SMART HOME USING CC3200 LAUNCH PAD

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Abstract — *This proposed work presents the design of Home Automation System with low cost and wireless control. This system is designed to assist as well as provide support in order to fulfill the needs of elderly and disabled in home. Also, the smart home context in the system improves the standard of living at home. The main concept is to control the various electrical appliances in home by a wireless network. The design remains the existing electrical switches and provides more safety control on switches having low voltage activating method. The switches status is synchronized in all the control system whereby each and every user interface indicates the real time existing switches status. The system intended to control the electrical appliances and also devices in the house with relative low cost design, user-friendly interface and ease of installation.*

Keywords- simplelink cc3200 launch pad, home automation, wifi module, arm cortex m4 processor, android application, current driver

I.   INTRODUCTION

Smart Home is the residential extension of the building automation. In this paper, smart home Technique is used to design and implement a remote controlled, energy-efficient and highly accessible home automation. It provides the residents with the basic features that maintain the comfort. Home automation for the elderly and the disabled can provide increased quality of life for persons who may otherwise require a care giver. It also includes centralized control of the lighting, kitchen appliances and other household systems. A home automation system integrates electrical devices in the house with each other. The techniques employed in automation of home include those applied in building automation and control of domestic activities like home entertainment systems, houseplant and yard watering, pet feeding and use of domestic robots. This paper uses applications of a smart home and presents to the user. A central control system is established which helps and regulates functionality of home appliances. As a central controller, a cc3200 launch pad is used that communicates with an android application. The web server is used as interface by the android application; this server can also be used as regulatory mechanism for various connected devices. This smart home presents a predictive behavior which adapts to change in system to its user's behavior. The automation system changes its pattern as per user's change its usage pattern. It finds out the variation in pattern and implements a new functionality for the change. This enables smart home to act on their own accord and provide user with the necessary comforts and the ambience. This paper will describe the unique approach which is applied to control various home appliances with Android smart phone embedded with application [1].

Smart home is a very promising area, which has various benefits of providing increased comfort, greater safety and also security, a more rational use of the energy and other resources thus contributing to the significant savings. This research of application domain is very important and will increase in the future as it also offers powerful means for helping and supporting special needs of elderly and disabled people, for monitoring environment and for control. There are a number of factors that need to be considered when designing the smart home system. The system should be an affordable and scalable so that new devices can easily be integrated into the system, and it also should be user friendly.

II.   RELATED LITERATURE

Smart home is not at all a new term for science society however, it is still far more away from people's vision and audition. As electronic technology is converging, the field of the home automation is expanding. Various smart systems have been proposed where the control will be via Bluetooth, internet, short message service (SMS) based, etc. Bluetooth capabilities are good and also most of current laptop/notebook, tablets and the cell phones have built-in adaptor that will indirectly reduce cost of the system. However it limits the control within the Bluetooth range of the environment while most other systems are not feasible to be implemented as low cost solution [2].

In a Wi-Fi based home automation system is presented, it uses the PC (with built in Wi-Fi card) based web server that manages connected home devices. The users can also manage and control the system locally (LAN) or remotely (internet). The system will support a wide range of home automation devices such as power management components and security components. The similar architecture is proposed where actions are coordinated by home agent running on a

PC. Also other papers also presented internet controlled systems consisting of the dedicated web server, database and a web page for interconnecting and also managing devices. These systems utilize PC which leads to a direct increase in cost and the power consumption. On other hand, the development and hosting of web page will also result in additional costs.

The design and the implementation of the microcontroller based voice activated wireless automation system are also presented. The user will speak voice commands through a microphone, which is made to process and sent wirelessly via radio frequency (RF) link to main control receiver unit. The voice recognition module is used to extract the features of the voice command. This extracted signal is than made to process by microcontroller to perform a desired action. The drawback of this is that the system can only be controlled from within RF range. The reference also presents the voice activated home automation system. This system provides a graphical user interface (GUI) using the Microsoft Visual Basic software hosted by a PC, and also uses Microsoft Speech Recognition engine. The signal is than transmitted via RF link to microcontroller to which the home appliances will be interfaced. Again a PC is used that account for an increased cost and also power consumption [3].

III.   HARDWARE AND SOFTWARE REQUIREMENTS

3.1. Development of the Android platform app

There are numerous platforms for developing applications on smart phone. Some of them are Windows Mobile, Symbian, iOS and Android. In this system, the Android platform app is developed as large number of the phones today people are using support Android operating system. Here in our project Java programming language which exclusively uses the Android Software Development Kit (SDK) has been used for the development and implementation of the smart home application. The SDK includes all the required development tools such as debugger, libraries, handset emulator with documentation, sample code and even tutorials for each. Eclipse, which is the officially supported integrated development environment (IDE), has been used along with the Android Development Tools (ADT) Plug-in to develop the smart home application. The screenshots of the smart home application developed is shown in Figure 1.

