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Design and Implementation of a Rehabilitation Wireless Networked System

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ABSTRACT

Many countries in the world do great efforts to achieve modern medical services to a lot of people; they applied modern network systems, electronic applications and programs to facilitate these issues. This paper will give a modern approach and algorithmic procedure for a rehabilitation system by using the modern aspects, techniques and protocols of the wireless networks. Firstly, an overview about previous works will be introduced then a proposal modern design for this system will be given, test and compare the obtained results with previous ones. A multi stage distributed servers will be used via this new design, this will assist and facilitate the ability of storage and delivering of the monitoring medical data, also checking for errors or damaged frames of data will be occurred at any stage.

1. INTRODUCTION

The Rehabilitation system is a modern medical monitoring system that can be monitored and checked the case of the patients after doing the operation, many of soft computing companies applied modern techniques and issued the software that have contributed to assist the doctors to follow their patients remotely and check their cases.

2. BACKGROUND

The basic architecture of the rehabilitation system can be consisted of medical sensors, personal servers, clinical database, and the main server of the hospital; the medical sensors can be connected with the personal servers by using the IEEE 820.15.4/Zigbee standard [1], while the personal servers can be connected with the main hospital server through the 3G networks. When the patient's data are arrive to the main hospital server, the data are either stored in the clinical data base or viewed from the doctors or the clinician via the hospital LAN, and then the doctors can analyze these data and give the suitable diagnosis advices

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accordingly [1]. Figure 1 shows the system architecture of the conventional rehabilitation system.

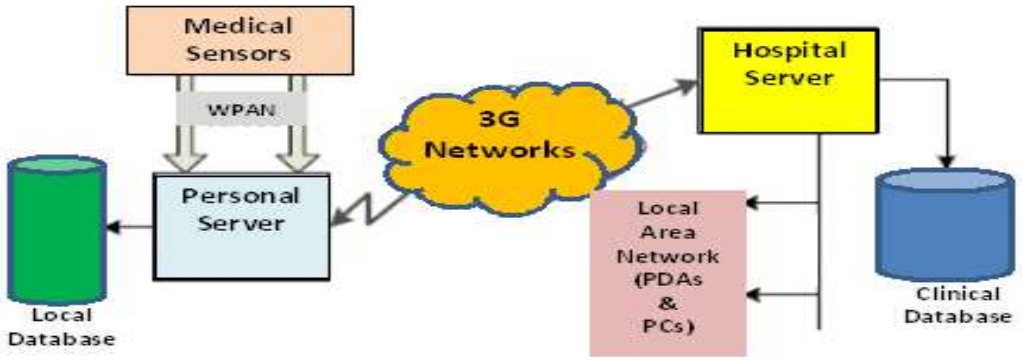

FIGURE 1. The architecture of conventional Rehabilitation system [1]

3. RELATED WORKS

This section surveys previous works in structured of Rehabilitation systems as shown below:

J. Bouchard, B. Prosperi, G. Bavre, M. Daudé, and E. Jeandupeux [2], presented a proposed software that uses a 3D model for representing patient and tool of medicine professionals.

Zhizheng Wu, Feng Li, Wenjun Mi and Jingtao Lei [3], proposed a new approach for Lower Extremity Rehabilitation Robot (LERR), this approach presented a good design for a robust controller for Rehabilitation Robot.

Stucki G, Bickenbach J, Melvin J. [4], presented a good discussion for securing access to functioning data of cases and treatments for Rehabilitation system.

Dirk Nolte, Claudia Tschammler, Markus Henzler, Robert Linsenmann, and Johannes Angermair [5], proposed a two-phase transplantation concept that represents a new surgical ways that ultimately arose from the absence of therapeutic alternatives.

Ovidiu Filip, and Tudor Deaconescu [6], presented a good study and explanations about the Rehabilitation equipment.

The motivation of the proposed work focuses on suggesting a good idea for storing the database of patient's cases and their treatments based on distributed servers concepts, as well as presents a good engine for auto treatments.

