Using LabVIEW to Implement the UDP Pervasive Protocol for a Smart Home Environment on MyRIO

N Naresh

Department of Computer Science Engineering, Usha Rama Engineering College, Vijayawada
Corresponding Author: nnareshcse@gmail.com

_____

Abstract: *The currently undertaken project deals with the investigation of the LabVIEW platform on an NI MyRIO embedded device to create the User Datagram Protocol (UDP) to connect the smart home. UDP is an efficient small network protocol that allows real-time data sharing among the components in the smart home. The system facilitates the easy process of interface sensor data collection, control signal transmission and connectivity of equipment in a smart home setting by using the LabVIEW graphical programming language. The MyRIO device performs minimal-latency routing and broadcasting of data through UDP as a central controller. The solution demonstrates the effectiveness of UDP in pervasive computing in smart environments, which offer connectionless, fast communication that is suitable in Internet of Things applications. The system enhances responsiveness and reliability of a home automation and displays usefulness of LabVIEW and MyRIO as a tool in the embedded smart systems.*

Keywords: *UDP, Smart home, LabView, MyRIO, Pervasive*

_____

I. Introduction

Over the past few years, the popularity of the smart home technologies has increased due to the growing necessity of increasing automation, convenience, and energy efficiency. Reliable and fast device-to-device communication is a crucial aspect of the smart home systems. The User Datagram Protocol (UDP) is a suitable protocol to be used in such applications due to (a) the connectionless characteristic (b) low latency and (c) low overhead. It is also ideal when delivering time-critical data in the pervasive computational accomplishment. The aim of the project is to develop a smart home communication network using LabVIEW to develop the UDP protocol on the NI MyRIO a embedded device.

National Instruments LabVIEW graphical environment makes the development of complex control and communication systems easy. It enables an easy interface with MyRIO, a real time embedded hardware platform that is designed to be prototyped and used in education. MyRIO acts as a hub controller in this system, where it monitors and controls the data that is being collected by the sensors and sends a set of commands into the actuators in the smart home set up. The network is capable of transmitting and receiving packets of data between nodes by using the pre-installed UDP capabilities of LabVIEW, and thus, real-time control and monitoring are possible. To advance the growth of Internet of Things (IoT) applications, this project demonstrates potentialities of LabVIEW, UDP and MyRIO to create efficient, reactionary, and flexible communication infrastructure in smart home scenarios.

II. Research Method

The research methodology is based on LabVIEW and UDP protocol on an NI MyRIO device which is utilized to construct and establish a smart home communication system. The first set of system requirements was types of sensors (light, motion, temperature and so on) and actuators (lights, fans, and so on) that had to be integrated. MyRIO device programming happened using LabVIEW to collect sensor data and sending control signals to actuators via UDP. The client-side and the server-side code were written in LabVIEW by the use of built-in UDP VIs (Virtual Instrument) that enabled two-way communication with MyRIO and a host PC or device. The network was tested under a controlled environment to assess responsiveness of a system, loss of data, and speed of transmission of packets.

