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A Real Time Monitoring System for Home Automation

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ABSTRACT: This paper presents a comprehensive description about new and advanced home automation systems and technologies. This project designs smart home device monitoring for demand response and load management "Smart Energy" applications which are needed in a smart energy based residential or light commercial environment. The control application domains included in this initial version are sensing device control, pricing and demand response and load control applications. In this project a home energy control system design is proposed that provides intelligent services for users and its implementation is done by demonstrating it using a real test bed. In this paper we presented a Home Automation System using Arduino and raspberry pi that deploys the integration of wireless communication, cloud networking, to provide the user with control over different electrical appliances and help store data on cloud server.

KEYWORDS*:* Automation, cloud, Arduino, raspberry pi, smart energy, monitor, wireless technology.

I. INTRODUCTION

Smart home is the mix of innovation and administrations through home systems administration for a better quality of living. It utilizes distinctive technologies to prepare home parts for more intuitive data monitoring and remote control and empowering them for persuasive symphonious collaboration among them to such an extent that the everyday house works and exercises are automated without user intervention or with the remote control of the user in a less demanding, more helpful, more proficient, more secure, and more affordable way.

Smart Home is the term regularly used to characterize a living arrangement that uses a Home Controller to incorporate the living arrangements different home automation frameworks. The Intelligent Home Controller or essentially the Home Controller is a product or any gadget that might be utilized to control the appliances in a home environment adroitly. [1] The Objective of building up a savvy home framework innovation is to satisfy their guarantee of inconceivably enhancing the way of life of families through socially fitting and auspicious help. Detecting, expecting and as needs be reacting to the different exercises in homes is the essential necessity of such frameworks.

A smart home is a space or a room which is furnished with the capacity to get acclimated without anyone else's input to specific circumstances to make the inhabitants feel good. [4,5] Smart homes could be basic remote control of electrical apparatuses or more mind boggling functionalities, for example, checking of the house insides utilizing discourse acknowledgment, by means of an iOS or Android application or acknowledgment of human gestures. Smart homes can possibly enhance home solace, accommodation, security and vitality administration. In addition, it can be utilized for senior individuals and those with inabilities, giving protected and secure situations.

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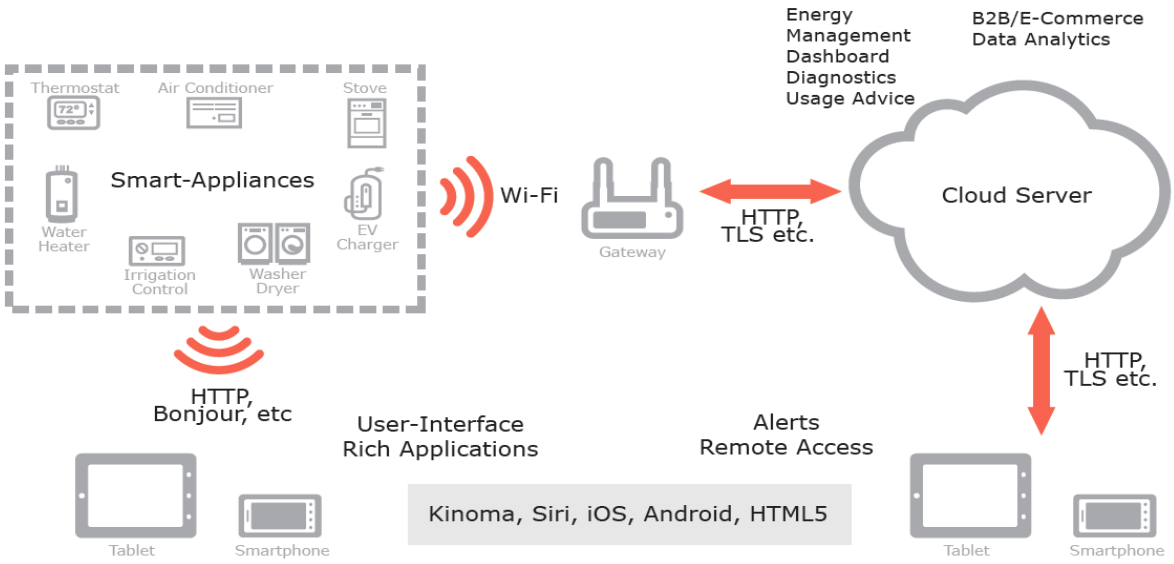

