Review on IoT based Smart Virtual Physiotherapist

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Abstract – *Current pandemic scenario of social distancing, wearing a mask, and staying at home has taught us to adapt to the environment and overcome many challenges in our day-to-day activities. Adhering to the saying "Problems are Opportunities", we have come up with a solution for an activity that requires keen medical attention which is 'Physiotherapy', our project allows patients to exercise at home and doctors to monitor the activity, remotely. The presented model has gyrometers and accelerometers which determine the position of the limb and with the help of a microcontroller, the data is stored in the cloud. Some of the authors have discussed physiotherapy based on a virtual assistant who monitors and corrects the prescribed exercise also… But remote monitoring by Authorized Physicians i.e., Doctors in real-time is the main feature developed by us in this paper.*

Key Words: Physiotherapy, Virtual Physiotherapist, Pandemic, IoT, Cloud.

1.INTRODUCTION

Physiotherapy is also known as Physical therapy, is one of the allied health professions that, by using physical activities treat acute or chronic pain. Physical therapy is used to improve a patient's physical functions through physical examination, diagnosis, prognosis, and physical intervention.

Virtual Physiotherapy is a provision, where patients can do their physical exercises and get them validated by their mentors i.e. Doctors. Here, there is no need of visiting Doctors physically, patients can exercise, and the data collected based on sensor movements is shared with Doctors with which the doctor can provide feedback to patients.

Digital Health Information in India is not readily available, there is a need for a whole infrastructure to be built from scratch, considering the demographics of the Nation. Storing information digitally is beneficial because of its characteristics like duplication, synchronization, compression, accessibility, etc. In this paper, we are doing a bit to support this, patient data is stored online over the cloud. This will help patients to integrate their Medical records in the future.

2. DESIGN METHODOLOGY

The proposed system will have 5 building blocks. 3D accelerometers (2) will record data and send it to the

microcontroller Node-MCU, a Wi-Fi-enabled microcontroller later the data is pushed to the cloud. As the project is a wearable device there will be a Li-ion battery to supply current to the board, which can be charged via a micro-USB charger.
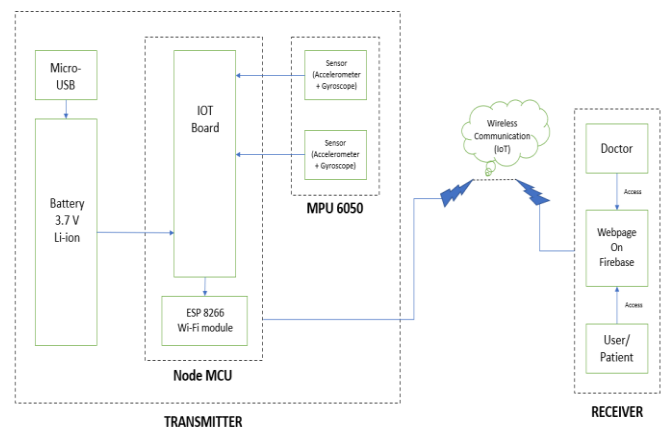

Fig (a): Block Diagram

3. LITERATURE SURVEY

"Virtual Human Physiotherapist framework for Personalized Training and Rehabilitation"

In this paper, a Virtual Human Physiotherapist (Diana) is equipped with all pre-programmed training. Patients can perform the exercise by mimicking the animation character throughout the exercise. There will be sensors which patients will wear on their limbs, the posture movement is captured in 3D using sensors and ultimately monitored by the character, there are some preset values for each exercise if the patient does not perform the exercise correctly i.e., the sensor fails to record the preset values then the assistant will notify and educate the right way of exercise to the patient. In this paper we do not rely on a virtual assistant rather we directly interact with Authorized Physicians for better monitoring and guidance in real-time. Also, exercises are not pre-defined hence there is no limitation and the patient can perform n number of exercises using this.