The designed application for the home automation system provides the below functions to user:

- Remote connection through internet to the smart home to cc3200 launch pad inbuilt wifi processor ; require server real IP and authentication of the user.
- Control and monitoring of electrical appliances.
- Scheduling of the tasks and setting automatic control smart home environment.
- To provide user compatibility password change option is provided.
- Will support voice activation for switching functions of various appliances.

(a)   (b)   (c)

Figure 1. Screenshots of the proposed smart home app

3.2. CC3200 Launchpad

TEXAS Instruments proudly announces CC3200 simplelink Launchpad as industry's first single chip microcontroller unit integrated with wifi connectivity. The launch pad has an inbuilt wifi processor. Many of applications can be implanted using this Launchpad. Some of them are: Home automation, cloud connectivity, access control, security systems, smart energy etc [4].

3.2.1 *Key Features*

- CC3200 Simplelink Wi-Fi, Consists of Applications Microcontroller, Wi-Fi Network Processor, and Power-Management Subsystems
- Wi-Fi CERTIFIED™ Chip
- Applications Microcontroller Subsystem
    - ARM® Cortex®-M4 Core at 80 MHz
    - Embedded Memory
        - RAM (Up to 256KB)
        - External Serial Flash Boot loader, and also Peripheral Drivers in ROM
    - 32-Channel Direct Memory Access (µDMA)
    - 8-Bit Parallel Camera Interface to which display sensors can be interfaced
    - 1 Multichannel Audio Serial Port (McASP), interface with Support for Two I2S
    - 2 Universal Asynchronous Receivers and Transmitters (UARTS) provided
    - 1 Serial Peripheral Interface (SPI)
    - 1 Inter-Integrated Circuit (I2C)
    - 4 General-Purpose Timers with 16-Bit Pulse Width Modulation (PWM) Mode exclusively
    - 1 Watchdog Timer
    - 4-Channel 12-Bit Analog-to-Digital Converters (ADC's)
    - Up to 27 Individually Programmable, Multiplexed GPIO pins
- 802.11 b/g/n radio, baseband, and MAC with embedded powerful crypto engine for purpose of fast, secure Internet connections with 256-bit encryption
- The power-management subsystem which includes integrated DC-DC converters supporting various ranges of supply voltages
- Backchannel universal asynchronous receiver/transmitter (UART) through USB to PC
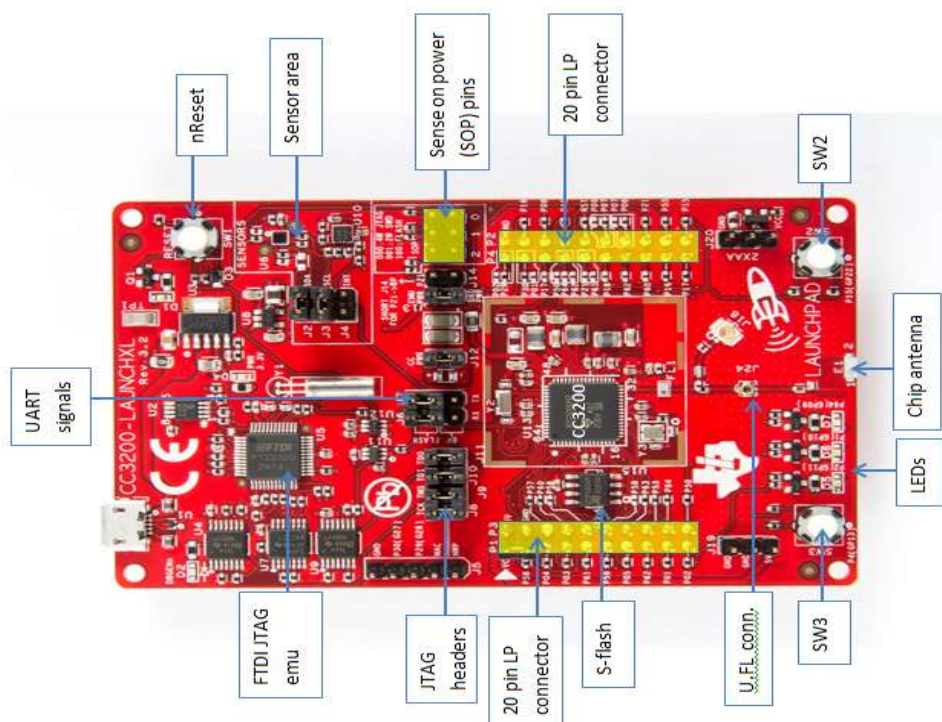- On-board chip antenna with U.F.L for conducted testing

Figure 2. CC3200 launch pad overview

3.3 Current driver circuit using uln2003a

The **ULN2003A** IC [5] has an array of seven NPN Darlington transistors which is capable of 500mA and 50V output i.e., high current and high voltage output. It includes common cathode flyback diodes for switching the inductive loads. It can also come in PDIP, SOIC, SOP or TSSOP packaging.

Darlington transistor is nothing but a pair of transistors which act as a single transistor providing a much higher current gain. The total current gain at the output of each Darlington pair is the product of current gains of individual transistors.

