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HOME AUTOMATION SYSTEM BASED ON BLUETOOTH

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Abstract

Significant change in the world of consumer electronics has been seen over the last decade. The notion of a smart house is meant to be achieved by numerous 'intelligent' gadgets such as mobile phones, air-conditioners, home monitoring systems, home theatres, etc. In home settings, they have built a Personal Area Network where all these systems can be integrated and controlled using a single controller. In home automation and networking, busy families and individuals with physical disabilities constitute an appealing market. It would be ideal to provide a wireless home network that does not incur extra wiring costs. A perfect approach for this purpose is Bluetooth technology, which originated in the late 1990s. This paper discusses the use of Bluetooth technologies in the area for home automation and networking. A network that includes a central mobile host controller and many client modules is proposed (home appliances). The client modules connect via Bluetooth devices with the host controller.

Keywords: *Bluetooth Development Kit, Graphical User Interface (GUI), Home Automation Protocol (HAP), Microcontroller, Special Interest Group (SIG)*

I. INTRODUCTION

The wireless Bluetooth platform is intended to revolutionize the way people in our homes and workplace settings experience digital technologies. They are no longer just individual devices; instead, they form a network in which appliances can connect with each other with the embedded Bluetooth technology [1]. In home settings, where there is hardly any infrastructure to interconnect intelligent appliances, this wireless technology is extremely useful. It may be suitably used for home automation in a cost-effective way. Operating on an unlicensed, freely usable 2.4 GHz bandwidth, it is capable of connecting digital devices at speeds of 1 Mbps within a range of 10 m (stretching to 100 m, by increasing the transmitted power). Adding upon this theme, we suggest a Bluetooth technology-based home automation system. In developing a home automation scheme, there are some challenges involved [2]. The framework should be modular, so that it is simple to incorporate new hardware into it. A user-friendly guide on the host side should be provided, so that the devices can be set up, tracked and managed. Some diagnostic services should also be provided by the interface so that such system issues, if any, can be tracked. To realize the true

power of wireless technology, the overall system should be fast enough. In order to explain its use in home automation, it should also be cost effective. The device built during the course of this research consists of a Personal Computer (PC), Host Controller (HC) and a temperature sensor/fan-controller based on a microcontroller that can communicate with the host using a Bluetooth connection [3]. In order to enable master-slave communication within a home automation network, the device is based on the Home Automation Protocol (HAP) developed by the authors. A prioritized, interlocked data sharing is guaranteed by this protocol. Dynamic inclusion and exclusion of devices on the network is also supported. Device registration, control and diagnostic utilities are supported by a user interface on the PC. Ericsson's Bluetooth development kit was used for the development. As the system controller for client modules, a microcontroller was used.

Protocol for Home Automation:

In a home automation device, the Home Automation Protocol (HAP) enables coordination between the host and client modules. Contact includes the process of configuration of the system and the process of data transaction [4]. The protocol is built on top of the Bluetooth device stack. It follows the Bluetooth Special Interest Group layer concept suggested by (SIG). The HAP is based on the heart of the Bluetooth protocol architecture, which consists of three stacks, given the specifications of the home automation environment:

- Logical Link Control and Adaptation Protocol (L2CAP)
- Service Discovery Protocol (SDP)
- RFCOMM protocol.

The method of HAP device configuration uses the improved SDP features to demand information and resources for the device. With protocol multiplexing capability, segmentation and reassembly operations, L2CAP provides the HAP with data services [5]. RFCOMM promotes wireless connectivity and offers home control systems with transport capability. A standard home automation device based on Bluetooth requires a host and multiple modules for the client.

PC Software for Bluetooth Home Automation:

The primary Host Control Application (HCA) for other DCs is the Bluetooth home automation PC device module. The HCA provides consumers with three key facilities, namely:

1. Device Registration
2. Diagnostics utility
3. Device Status and Control.

Device Registration:

The Plug and Play (PNP) technique is enabled by the home automation scheme, which ensures that a new computer can quickly be connected to the system. A system database is maintained on the HCA to accommodate the diverse inclusion of new devices and to decrease the sophistication of the client applications. Similar to PC printer drivers, this device database provides information about each device model that is supported. If there is a need to incorporate a new unit, the device

registry utility could be used to register it [6]. For any of the client modules, the database may be viewed as an engine. The whole database is saved in the initialization file stored in the Windows directory of the device. Other user settings needed to configure the serial port to connect with the Bluetooth Toolkit are also included in the initialization file. The menu contains an Open File option that allows you to load the initialization file from the disc. Similarly, for backup purposes, a Save File option will cause this file to be transferred to a disc. A graphical user interface (GUI) will be provided upon beginning the application. The details for each device registered will be added to the list of devices. This device list and details on each selected registered device will be provided to the user for selection when the user selects the Registration Tab. After the information for each device is shown, the user can opt to edit the device information for the device chosen, or to install a new device [7]. If one of these choices is picked, a new interface of the same kind would be presented, allowing the user to update the current device information or enter a new information set and register as a new device.