Figure 1: Smart Home System

IOT innovation can be connected to smart home. It offers some new thoughts and expansive space for improvement, going for enhancing the personal satisfaction and making it more agreeable and brilliant. We can utilize a cell phone or tablet to control an assortment of gadgets which are associated with the system, for instance savvy home framework could screen the vitality utilization of family unit apparatuses. The client can likewise tweak the light's turn on and off time. [10,12] Smart home indoor regulator can naturally change the indoor temperature as indicated by the client time timetable to enhance vitality effectiveness. Once been generally utilized, IOT will have far reaching sway on our work and life which would enable individuals to get things done in a couple of straightforward and advantageous approach to monitoring vitality and diminishing waste.

II. RELATED WORK/ LITERATURE SURVEY

In the paper written by Chathura Withanage and Rahul Ashok [4] a very detailed and precise comparison of popular home automation technologies are presented like X10, Z-Wave, ZigBee, INSTEON, and EnOcean.
The work of John J. Greichen [14] discussed some of the early challenges faced by home automation systems. These include high manufacturing costs, high development costs, high installation costs, additional service and support costs, lack of home automation standards, consumer unfamiliarity with technology, and complex user interfaces. With the advancement of time, we saw a rapid development in technology and processing power which leads to a considerable reduction in device cost and size. [28] All of these factors have contributed to the popularity of electronic devices today, so people are no longer confused or unsure about the use of computer, mobiles, or tablets.

Whereas the book written by Richard harper on" Inside the smart home" not only presents a complete picture on the home automation environment but also tries to capture the essence behind home automation.
Smart homes of today comprise of a plenty of gadgets like various cameras, receivers, diverse sensors, actuators, gadget controllers, and home databases, which can be remotely gotten to for client comfort. These gadgets, alongside the home database, have an assortment of individual data with respect to a home's occupants, similar to human services data, money related data, recordings, pictures, live video sustains from home, day by day propensities or schedules, most loved music, motion pictures, and some of the time even an individual dairy.[23, 27] In some uncommon cases, tenants may utilize embedded medicinal gadgets, which should be remotely gotten to by doctor's facilities or therapeutic experts, which should be possible through the home system.

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Moreover, the paper written by Khushwinder Gill [3], Shuang-Hua Yang and Fang Yao on "A ZigBee based home automation system" presents a home automated system interconnected by WIFI and a ZigBee device which are used to demonstrate the feasibility and effectiveness of the proposed system, four devices, a light switch, radiator valve and safety sensor.
Whereas the paper written by A.Z. Alkar and U. Buhur [15, 16] on "An Internet based wireless home automation system for multifunctional devices" depicts a central hub connecting the various devices to the board using parallel connections.

In the paper written by N. Sriskanthan, F. Tan and A. Karande[18] on "Bluetooth based home automation system" shows a home automation system powered by Bluetooth connection between the various devices.
The paper goes ahead to talk about different home automation frameworks and their security issues in view of strategy utilized: setting mindful home automation, focal controller-based home automation, Bluetooth-based home automation, versatile or GSM-based home automation, Internet-based home automation, and a decentralized way to deal with home automation. At long last, we talk about the part of UIs in security and close by examining where the scientists ought to centre their work in the field of home automation security. [15,21]
As a matter of first importance, establishment expenses are essentially diminished since no cabling is vital. Wired arrangements require cabling, where material and the expert laying of links (e.g. into dividers) is costly. [21,24] Deploying a remote system is particularly favourable when, because of new or changed prerequisites, expansion of the system is fundamental. As opposed to wired establishments, in which cabling augmentation is monotonous. This makes remote establishments a fundamental speculation.
Apart from covering a bigger territory, this credit full aesthetical necessities also. Illustrations incorporate delegate structures with all-glass engineering and recorded structures where plan or studio reasons don't permit laying of links. [26, 28] With remote systems, partner cell phones, for example, PDAs and Smartphones with the automation framework ends up noticeably conceivable all over the place and whenever, as a gadget's correct physical area is no longer essential for an association (the length of the gadget is in reach of the system).
For every one of these reasons, remote innovation is not just an alluring decision in redesign and renovation, additionally for new establishments.