The comparison between the related mentioned works and the proposed algorithm is the proposed algorithm can give a new ways for managing and administrating the medical issues, it can present a good way for storing a database with many attributes and entities for patients, cases, diseases, medical treatments, diagnoses, and information about doctors who work inside the hospital, as well as gives an auto engine researching algorithm for finding a suitable doctor for a certain patient's case, and monitors the patients remotely.

THE PROPOSED ARCHITECTURE

The proposed architecture of the Rehabilitation system consists of medical wireless sensors, as well as the distributed servers that can be used as database storages. The patient's data can be encapsulated according to a certain format including the source and destination IP addresses for the patients and doctor respectively. The central router delivers the incoming

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data to their corresponding destinations. The doctor analyzes these data and gives a suitable advice for the patient. Figure 2 shows the design of the proposed system.

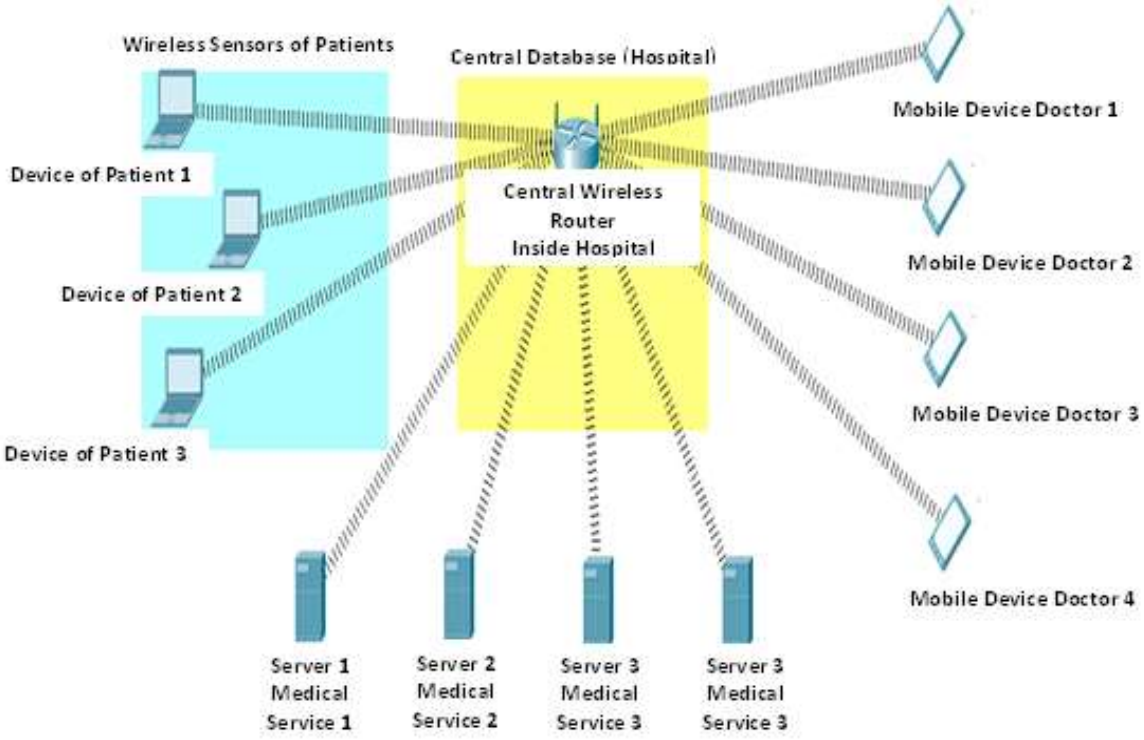

FIGURE2. Design of the proposed architecture of the Rehabilitation system

4. EXPERIMENTAL RESULTS

