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Wi-Fi to Legacy Protocol Gateway for B.One Smart Hub

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ABSTRACT: Smart Home Technology is smarter than ever. The newest devices and apps are simplifying tasks, making better use of resources, and transforming the way we live. Wired protocol based Smart homes are still widely used and has constant wired connection for no dropouts, interoperable, guaranteed interference free, holistic and consistent performance than wireless protocol based Smart homes. But today most of the devices support wireless protocol stack. Many existing and well established Home Automation systems are wired communication protocols like Insteon, X10, KNX, BACnet, Lon Works, Modbus etc.,. These protocols have high data rates, less noise immunity and are faster. B.One Hub is the World's most advanced, intelligent and secured IOT smart hub developed so far. It is proposed to use Texas Instruments (TI) based SimpleLink CC3200MOD Wi-Fi certified chipset to accomplish this project. The main aim of this project is to control Insteon devices through B.One Hub and B.One Application. Insteon Cloud API's helps to communicate with Insteon devices.

KEYWORDS: Smart Home Technology, Wired Protocol, Wireless Protocol, Home Automation Systems, B.One Hub, IOT, Legacy systems, Insteon, X10 and CC3200MOD.

I. INTRODUCTION

The drastically growing Home automation technology and its demand are increasing in a wide range of sectors. It maintains human comfort without human intervention. The theme of home automation technology is its ability to intensify the security features of the home without requiring much change in the architecture.

To revolutionize the Home Automation System, Blaze Automation Inc has developed a Smart Home Hub called B.One. B.One Hub is the World's most advanced, intelligent and secured IOT smart hub developed so far. The flexibility of this system can be achieved using Wi-Fi Technology. Wireless technology like Wi-Fi is more commonly used in Home Automation because of reduced installation cost, system scalability and easy extension. The legacy Smart home system users connect to this gateway and establish the communication and have an advantage of hardware by just having Smart B.One hub which integrates with the existing technology.

Insteon network is simple and cost effective which can be networked together using the dual technologies like power line, radio frequency (RF), or both. All Insteon devices are peers, meaning which explains that every device can transmit, receive, or repeat other messages, without requiring a master controller or complex routing software. Adding more devices makes an Insteon network more robust, by advantage of a simple protocol for communication retransmissions and makes the communication easy. On the powerline, many Insteon devices are compatible with legacy X10 devices.

II. RELATED WORK

Insteon home network technology fills the gap between the wired protocols and the wireless protocols because Insteon is the optimum combination of simplicity, affordability and reliability. Created by Smart Labs, the world's leading authority on electronic home improvement, Insteon grew out of thirteen years of experience delivering real-world home control products to consumers and professional installers all around the world.

Insteon is a dual-band communications protocol which means digital signals can travel over the home's wiring system and over radio frequencies. More than 200 available products are available that could be configured and can understand Insteon communications. Insteon core protocol can support more than 16 million devices per network that

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anyone would ever use. The Insteon message is composed of the following: from address (3 bytes), to address (3 bytes), flag (1 byte), command (2 bytes), and redundancy check (1 byte). There are two main types of INSTEON modules, 'Controllers' and 'Responders'. Controllers: Controllers send signals based on manual or automated events, and include devices such as the programmable network hub, remote controls, motion/door sensors etc. You choose your controllers based on how you would like to interact with your home. Responders: Responders receive the commands sent by controllers and, well, respond! They are what actually switch the electricity to your lights and devices, control your heating, and send IR signals and more. INSTEON responders essentially choose themselves for you, as their choice is defined by the device you wish to control. The CC3200MOD integrates all required system-level hardware components including clocks, SPI flash, RF switch, and passives into an LGA package for easy assembly and low-cost PCB design. The part number of the module is CC3200MODR1M2AMOB. The integration of B.One with Insteon has many advantages because of Insteon's dual network. Insteon protocol is designed to bridge a gap between the powerline and the wireless network.