III. SCOPE OF RESEARCH

In the main contribution of the work a home automation kit was developed in which Arduino mega, ArduinoUno and raspberry pi was used. The Arduino was used to establish a connection between different sensors using a relay board of 5v as shown in the figure below. The setup is also connected to the main power source (AC source) in the house and also with Ethernet shield to send data on the remote servers.

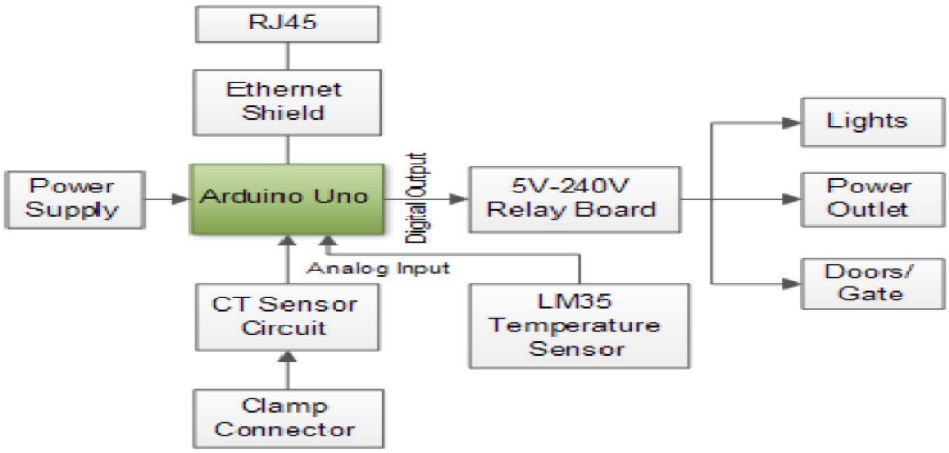

Figure 2: Circuit diagram

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The values of the sensors are displayed using a 16X2 LCD display and also on the PC using Arduino software. Furthermore, an android application is used to show all the values from the sensors connected to the Arduino which will be stored in the database of the server using AWS and google drive. The raspberry pi was used to show the reading/consumption of each and every in the house so that the data can be monitored and changes can be made accordingly so as to reduce the power consumption.