To test and check the proposed architecture, a prototype design can be applied. This prototype design consists of three patients with different medical cases, the data of these patients are encapsulated to a certain protocol format that contains the source and destination IP addresses, these packets transmitted wirelessly to a central router locates in the hospital's position. This router will deliver these packets according to their corresponding destinations. The doctors will analyze and study the receiving data and give the suitable diagnosis and advices. The distributer servers can be used for storing the copies of all the transferring data including their cases and advices. The proposed system suggests an auto treatment engine, this engine can transmit a suitable advice for an urgent patient's case, and can alert for the dangerous cases. This proposed system can monitor the patients after their medical operation and leaving the hospital, so it monitors the patients remotely by using the aspects of the wireless networked systems, like 3G and 4G mobile techniques. The prototype design can be applied by using the Packet Tracer ver. 3.0 simulator and gave the results as shown in Figure 3, through Figure 8. Figure 3 shows that the sensor that connected to patient 1 is transmitted its data to a smart mobile device of doctor 1.

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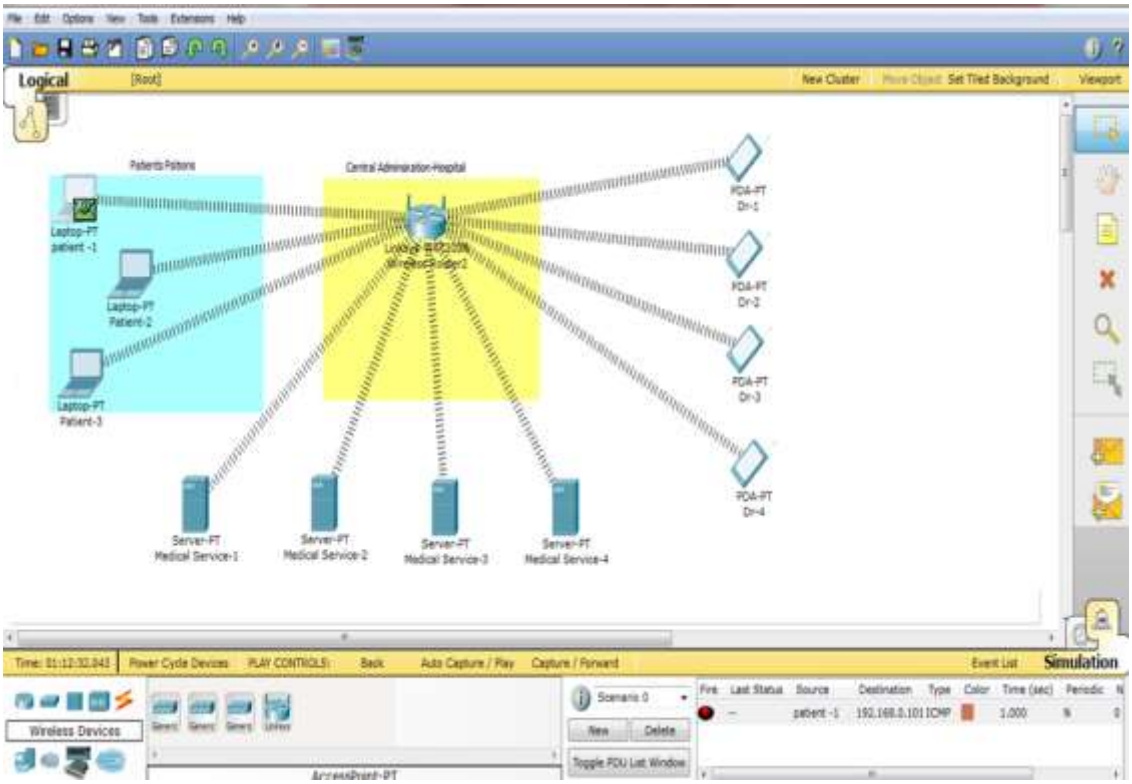

FIGURE 3. Sensor of patient 1 ready to transmit its packet of data to smart mobile device of doctor 1

