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Smart Module for Home Automation Using Android Application

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***Abstract*—Automation of home appliances using IoT is very common and demanding in the present scenario. On the other hand, we face difficulties since all the electrical cables are being replaced by newer ones and also the entire switch boards have to be replaced, this increases complexity and cost. Therefore, we proposed a design which is portable, compact and does not require entire cable alteration. Entire module consists of two hardware sections, sensor and controller section. Wi-Fi (ESP 8266) is used for inter sectional communication. The electrical appliances are controlled by an android application 7.1.2. Making Home automation easy and accessible to all.**

Keywords—automation, sensor, android, controller, IoT

I. INTRODUCTION

How amazing would it be if there was a way to switch on your air conditioning system minutes prior to reaching home or else having a smart [7]- [8] security system that would detect any sort of smoke and heat anomaly or burglary attempt and immediately alert you as well as concerning agencies? These are just the tip of the iceberg called home automation.

Home automation has transformed our primitive homes into the ideal living place often termed as Smart homes - A home that detects our presence, remembers our choices of lightings, taste of music and sound adjustments with an idea of what and when to do. A house that waters our garden every day, turn on our water heater in the morning while we get ready for shower. All of this is an amalgamation of the Internet and IoT platforms [1]- [3] that have enabled us to link household errands and daily life household appliances with a centrally controlled system. Automation is the use of control systems and information technology to control equipment, industrial machinery and processes whilst reducing the need of human intervention and eliminating the risks of human error.

II. PRELIMINARY CONSIDERATIONS

Before the actual design of the project work, choices in selection of appropriate implementation platforms and hardware components were made. Priority was given to low Cost availability, reliability, flexibility and simplicity in all these selections. A number of options were considered for each of the products and the pros and cons were taken into consideration to make this project as efficient and cost effective as possible.

III. SELECTION OF IMPLEMENTATION OF PLATFORM

As already explained previously, there are a large number of platforms over which a home automation system can be implemented. Some of the popular available platforms among them were Ethernet, Bluetooth, infrared, GSM and Microcontroller. However, Microcontroller was found to be most appropriate due to the low cost, availability, reliability and simplicity when used for setting up an individually controllable home automation system. Ethernet is too expensive and complex for this kind of home automation system, while Bluetooth and infrared are unreliable.

IV. SELECTION OF HARDWARE COMPONENT

Each platform has a set of hardware components which can be implemented to provide desired result. For Microcontroller, the popular ones are those produced by Microchip, ATMEL, Motorola and Texas instruments, of all these Microchip manufactured PIC microcontroller were found mostly suitable due to their low cost, availability, readily available programmers, compilers and flexibility.

V. MODULE

The designed home automation system uses ESP8266 microcontroller, PIR sensor, Temperature sensor LM35, LDR Sensor and IR Sensor for communication between the microcontroller, mobile phone and the sensors, a relay and a driver for interfacing the relay. As illustrated in the block diagram. To make the communication between controller module and client application easier and efficient, two Node MCU were used as client and were connected to a central server thus facilitating flow of commands, data and instructions from users to controller module and vice-versa.

A. Controller Module

This module consists of an AT mega 328P-PU microcontroller, a solid state relay and a Hi-Link Voltage regulator. This block is responsible for basic control mechanism of the automation system. The microcontroller is constantly receiving data from various sensors used in the sensor module. This data is then sent to the client application for monitoring as well as modification purposes. The relay does the job of driving and switching the circuit as per the data received from the sensor module, whereas the hi-link voltage regulator is used to convert the voltage received from the central power supply system of home and then providing the required 5v supply to the controller module.

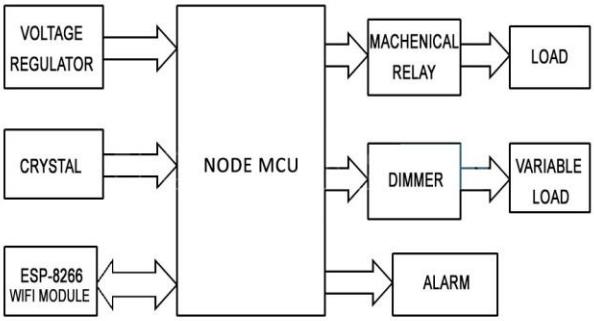

Fig.1 Block diagram of proposed Controller Module

B. Sensor Module

This module consists of a PIR sensor, a LM35 Temp Sensor, a TSOP IR Sensor, a LDR Sensor and a MQ5 gas sensor. The sole purpose of this module is to transmit the data of the surrounding environment to the controller module for its switching and operational purposes. This is responsible for sending instantaneous real time data from sensor to provide real time changes. For example: The instantaneous data from LDR and PIR sensor [10] helps detect human presence in the room and thus will let the controller know that a light source has to be switched on and with what intensity.