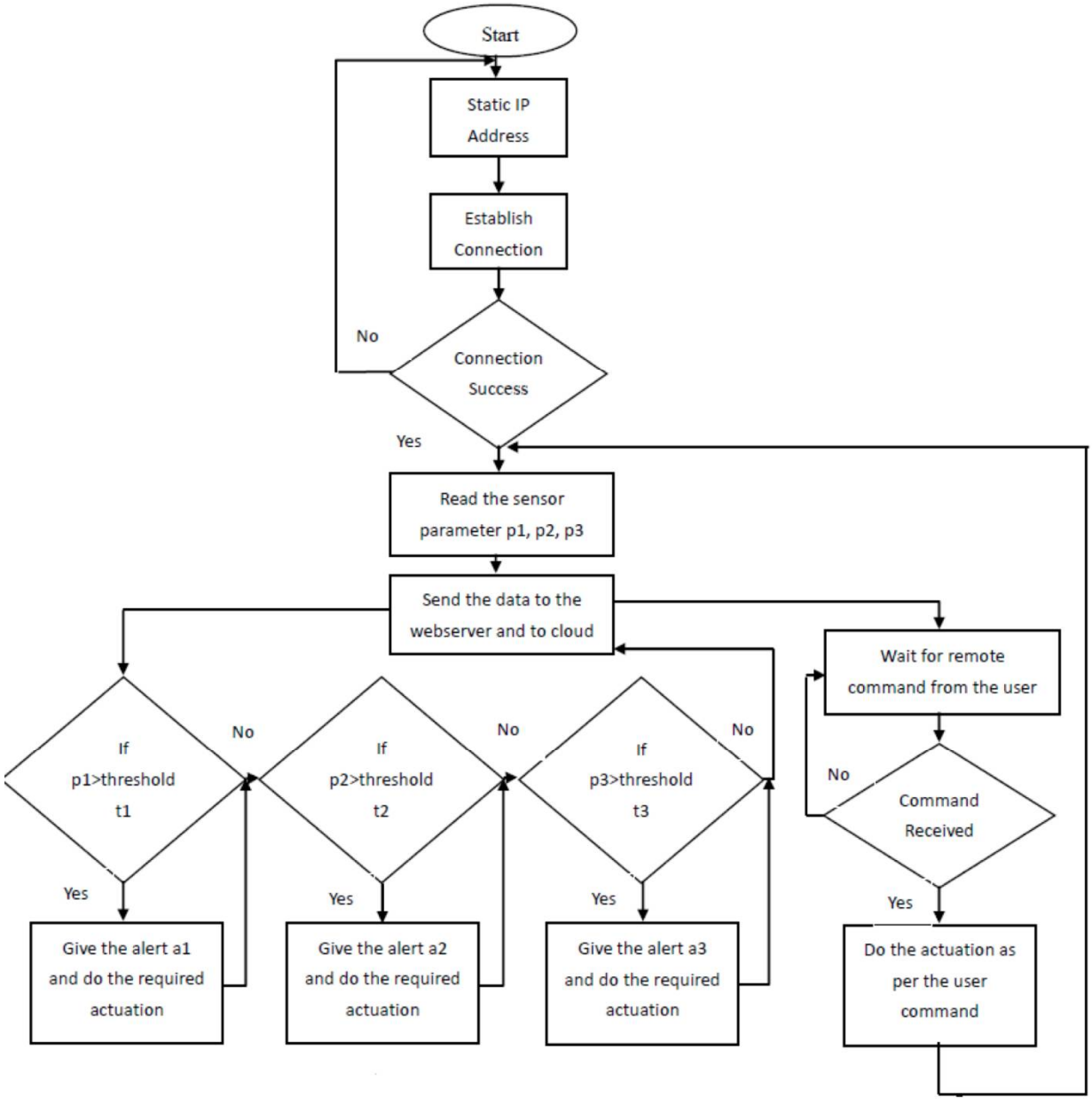

Figure 3: Flowchart for Control flow

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IV. PROPOSED METHODOLOGY AND DISCUSSION

The list of components and software used is mentioned below:

- **Hardware Used:** Arduino Uno, Arduino Mega 2560, Ethernet shield, Heartbeat sensor, proximity sensor, temperature sensor, accelerometer sensor, LCD display, LED display, Webcam, OV2620/OV7670, Transformer, Crystal oscillator, resistor, Regulator, energy meter, raspberry pi 3/raspberry pi B+, GPS module, GSM module, capacitors, diode and electric powered appliances.
- **Software Used:** Arduino, Raspbian, Keil micro vision.
- **Languages:** Embedded C, Assembly language, Python.

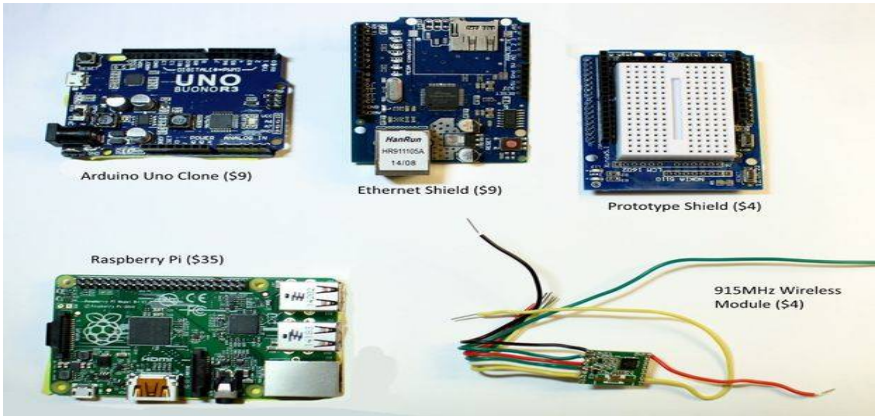

Figure 4: Component diagram 1

The components are displayed below and above for further references. The Hardware kit was developed in such a manner so that the Arduino and raspberry pi can work side by side to provide efficient results. Sensors like flame sensor, ultrasonic sensor, sound sensor, temperature sensor, PIR sensor, light sensor and many more were used to develop the kit. The raspberry pi is coded in python for controlling the camera module for surveillance and was also used for face recognition for unlocking the door.