III. METHODOLOGY

The block diagram of Wi-Fi to legacy protocol gateway for B.One Smart Hub is shown in Fig.1. The hardware that is proposed to use is Texas Instruments (TI) based Wi-Fi certified chipset to accomplish this project. Since CC3200MOD is a Wi-Fi module it is the apt hardware selected for this project. The Simple-Link™ Wi-Fi@ CC3200MOD Launch Pad (with certified module) is an evaluation development platform for the CC3200 wireless microcontroller (MCU), the industry's first single-chip programmable MCU with built-in Wi-Fi connectivity. B.One Hub with CC3200 Mod now can communicate with the Insteon cloud Rest API's and discover the Insteon devices. The software evaluation of the program for CC3200MOD can be evaluated using Code Composer Studio. The discovered devices can be fetched through B.One App from B.One Hub. Hence the communication is established between the B.One Smart Hub and Insteon Devices.

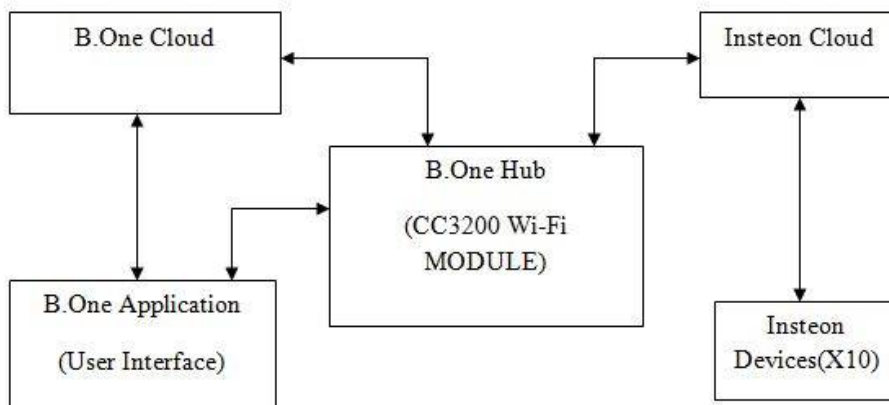


Figure.1: Block Diagram of the Project

The hardware thus decides to go a more customized route we can utilize TI CC3200 chip, it is a full solution Internet on Chip with an onboard ARM-Cortex M4 and Wi-Fi MCU this board is capable of controlling an embed design while taking care of the details and complications of implementing our own Wi-Fi stack, in addition it makes use of Texas Instruments SimpleLink Platform which allows it the ability to be programmed over a IOS or Android application.

The microcontroller supplies voltages to bias both transmitter and photodiode. The photodiode output is given to the amplifier and the amplified signal obtained from photodiode is supplied as input to the analogue pin of the microcontroller. In this the Wi-Fi module CC3200MOD acts as a gateway for the B.One Hub to the Insteon cloud. The cloud REST API's of Insteon helps us programmatically to get the status of the Insteon devices. The Insteon hub device status thus can be fetched into B.One Application which is the user interface.

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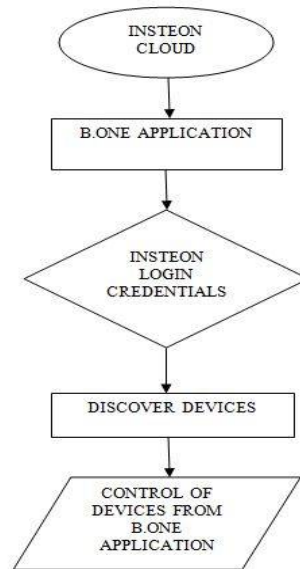


Figure.2: Flowchart of the Project.