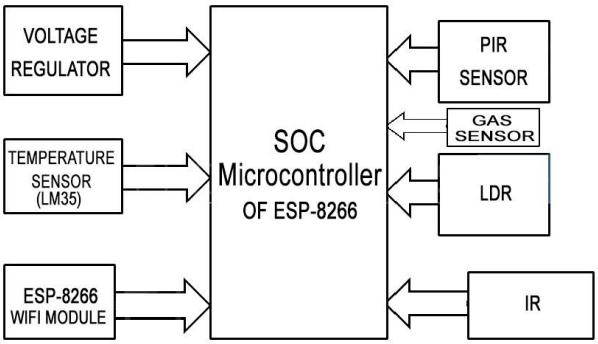

Fig.2 Block diagram of proposed Sensor Module

C. Android application Module

A prototype app was created keeping in mind the purpose and functions of the modules used and with easy to use interface as its priority. The app consists of primarily 4 section namely control, Sensors, Manual and Automatic Mode. The Control and Sensor section is used to monitor [5] the data from sensors at the location at which they are placed. For example, choosing kitchen from control section will activate the gas and temperature module whereas the room option will activate LDR, PIR and other sensors.

The Manual section primarily controls the functionality of home appliances specifically as per the user's requirements. It consists of touch buttons to switch the appliances on/off and a slider control to vary the speed or intensity of the appliance with the users wish.

The Automatic mode is especially designed for users who do not wish to change every appliances' working every instant and instead prefer it to change automatically and accordingly when required. For example: The Night mode in the automatic section helps changing the light intensity and the automatic temperature mode changes the speed of the fan according to the temperature of the room thus, reducing the human interference. Images of the app with their working status is shown below:

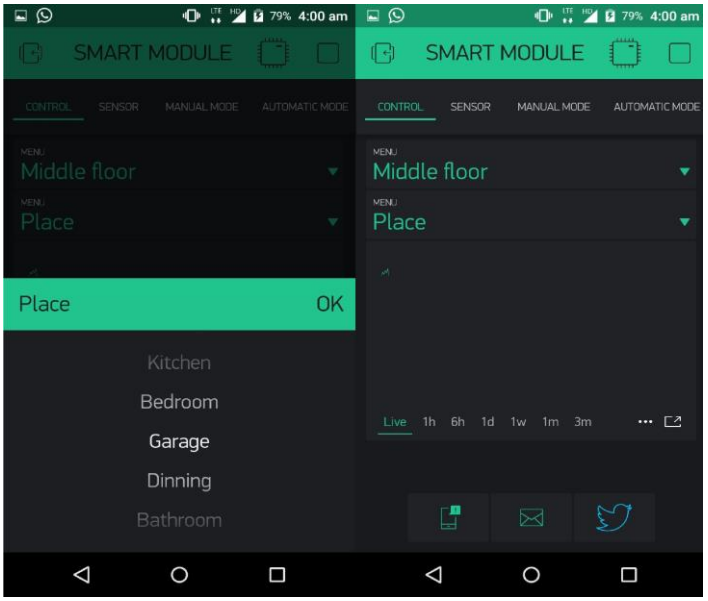

Fig.3 Android Application to control by selecting the floor and place of home

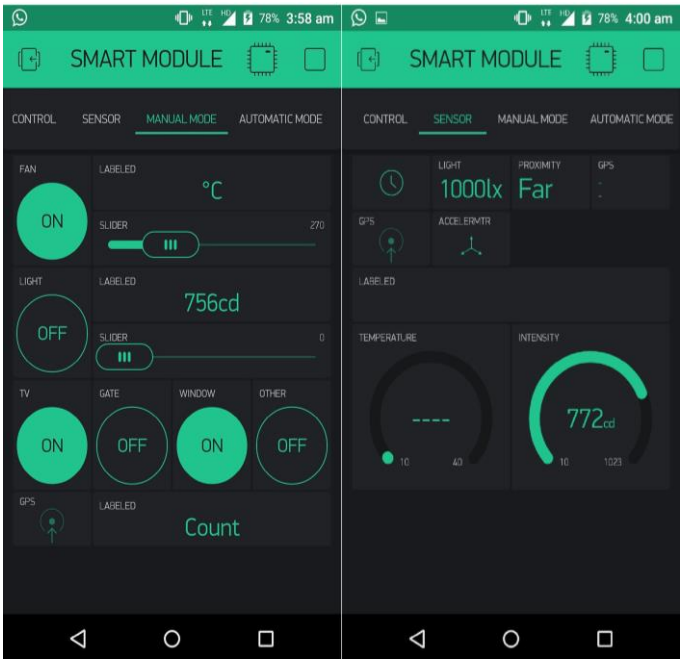

Fig.4 Android Application to control appliances manually and monitoring of the data in sensor activity.

D. Working of android application module

- User first need to create an account using email id in the android application and then login their account.
- After successful authentication the user will face a welcome activity with all the floor map (refer fig.3 right) so as to select the required area of action from the drop down list i.e. Floor →Domain. Where domain represents different area of the floor where controller module is placed (Ex. Kitchen, Bedroom, etc. refer fig. 3 left).
- Once user selects the desired domain, in the backend, the application sends http request to the

blynk server to fetch the data from the blynk database.