Diagnostics Utility:

The diagnostics utility offers a way for the HC to test critical Bluetooth communications at the device level with the DC attached to it. It allows the user to link and send data to the DC from the HCA. This usefulness is useful and even important for troubleshooting purposes during the creation process. Links to the utility features is supported by a user-friendly Interface. The correct serial port, as shown in the user setup menu, will be connected at the required baud rate upon start-up [8]. Upon termination of the program, the user configuration menu will be stored in the initialization file. The user will execute diagnostic Bluetooth functions after a link is made to the designated serial port. Reset, Bind ACL (Asynchronous Communication-Less link) or Synchronous Connection Driven link, Reconnect, Inquiry, Board Address and Submit Data are the Bluetooth functions offered on the HCA. In the list below, the sequence of operations for a typical data relation from the HCA is highlighted:

1. To initialize your Bluetooth, perform a reset process.
2. To scan at all the Bluetooth devices present on the piconet, conduct an Inquiry procedure.
3. After a Bluetooth client address is received, a Connect ACL operation to this address is required to set up a data transfer link.
4. After the completion of the ACL link, data could be inserted in the textbox of the data entry and sent to the client via the Send operation.
5. A reconnect operation is performed to end the Bluetooth link until all data is transferred.

Device Status and Control:

The key program to screen and track ADs is the System Status and Control application. The System Status and Control program executes the same tasks on a hidden layer, in contrast to the Diagnostics utility, which can also be used to collect status information about an AD and to control the device. A list of Advertisements for registration will be shown using the GUI. When an AD is chosen, the relevant device information is accessed in a secret layer from the attached device, consisting of ACL links, data transfers and detaches operations [9]. Data transfers and link operations conform to the protocol for the switch between the HC and a DC to be coordinated. In addition, the protocol allows for multiple packets to be sent for various purposes, and all these

operations are conducted on a secret layer. The consumer is not concerned with the packet formats and the protocol between HC and DC at this stage. The customer may still opt to monitor the AD, in addition to receiving the AD status [10]. The control values will be sent to the AD when the user chooses the AD and the control choice is chosen, and the DC will be able to use these values to control the AD, depending on the system type.

II. CONCLUSION

The goal of this proposal was to build a framework of home automation based on wireless Bluetooth technology. The effect is the HAP, which helps the user in the home environment to track and manage various equipment's connected through a Bluetooth network. By designing a room temperature control system, the system has been seen to be working. The essence of this initiative is such that it gives a broad scope for more advances. The error detection and correction facility is done in this device only at the Bluetooth level. It is possible to build a comparable facility at the application stage. In addition, certain protection precautions may also be integrated into the program to prevent intrusion from nearby home automation devices. The functionality of the HAP can be checked using several Bluetooth devices with a wider network. We used the I2 C interface between the DC and the ADs for this project. The idea of a parallel interface for faster systems or a power line interface, etc, can be discussed. One Bluetooth module is paired with only one DC in our program. The feasibility of a multi-drop RS232 protocol between a Bluetooth module and DCs can be measured. Of necessity, in optimum conditions, each computer would have its own Bluetooth module.

III. REFERENCES

[1] N. Sriskanthan, F. Tan, and A. Karande, "Bluetooth based home automation system," *Microprocess. Microsyst.*, 2002, doi: 10.1016/S0141-9331(02)00039-X.

[2] R. Piyare and M. Tazil, "Bluetooth based home automation system using cell phone," in *Proceedings of the International Symposium on Consumer Electronics, ISCE*, 2011, doi: 10.1109/ISCE.2011.5973811.

[3] K. Gill, S. H. Yang, F. Yao, and X. Lu, "A ZigBee-based home automation system," *IEEE Trans. Consum. Electron.*, 2009, doi: 10.1109/TCE.2009.5174403.

[4] M. Asadullah and K. Ullah, "Smart home automation system using Bluetooth technology," in *ICIEECT 2017 - International Conference on Innovations in Electrical Engineering and Computational Technologies 2017, Proceedings*, 2017, doi: 10.1109/ICIEECT.2017.7916544.

[5] N. David, A. Chima, A. Ugochukwu, and E. Obinna, "Design of a Home Automation System Using Arduino," *Int. J. Sci. Eng. Res.*, 2015.

[6] A. Cyril Jose and R. Malekian, "Smart Home Automation Security: A Literature Review," *Smart Comput. Rev.*, 2015, doi: 10.6029/smartcr.2015.04.004.

[7] L. Kamelia, S. R. Alfin Noorhassan, M. Sanjaya, and W. S. Edi Mulyana, "Door-automation system using bluetooth-based android for mobile phone," *ARPN J. Eng. Appl.*

Sci., 2014.

[8] M. Asadullah and A. Raza, "An overview of home automation systems," in *2016 2nd International Conference on Robotics and Artificial Intelligence, ICRAI 2016*, 2016, doi: 10.1109/ICRAI.2016.7791223.

[9] S. Kumar and S. R. Lee, "Android based smart home system with control via Bluetooth and internet connectivity," in *Proceedings of the International Symposium on Consumer Electronics, ISCE*, 2014, doi: 10.1109/ISCE.2014.6884302.

[10] S. Palaniappan, N. Hariharan, N. T Kesh, V. S, and A. Deborah S, "Home Automation Systems - A Study," *Int. J. Comput. Appl.*, 2015, doi: 10.5120/20379-2601.