Figure 4 shows the outbound data format of patient 1 that is transferred to doctor 1

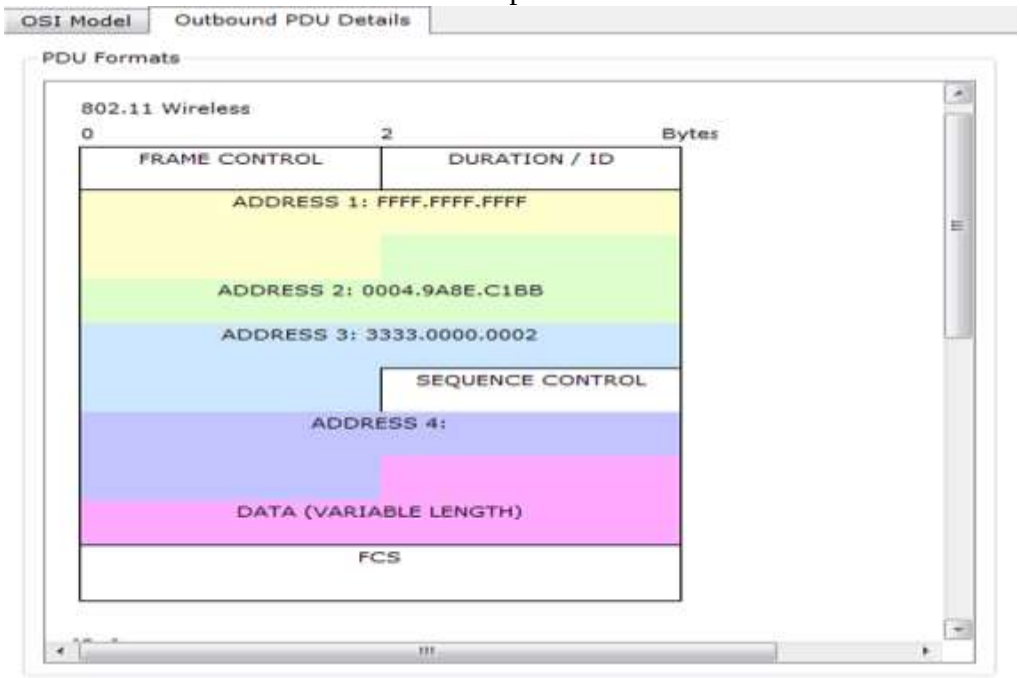

FIGURE 4. Outbound data packet format of patient 1

Figure 5 shows that the data packet of patient 1 are arrived in the central router which is located in a certain position at the hospital

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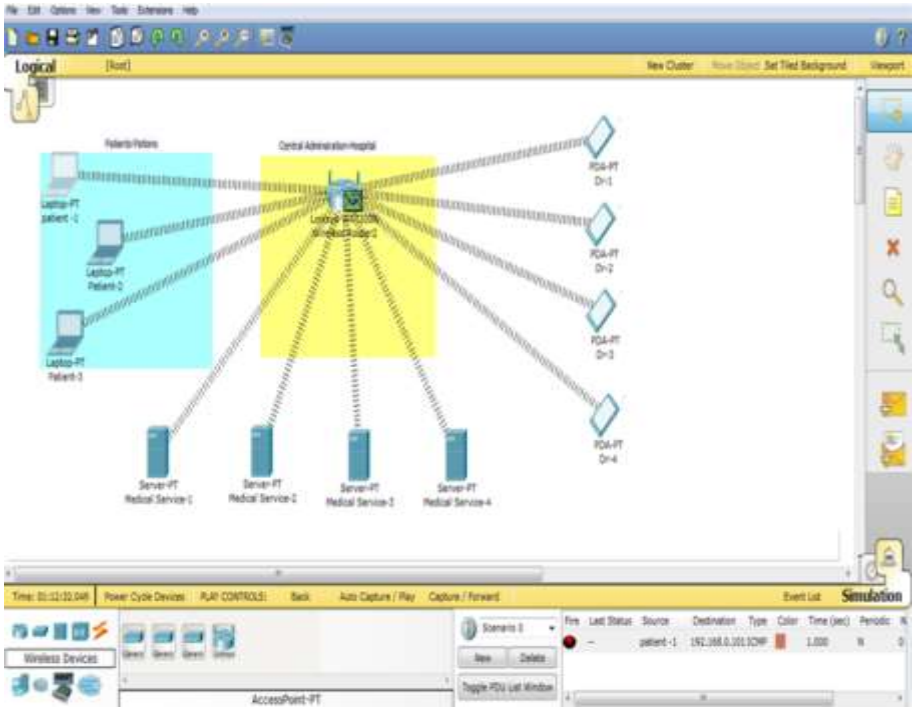