_____

Fig 1: Machine Area Network Algorithm
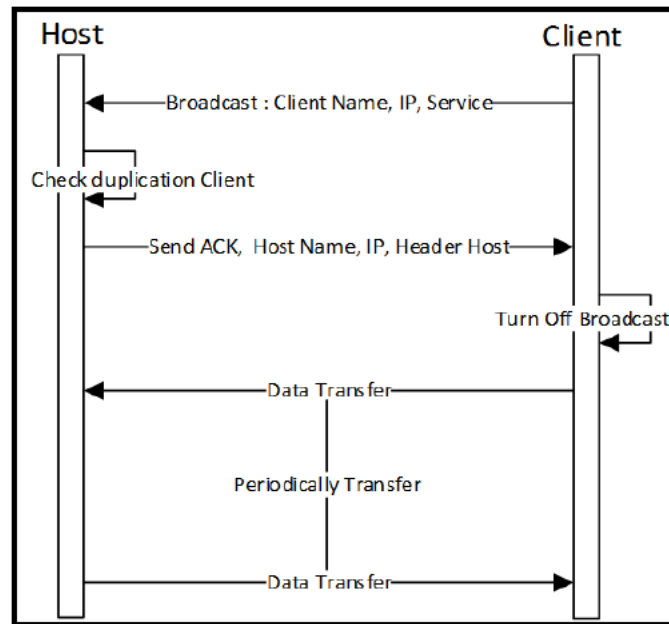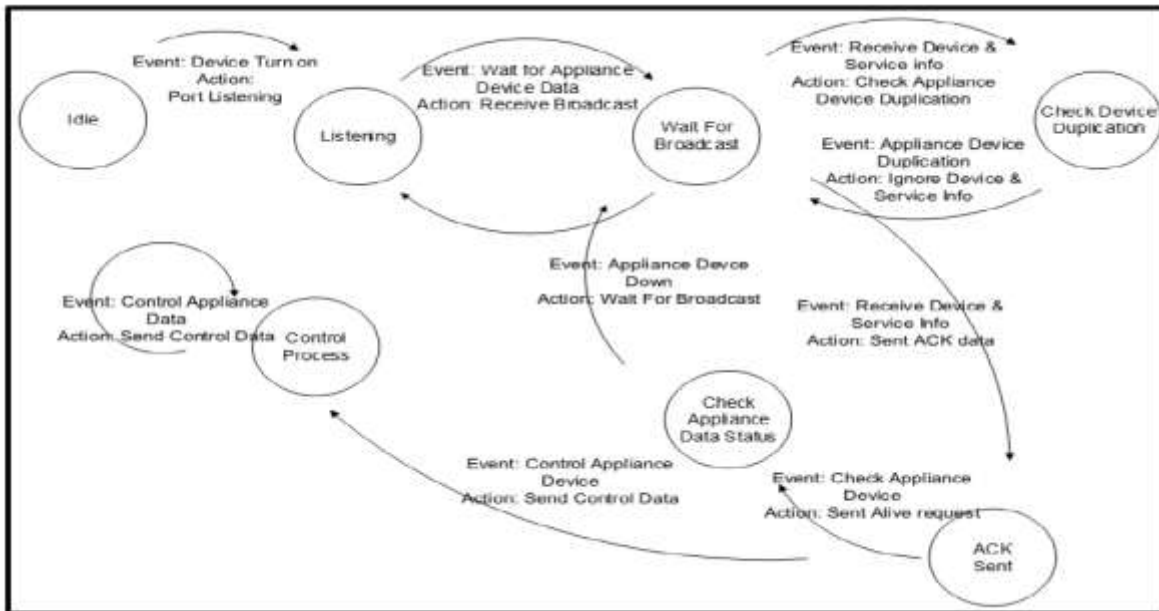

Fig 2: Machine Diagram Hot State

The indicators of reliability and latency were estimated through data logs and performance indicators. This proved to be an experimental arrangement of UDP as a lightweight and scalable approach of communication since in this arrangement it was thoroughly proven that UDP is viable and effective when used in real-time applications in the smart home scenario.
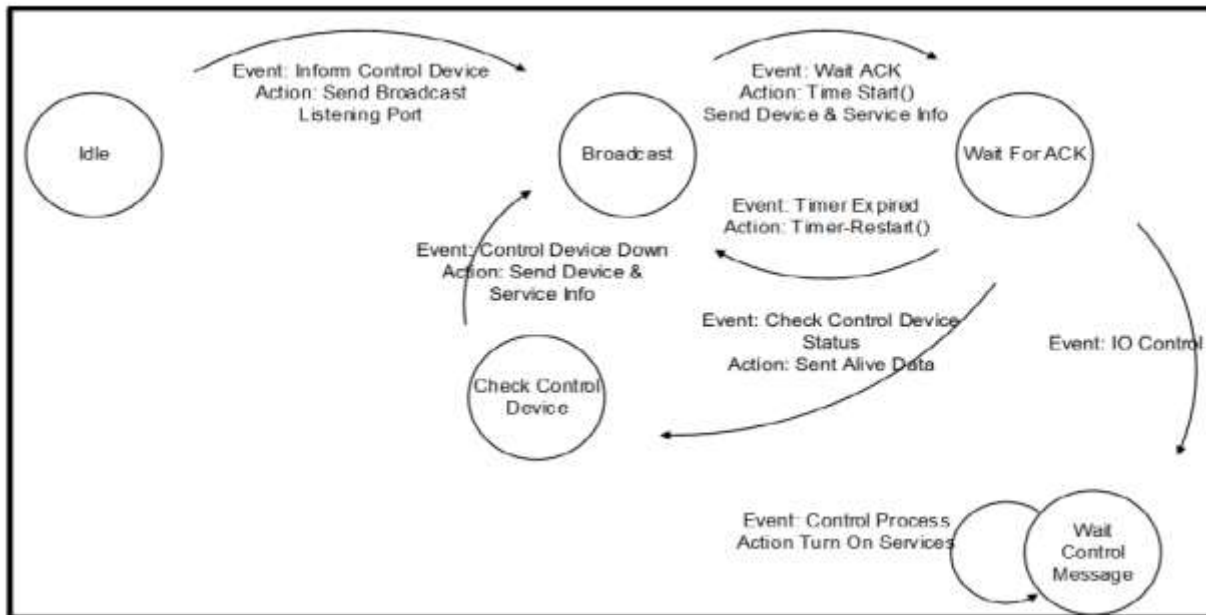
Fig 3: Machine Diagram Client State

