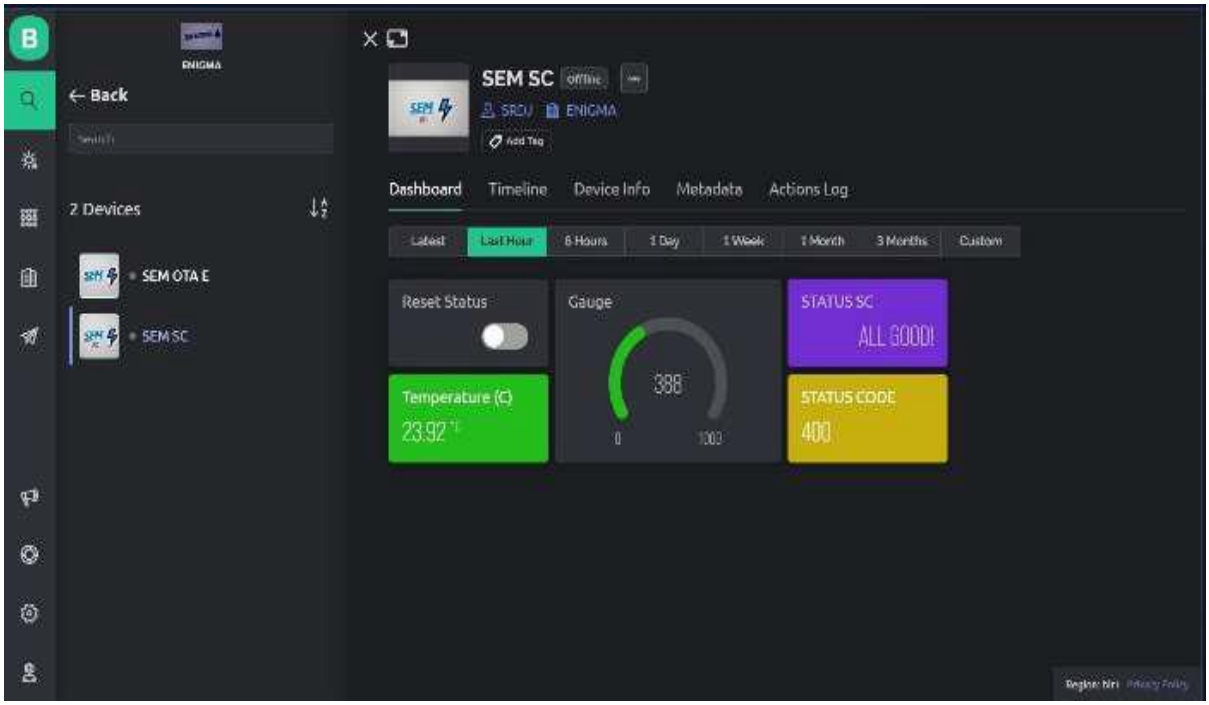
Results and Conclusions:

The proposed system is implemented, and its performance is observed. All the three devices can be operated with Voice Commands using Alexa. The devices can also be remotely operated and monitored using the Cloud Dashboard or the Blynk App.

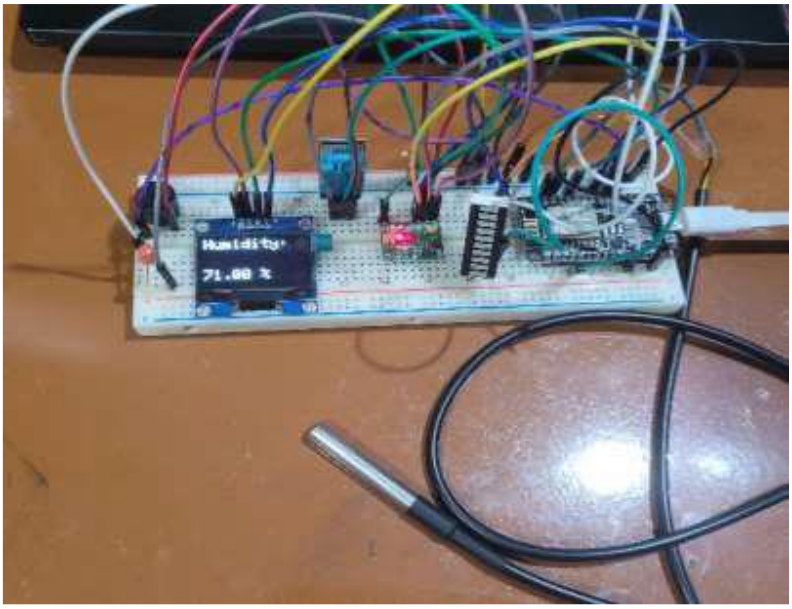
Above Figure shows the Smart Energy Meter Pv2 in action with Alexa Speaker. The bulb on the device is the dummy load used to test the device. The bulb is turned on by giving a voice command to Alexa.



Above Figure shows the Secondary subsystem of the device in action.