- This application consists of two different activities i.e. sensor activity and controller activity. In sensor activity one can monitor the data fetched from all the sensors (refer fig. 4 Right side). Whereas controller activity have three modes, manual (refer fig. 4 Left side), automatic and night mode (refer fig. 5).

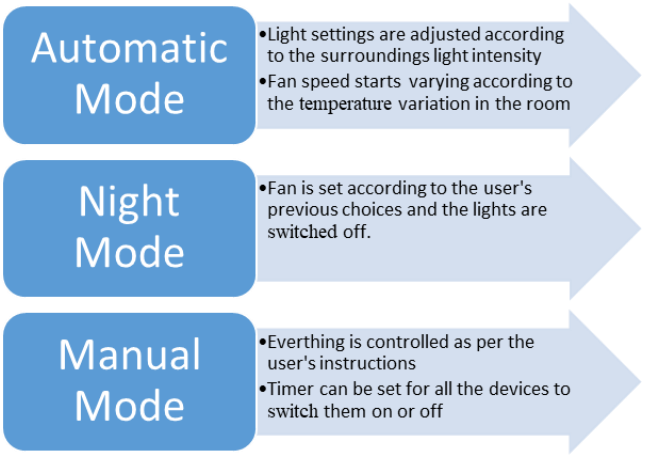

Fig.5 Different modes of controller activity

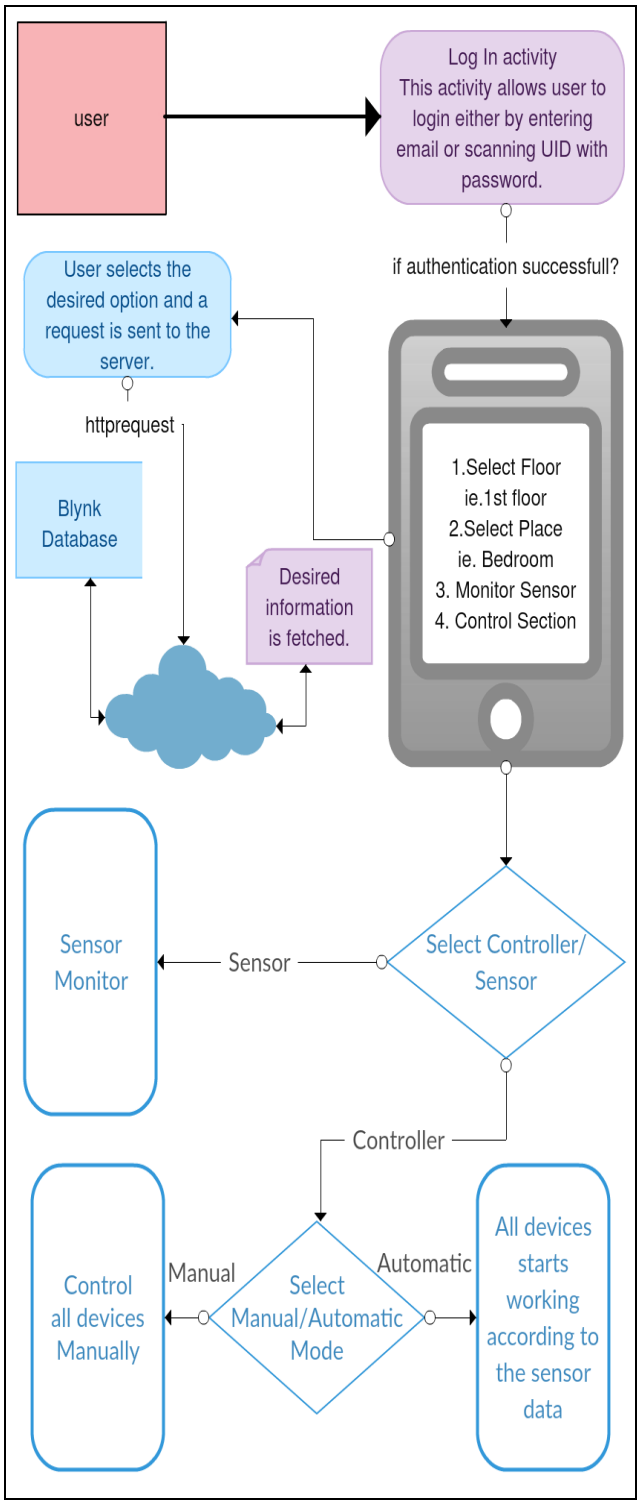

Fig.6 Flow Chart of android application

VI. Conclusion

It is evident from this project work that an individual control home automation system can be cheaply made from low-cost, locally available components and can be used to control multifarious home appliances ranging from the security lamps, the television to the air conditioning system and even the entire house lighting system and better still, the components required are so small and few that they can be packaged into a small inconspicuous container.

The designed home automation system was tested a number of times and certified to control different home appliances used in the light ng system, fan, and many more (this is as long as the maximum power and current rating of the appliance does not exceed that of the used relay). Finally, this home automation system can be also implemented over infrared and WAP connectivity with little to no change in the design and yet still be able to control a variety of home appliances. Hence, this system is scalable and flexible.

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