"Home-based virtual reality training after discharge from hospital-based stroke rehabilitation: a parallel randomized feasibility trial"

In this paper, Virtual Reality Training (VRT) is provided to the patient with an interactive game using computer software

to track their movements. This is mainly used for the Rehabilitation of arm, balance and, walking post-stroke. This is convenient, enjoyable and, timely. Its primary objective is to measure the feasibility of using VRT at Home post-stroke. VRT has been shown to benefit standing balance, overall function in the sub-acute and chronic phase of post-stroke. Since this is a home-based exercise, the patient need not visit the doctor frequently, they can exercise with the game and, later can visit the doctor for casual feedback on progress. In this paper we understand the need of the doctor to say if a patient is not doing the exercise properly or not doing the exercise at all then the doctor can intervene and educate the patient appropriately, also if the doctor is busy during the session he can later examine the data and provide his feedback accordingly.

"IoT Based Virtual Reality Game for Physio-therapeutic Patients."

Physical therapy is a big part of rehabilitation, but nobody wants to do exercises. The motive of this training is to improve muscle strength and also facilitate the fast recovery of injured body parts. Traditional physiotherapy provides pain relief, various stretching, strengthening exercises, and aerobic training. In the last few years, Virtual Reality (VR) has begun to be used as a complementary tool in rehabilitation as a new form of interactive play. In recent years, researchers have focused on exercise games or active video games using VR in clinical practice. With fun, VR also became a driver in the world of rehab. On the other side, the Internet-of-Things (IoT) is a network in which electronic devices, sensors, software, and connections are placed. This network consists of physical elements (devices), tools, home appliances, and other items that allow objects to collate and modify data. However, VR and IoT share the same objective and principle to bridge the digital and physical domain, regardless of the contradicting approaches of the activity. VR is about producing the digital domain look with the use of physical wearable devices. On the contrary, IoT is about making actual physical elements usable in the digital domain.

4. DISCUSSION

In 1st research paper, the author has discussed a Virtual Human Physiotherapist (Diana) a pre-programmed computer-based trainer who will monitor and correct the exercise of the patient using 3D sensors on their limbs.

In 2nd research paper, the author has discussed Virtual Reality Training (VRT) a computer-based game that is user-friendly and playful for post-stroke patients for rehabilitation of arm movements, balance and, walking.

In 3rd research paper, the author suggested using Virtual Reality (VR) as a technology to help people who are suffering from physical ailments. Here using a combination of physical wearables and visual graphics one can perform physical exercise and get well. Here the exercise is incorporated with gaming activity, where the rehab process will be a fun activity.

In this paper, our primary focus is to get the exercise monitored by a Doctor. Expertise is very much required in this critical stage. A GUI is presented to both for a better understanding of the movement of limbs. The data is stored over the cloud, hence can be archived and accessible from anywhere around the globe.

5. CONCLUSION

This paper reviews the criticality of the rehabilitation post any injury/ accident. Monitoring and Control are required frequently to avoid any permanent damage to the body part. A doctor regularly monitors the activity of the patient and provides feedback, in other papers we saw the exercise were pre-loaded into the computer-based applications, here the doctor has the liberty to change or tailor any exercise based on the condition of the patient. Historical data helps the doctor to examine the patient more accurately. In the future, other health sensors can be added to check the temperature of the body, SPO2 (oxygen level), Heart rate, etc.

6. ADVANTAGES

- Patient need not visit the doctor daily for physiotherapy in this pandemic situation, hence also helps in reducing the spread of COVID.
- The data is stored over the cloud, hence tracking and mentoring are easy.
- The patient has access to current and historical data over the cloud, which empowers him to consult another doctor if required.
- With the help of GUI, the patient can also learn and provide feedback to the doctor.

7. APPLICATION

IoT is the basic need of day-to-day life to make the journey easier and happy these are used in a smart system which is useful for the smart system, as a smart virtual physiotherapist.

The proposed system will be useful in the following applications:

- Virtual physiotherapist.
- Virtual gym trainer.
- Dance Instructor.
- In general, we can connect it to any body part whose position/ posture is to be monitored remotely.

8. ACKNOWLEDGEMENT

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