FIGURE 5. Data packet of patient 1 which arrived at the central router

Figure 6 shows the outbound data format for patient 1 when it is arrived at the central router in the hospital; this format includes the addresses of the patient 1 and the doctor 1 respectively.

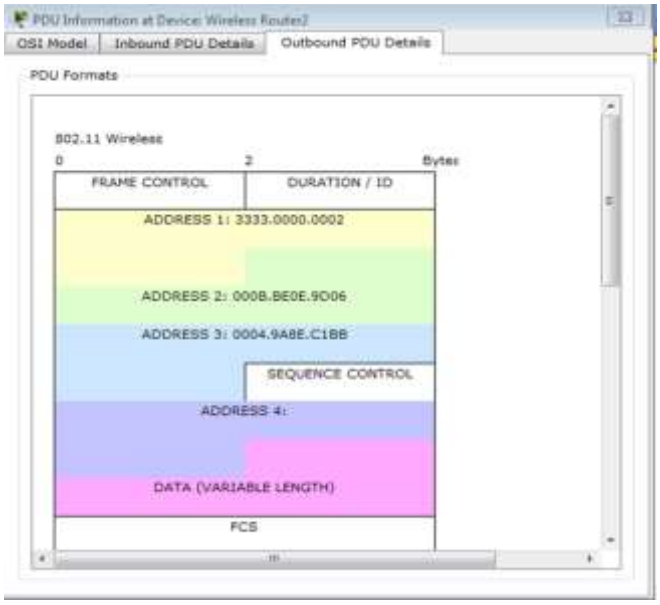

FIGURE 6. Outbound data packet format of patient 1 which arrived at central router

Figure 7 shows the data packet format of patient 1 which arrived at the smart mobile device of doctor 1.

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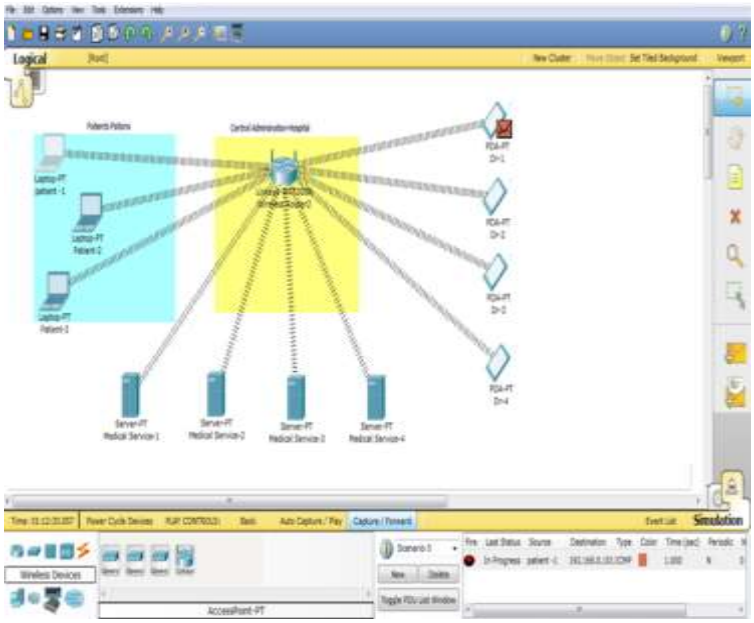

FIGURE 7. Data packet of patient 1 which arrived at the smart mobile device of doctor1

Figure 8 shows the outbound data format for patient1 when it is arrived at the smart mobile device of doctor1.