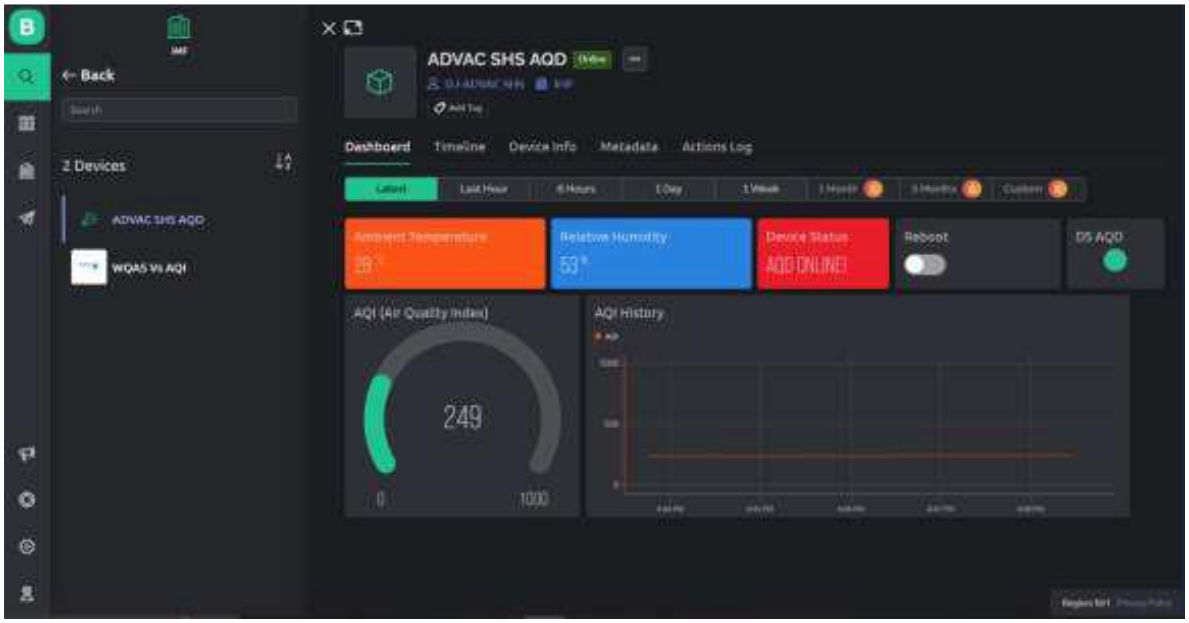


Above Figures are the dashboards of SEM Pv2. The first one represents the dashboard of the Primary Subsystem/unit of SEM Pv2 and the second one represents the dashboard of the Secondary Subsystem/unit of SEM Pv2 which is used to sense Gas Leakage and/or Earthquake., In the first figure Voltage across the load, and Current consumed by the load is displayed in widgets (known as labels).There is a toggle switch “Alarm” is used to disengage the alarm remotely from the dashboard (the alarm is triggered by the Secondary unit). The load can also be controlled using the “Power On” toggle on the dashboard. The status of the device is also displayed on the labels. In the second figure, a Gauge widget displays the concentration of Gas levels detected by the sensor in real-time. It is measured in terms of PPM. A “Temperature” label displays the ambient temperature around the Secondary unit. “STATUS SC” label displays the alert status of the device. It changes to “EARTHQUAKE!” or “GAS LEAK!” upon detection of an earthquake or a gas leak respectively. A toggle switch named “Reset Status” is also present on the dashboard to reset the alert status of the device to resume normal operation.



The above Figure shows the Smart Health Tracker Pv2 hardware setup in action. SpO2%, Heartrate, Body Temperature, (in Celsius) Ambient Temperature (in Celsius) and Ambient Humidity is being sensed by the respective sensors and also relayed to the Blynk Cloud server. The Cloud server updates the widgets in dashboard depicted by the next figure. The real-time values of Body Temperature, Ambient Temperature and SpO2% are updated in Gauges, whereas the Relative Humidity (%) and Heartrate (BPM) are being updated in Labels on the dashboard.

The above image shows us the readings of the air quality device. We can see the air quality index reading, ambient temperature and the humidity in the environment. Like all the devices mentioned above the device readings are uploaded to the Blynk IoT dashboard.



The above image shows us the live page of the blynk dashboard having all the readings from the Air Quality Device Pv2.

What is the innovation in the project?

By 2025 it is said that all the household electricity meters are being replaced by a smart prepaid meter. We did this research based on that. Our model has auto shutdown feature which could be used for prepaid meter and also there are many smart features integrated with our energy meter and this is just about one of the smart systems. Similar ideas about the expansion of the smart features to other household devices is also discussed. This project also aims to explore and demonstrate the possibility of creating custom made Smart Devices using

open-source generic hardware components and integrate the said devices with the pre-existing Smart Devices to implement an IoT based Smart Home environment.

Scope for future work:

As technology advances every day, smart devices gradually become an inevitable part of our daily lives. This brings about the need to design systems which can function autonomously and perform their core functions even in the case of a network failure. The system should also be upgradeable with respect to both its hardware and software to extend its useful life and reduce E-Waste. The proposed system highlights how this can be achieved by integrating individual devices developed using hardware components to present day, smart home devices (Alexa in this case) available in the market. The firmware of the individual devices can be upgraded using Blynk Edgent to ship out OTA updates. OTA updates can contain bug fixes as well as new features. Using Blynk Cloud Platform, it is practically easy to scale up the implementations for real-world applications apart from research purposes. We can add industrial graded sensors for better outcomes. This could give us proper readings and outputs. Now we have used all the open-sourced sensors and software. A specialised application can be built instead of using Blynk IoT. This could ease the user interface. A localised server can be added to store the sensor data for higher researches on it. Research like ML analysis could be done on this data and the future outputs could be predicted. A detailed routine can be created for each users using Alexa application.