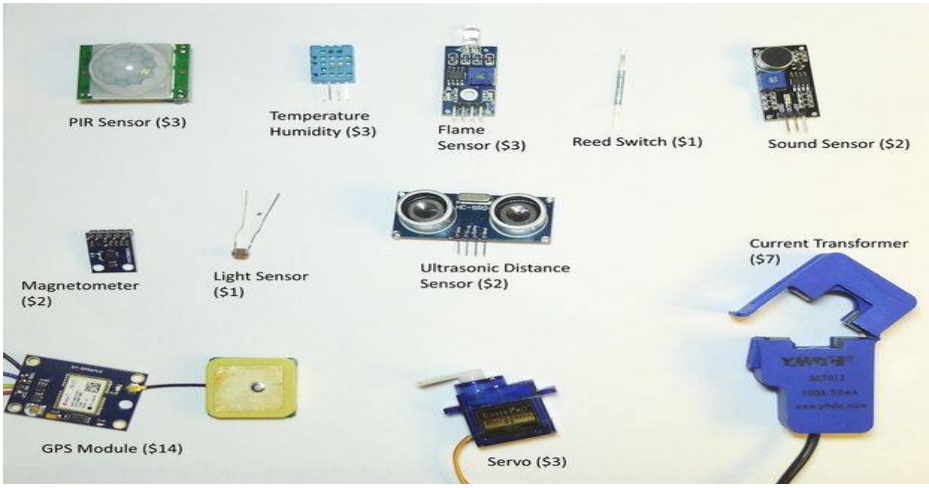

Figure 5: Component diagram 2

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The Android application will be used to display all the values of the sensors effectively and efficiently.
The application will store data for each and every user by providing access to google account and google drive. The application will also provide weekly and monthly usage of the electricity consumed by the appliances. The Hardware kit will be connected to the cloud by using Amazon web services(AWS). AWS will also be used to store data of the user and also for controlling and managing the face recognition API. The complete kit can further be used for mass production.

V.RESULTS

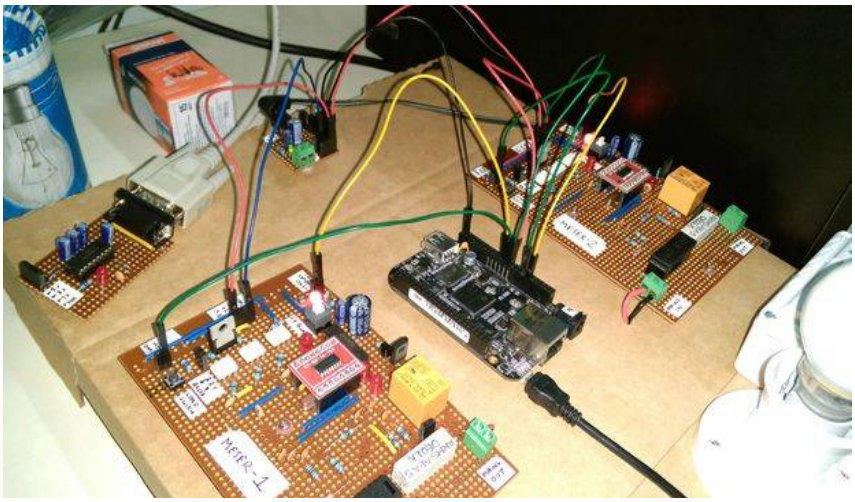

Figure 6: Circuit Diagram of the Kit

The Complete kit is developed using Arduino and raspberry pi which will be further minimized to a compact kit consumer use. This kit presents an efficient use of power and will be greatly effective in reducing power consumption. The above figure shows the completion of the demo kit for production purposes.

VI. FUTUREWORK

In later designs this project can be used for real time response for the users. Further additions have been made to the kit like the addition of Face recognition system for unlocking door and security purposes. The face recognition algorithm uses machine learning algorithm to identify the user and send appropriate response to the hardware kit. The addition of further more sensors will increase the productivity of the kit and will also help enhance user experience.

VII.CONCLUSIONS

In this paper an application and implementation of smart home system is presented. In this paper, an activity has been taken to clarify the idea of a smart home automation framework by considering all the essential segments of the framework with the assistance of a square chart. The investigation of the work done by a few different creators on home automation framework has given a thought of the scope of utilizations that are conceivable utilizing different remote advances.

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