Current gain of the Darlington pair = current gain transistor1 * current gain transistor2
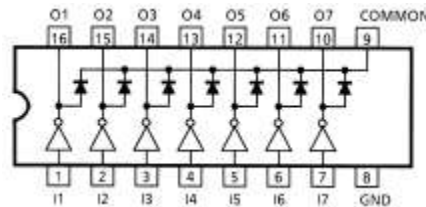

Figure 3.internal schematic of uln2003a

3.3.1 Features:

- Higher current output i.e., 500 mA rated collector current (single output)

- Higher voltage i.e., 50 V output (there is also another version that supports 100 V output)

- It also includes output common cathode flyback diodes

- All the inputs compatible with TTL and 5-V CMOS logic

3.4 Relays

A **relay** is electrically operated switch which uses an electromagnet to mechanically operate a switch. Relays are used wherever there is necessary to control a circuit by a low-power signal by providing a complete electrical isolation between control and controlled circuits.

Contactor is a type of relay that can even handle the high power required to directly control an electric motor or any other loads. Relays with relevant operating characteristics and sometimes multiple operating coils are even used to protect electrical circuits from overload; in modern electric power systems the above functions are performed by digital instruments called as "protective relays".

The relay works using a small voltage and currents to drive large loads. When the current flows across the coil an electromagnetic field is induced across the coil. This magnetic field created attracts the contact which completes the circuit. Thus the bulb glows as the circuit is closed. When the current flow stops, there is no further any creation of electromagnetic field. Thus absence of the magnetic field causes the contact to repel using the spring provided to the contact. Thus the bulb will be off as the circuit is open.
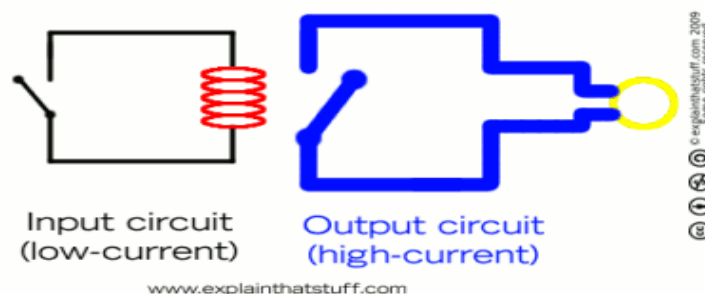

Figure 4. Working of relay

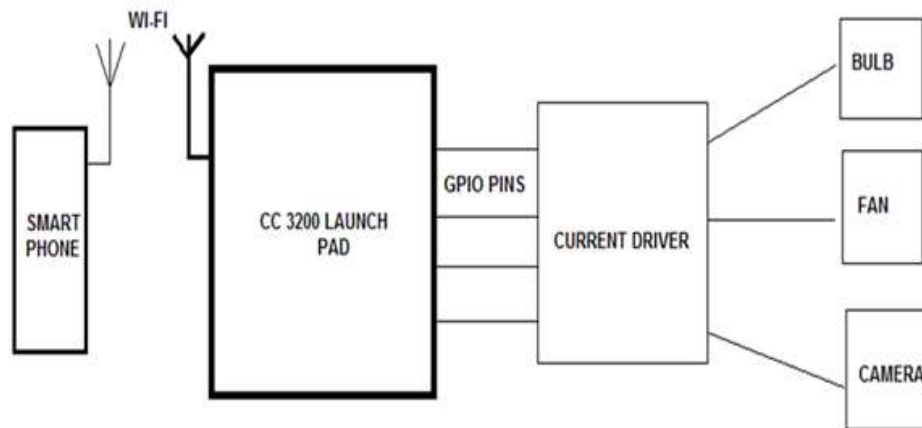## IV.   METHODOLOGY

4.1 Block diagram

Figure 5. Block diagram to Control Electrical Appliances through Smart Phone

4.2 Working of the module

The module works on the principle of wireless communication between smart phone and cc3200 launch pad which is embedded with wireless microcontroller(MCU), with built in Wi-Fi connectivity, Which in turn controls the required electrical appliance through the commands given by the user.

The commands given by the user from the smart phone having the custom android app for the specific application is received through Wi-Fi by the Launchpad and is decoded through the microcontroller unit. This decoded information is further transmitted through GPIO (General Purpose Input Output pins) to the current driving unit, which includes relays and voltage regulators, which is used to provide necessary voltage and current to drive the electrical appliances based on their requirements.

V.   CONCLUSION

In this paper, a Wi-Fi based smart home system that remotely controls upon user authentication is proposed and has been implemented. The Android operating system based smart home application communicates with the cc3200 launch pad via inbuilt Wi-Fi processor. Any android supported handset or device can be used to install this smart home application, and monitor the home environment using automation. A low cost smart home system has been developed which does not require a terminals like personal computers as all processing is handled by the using the microcontroller. The home automation system also can de further developed to use the Google speech recognition engine thus eliminating the need for any requirement of external voice recognition module. Many future works include incorporating SMS and call alerts, and reducing the wiring changes for installing the home automation system in pre-existing houses by creating a wireless Wi-Fi network within the home environment for monitoring the entire smart home environment.

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