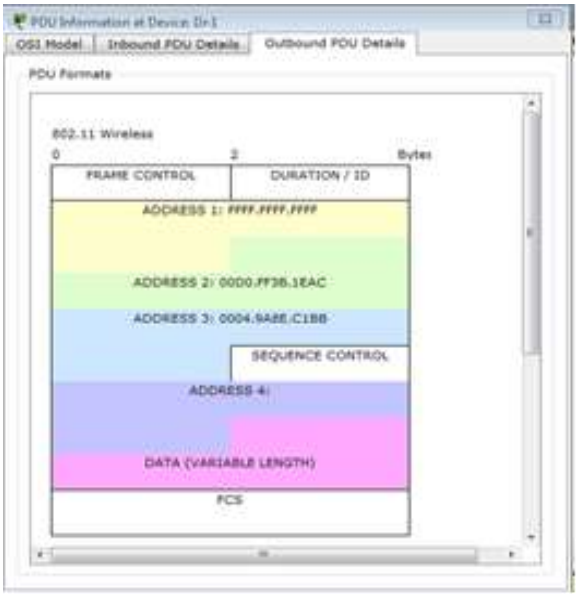

FIGURE 8. Outbound packet format of patient 1 which arrived at the smart mobile device of doctor 1

5. CONCLUSION

The Rehabilitation system can offer many medical services remotely, it is easy for the doctors to check and monitor cases of their patients remotely. The proposed architecture gave good results for that, this system can give additional features like storing data for different patient's cases with their treatments; it also offers a good engine for auto medical treatment

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of urgent cases if there are no responses from corresponding doctors, as well as give auto monitoring for patient's cases. This proposed system can be applied within a certain zone of operation, to exceed this zone for a wide range; the other modern techniques of wireless network system must be adopted like 3G, or 4G networks.

REFERENCES

[1] Rajasekaran.S., Kumaran.P., Premnath.G., and Karthik.M. (2013). ″Human Health Monitoring Using Wireless Sensors Networks (WSN)″. International Journal of Application or Innovation in Engineering & Management, Vol.2, Issue 12, pp. 323-330

[2] J. Bouchard, B. Prosperi, G. Bavre, M. Daudé, and E. Jeandupeux (2013). "A Predictive Rehabilitation Software for Cerebral Palsy Patients″. International Journal of Medical, Health, Biomedical, Bioengineering and Pharmaceutical Engineering, Vol. 7, No. 8, pp. 456-459.

[3] Zhizheng Wu, Feng Li, Wenjun Mi and Jingtao Lei (2014), " Robust Controller Design for the Cooperative Control of Lower Extremity Rehabilitation Robot″. International Journal of Control and Automation, Vol.7, No.4 , pp. 313-328.

[4] Stucki G, Bickenbach J, Melvin J. (2016), "Strengthening Rehabilitation in Health Systems Worldwide by Integrating Information on Functioning in National Health Information Systems", US National Library for Medicine, National Institute for Health.

[5] Dirk Nolte, Claudia Tschammler, Markus Henzler, Robert Linsenmann, and Johannes Angermair (2017), "Two-Phase Transplantation (TPTX) Concept: A New Approach for Instant Rehabilitation of Young Children after Avulsion of Central Incisor", Open Journal of Stomatology, Scientific Research Publishing, 136-146.

[6] Ovidiu Filip, and Tudor Deaconescu (2017), "Finite Element Analysis of Some Pneumatically Actuated Wrist Rehabilitation Equipment", MATEC Web of Conferences 94, published by EDP Sciences.