IV. HARDWARE DESCRIPTION

Code Composer Studio supports both run mode debug and stop mode debug of Linux/Android applications. In run mode debug, it is possible to debug one or more processes. To accomplish this CCStudio launches a GDB debugger to control the target side agent (a GDB server process). The GDB server launches or attaches to the process to be debugged and accepts instructions from the host side over a serial or TCP/IP connection. The kernel remains active during the debug session. In the stop mode debug, CCStudio halts the processor using a JTAG emulator. It is then possible to examine the state of the processor and the execution state of the current process. Additional plug-ins such as the Google Android Development Tools (ADT) is available and can be added to the CCStudio environment to improve the Android development experience.

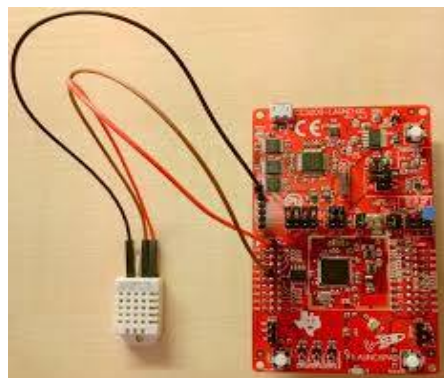


Figure.3:CC3200MOD.

V. SOFTWARE ANALYSIS

Code composer studio is an integrated development environment (IDE) that supports ti's microcontroller and embedded processors portfolio. Code composer studio comprises a suite of tools used to develop and debug embedded applications. It includes an optimizing c/c++ compiler, source code editor, project build environment, debugger,



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profiler, and many other features. The intuitive ide provides a single user interface taking you through each step of the application development flow. Familiar tools and interfaces allow users to get started faster than ever before.

Code composer studio combines the advantages of the eclipse software framework with advanced embedded debug capabilities from ti resulting in a compelling feature-rich development environment for embedded developers.

The results were observed in the B.One Application and the software analysis of the API's can be seen in the hyper terminal window. Thus we can able to perform the basic functionality of ON and OFF of Insteon devices and could get the latest status of the devices through B.One Application.

```
COM5:115200baud - Tera Term VT
File Edit Setup Control Window Help

*****
CC3200 HTTP Client Application
*****

Host Driver Version: 1.0.0.10
Build Version: 2.4.9.2-31-1-3-0.1-1.0.3.34
Device is configured in default state
Device started as STATION
(MLAN EVENT) STA Connected to the AP: DemoAP , BSSID: f8:e0:79:9b:d4:81
(MLAN EVENT) IP Acquired: IP-192.168.43.245 , Gateway-192.168.43.1
Connected to the AP: DemoAP
Connection to server created successfully

HTTP Post Begin:
HTTP Status: 200
Content-Type: application/json
Successfully parsed 37 JSON tokens
HTTP Post End:

HTTP Delete Begin:
HTTP Status: 200
Content-Type: application/json
Successfully parsed 21 JSON tokens
HTTP Delete End:

HTTP Put Begin:
HTTP Status: 200
Content-Type: application/json
Successfully parsed 25 JSON tokens
HTTP Put End:

HTTP Get Begin:
HTTP Status: 200
Content-Type: application/json
Successfully parsed 15 JSON tokens
HTTP Get End:
```

Figure.4:Output on Hyperterminal.

VI. CONCLUSION AND FUTURE WORK

The project was successfully implemented on B.One hub and Application was able to control the Insteon devices. The legacy Smart home system users connect to this gateway and establish the communication and have an advantage of hardware by just having Smart B.One hub which integrates with the existing technology. There are various approaches that are recommended for future implementation and for the development of this work. The later proposal for the development of this project is through the chipset of Insteon being embedded on the B.One Hub.

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BIOGRAPHY

Dr.Vangala Padmaja is a Professor in the Electronics and Communication Engineering Department, College of VNR Vignana Jyothi Institute of Engineering & Technology. She received Doctor of Philosophy(Ph.D.) under study and exploration of new methods in test pattern vectors and pattern classification design in the year 2009. Her research interest is Pattern classification Embedded systems.