III. Result and Analysis

The lower level monitoring possibilities of the use of the UDP protocol on the NI MyRIO device with the help of LabVIEW made the real-time communication in a simulated smart home environment available. Sensor data, temperature, motion, and light intensity, with an average delay of less than 50 milliseconds per packet was broadcast by UDP over the MyRIO to a host PC. The PC control order instructions to actuators such as fans and LEDs were also highly responsive since they were executed almost immediately. In a normal network, the loss of the packet was demonstrated to be negligible, proving the potential of UDP to be used in urgent, short information transfer in local smart systems. The system managed to keep the stability even in the cases of multiple interacting devices, and the data flow remained stable at relatively high times of the continuous data transfer.
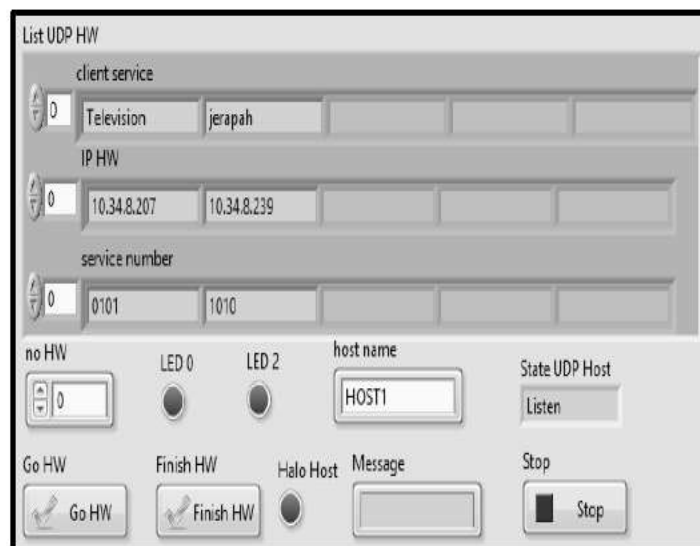
Fig 4: Host front panel
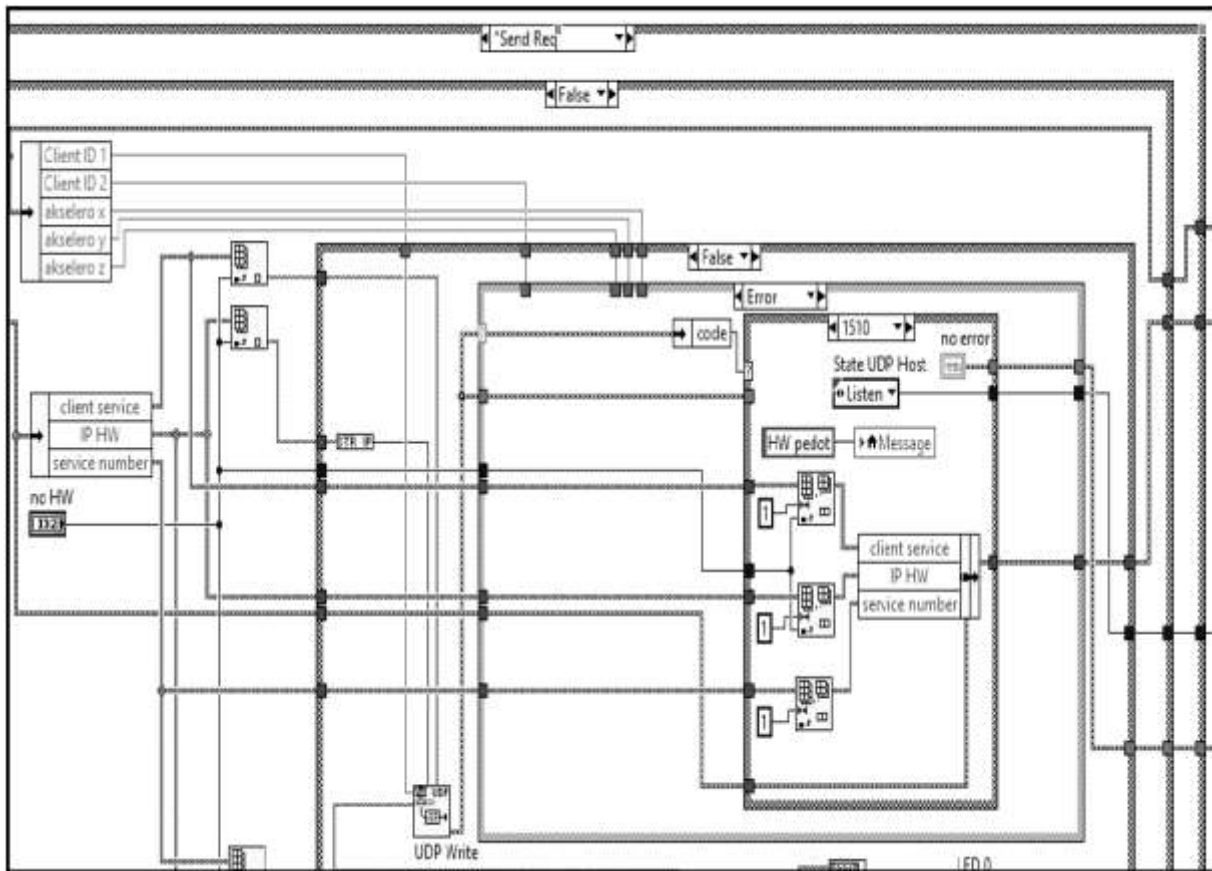
Fig 5: Host block diagram

Evaluation of the LabVIEW UDP VIs showed that the host PC and MyRIO do not utilize much CPU and RAM indicating good utilization of system resources. However, as one might have expected with UDP, it had no inherent error correction thus upon network congestion, there would be occasional loss of packets. On the whole, the results showed that LabVIEW, UDP, and MyRIO can offer a lightweight and efficient implementation of integrating real-time communication into the smart home system, particularly in scenarios when simplicity and speed are more alienated than confirmation of delivery.

Fig 6: Front panel

Fig 7: Block diagram of client

IV. Conclusion

In this project we succeeded in showing how we can utilize the UDP protocol to the NI MyRIO device within a smart home environment within LabVIEW. The system has shown the effectiveness of the UDP in pervasive computing systems in terms of supporting real-time, low-latency inter-sensor, inter-actuator, and sensor/actuator to controller messaging applications. LabVIEW which is a graphical user interface made programming simpler; MyRIO provided reliable hardware assistance in programming embedded application. Although UDP did not have any inbuilt error recovery procedures, it was actually used successfully in typical applications hence suitable to smart home where time is critical. The evidence shows that LabVIEW and MyRIO, used with UDP is a practical and scalable option of home automation based on the Internet of Things (IoT) when the priority is greater speed and ease of use than bulletproof data delivery. Future studies can examine hybrid procedures as a way of enhancing reliability.

References

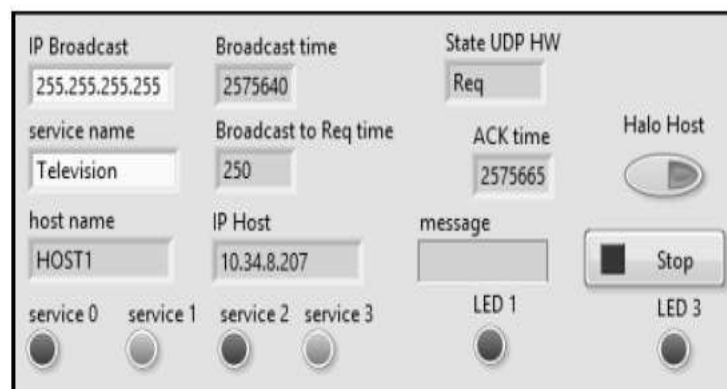[1] Shabnam, Ali Khan and Md Sohail, "Research Survey on Cloud Computing" IEEE Trans. Neural *Networks,* pp. 436-447, 2001.

[2] Vardhaman. Kalsi and Srikanth, "Internet of Things – Universal Technological and Societal Trends," Singapore Publishersa, December 2014.

[3] I.F. Akyildiz, W. Su, Y. Sankarasubramaniam and E. Cayirci, "Wireless sensor networks: a survey," *Elsevier Science,* vol. 22, no. 6, p. 132-142, 2012.

[4] Munir, S.A., Ren, B., Jiao, W., Wang, B., Xie, D. and Jian, M., *"Mobile Wireless Sensor Network: Architecture and Enabling Technologies for Ubiquitous Computing,"* in 21st International Conference on International Conference on, Advanced Information Networking and Applications Workshops, AINAW '07, 2007.

[5] Pan S. J, *et al.*, "Comparative Investigation on Various On-Chip Center-Tapped Interleaved Transformers," *International Journal RF and Microwave CAE*, vol. 14, pp. 424-432, 2004.

[6] Sasikumar M and Chenthur Pandian S. "Characteristics Study of ZSI For PMSG Based Wind Energy Conversion Systems". Journal of Electrical Engineering (JEE). ISSN: 1582-4594.