VIRTUAL PHYSIOTHERAPY

Presented By
PRATIK MAHAJAN

Abstract :

Physical therapy (PT), also known as physiotherapy, is one of the associated health professions that aims at remediating impairments and promoting mobility and function by using mechanical force and movements, manual therapy,exercise therapy, and electro therapy. The success of physiotherapy treatment depends on whether the recommended exercises are being done in proper way. Hence, the treatment may not be successful due to patient's noncompliance with the prescribed exercises. Analysis of human posture has many applications in the field of sports and medical science including patient monitoring, lifestyle analysis, elderly care etc. Many of the works in this area have been based on computer vision techniques. These are limited in providing real-time solution.Thus, Machine Learning based solution are being planned and used for the human posture recognition and detection. It is not easy for novice people to find the incorrect parts of their specialized exercises by themselves.
In this report, i propose a Physiotherapy exercise assessment system using pose detection to help the self-learning of Physiotherapy Exercises. The system first detects a Physiotherapy exercise using multi parts detection only with PC camera. Then the user will be assessed and will be checked weather the exercise he is performing is correct or not. After the session is over a report will be generated about the accuracy, sets and reps of the exercise performed by the user. Now this report can be used to consult the doctor for the further treatment .

1) Problem Statement :

The problem statement is the need for virtual physiotherapy arises due to the limitations and challenges faced by individuals in accessing traditional in-person physiotherapy services. There is a growing demand for a flexible and convenient alternative that provides effective rehabilitation and support remotely. The current problem revolves around the following aspects:
The need for virtual physiotherapy assistance arises from limited access in remote areas, time and cost constraints of frequent clinic visits, challenges posed by the COVID-19 pandemic, limited availability of post-operative services, difficulties faced by the elderly and disabled populations, the requirement for continuous monitoring and progress tracking, inaccessibility to specialized services, lack of convenience and flexibility, and the need for an alternative solution that provides comprehensive care remotely.

2) Market/Customer/Business need Assessment :

The market/customer/business need assessment for virtual physiotherapy reveals a strong market demand for accessible healthcare options, particularly in remote or underserved areas. Customers value the convenience and flexibility of receiving physiotherapy treatment from their homes or workplaces, while also benefiting from cost savings compared to traditional in-person visits. Virtual physiotherapy ensures continuity of care, even during situations like lockdown or travel restrictions. It offers a convenient solution for post-operative rehabilitation, eliminating the need for physical travel to clinics. Additionally, virtual physiotherapy addresses the accessibility challenges faced by the elderly and disabled populations.

3) Target Specification and Characterization :

It's important to note that the appropriateness of virtual physiotherapy for specific individuals may vary based on their condition, treatment requirements, and the professional judgment of healthcare providers.
The most appropriate target customers for virtual physiotherapy assistance include individuals in remote or underserved areas, busy professionals, elderly individuals, individuals with disabilities, post-operative patients, individuals seeking convenience and flexibility, and tech-

savvy individuals. Virtual physiotherapy provides much-needed access to rehabilitation services for those in geographically isolated or underserved areas. It accommodates the busy schedules of professionals, allowing them to receive treatment from their homes or workplaces. The elderly and individuals with disabilities benefit from the accessibility and personalized care offered by virtual physiotherapy. Post-operative patients can conveniently access specialized rehabilitation services without physical travel. Those seeking convenience and flexibility appreciate the ability to schedule sessions according to their availability. Tech-savvy individuals embrace the digital solutions provided by virtual physiotherapy. These target customers find virtual physiotherapy to be a valuable and convenient alternative to traditional in-person sessions, addressing their specific needs and preferences.

4) External Search :

- Why there is need of Virtual Physiotherapy
- Benefits of Virtual Physiotherapy
- Is it as effective as in-person treatment ?

The resources I referred online are the articles that are listed above as a reference to gain more insight in this business idea that why virtual Physiotherapy is needed and its benefits and is it as effective as in-person treatment.
This search helped me a lot to understand about the physiotherapy exercises and why the accuracy of this exercise matter the most when it comes to effectiveness of same for our body. This research also gave me an good idea about why this can be the good business idea. As the pandemic is over people are more bound to enjoy things from home and digitalization and advancement in the technology has played an important part in it. Why to waste your time waiting for your physiotherapist to arrive at his given time when you can get assisted at your pace , at your convenient time and place in much affordable cost.

5) Benchmarking :

This section contents the information about the existing services for Virtual Physiotherapy
One them is PORTL which was introduced in the current season of Shark Tank.
This is not completely the same idea about Virtual Physiotherapy but instead it is a smart home work out system which consist of a mirror which helps in working out by various means. I am very much inspired by the idea that a physiotherapy can be provided at home with same means as PORTL.

- PORTL

6) Applicable Patents :

- Virtal Environment for Physiotherapy
- Virtual Physical Therapy

There are many patents that can be found on the Google Patents about the same topic or at least relatable to to the topic but this two patents are more suitable and relatable to the actual problem and business implementation that I am trying to convey in this report.
The first patent describes a method of enhancing physical therapy sessions through the integration of a virtual reality component, monitoring sensors, and a brain-computer interface.

This technique is aimed at improving the treatment of patients with movement limitations or pain-related conditions. By utilizing sensors, the patient's movements can be accurately tracked and analyzed in real-time, providing valuable data for the therapy session. The virtual reality environment offers an immersive and interactive experience for the patient, allowing them to visualize their movements in a virtual setting. Additionally, the brain-computer interface enables the patient to control and interact with the virtual environment using their brain signals. Overall, this patent presents an innovative approach to physical therapy by combining advanced technologies to enhance the effectiveness and engagement of therapy sessions.

The second patent describes a virtualized physiotherapy system that employs a method, system, and computer program product. This system aims to enhance physical therapy sessions for patients. The method begins with initializing the virtualized physical therapy system for a specific patient and selecting appropriate actions to be performed during the therapy session. As the patient carries out these selected actions, the system recognizes their performance and displays a virtual representation of the actions. Throughout the session, the system continuously monitors the patient using the virtualized physiotherapy system, collecting relevant data. This monitoring data is then used to update one or more patient models. Finally, based on these patient models and monitoring data, a session evaluation report is generated, providing valuable insights into the effectiveness and progress of the physiotherapy session. This patent introduces an innovative approach to virtualized physiotherapy, utilizing technology to optimize patient monitoring and evaluation during therapy sessions.

7) Applicable Constraints :

- Data collection from patients
- Technical Infrastructure: One constraint is ensuring that the required technical infrastructure, including hardware and software, is accessible, reliable, and compatible with the virtual physiotherapy setup.
- Internet Connectivity: Reliable and high-speed internet connectivity is crucial for seamless virtual physiotherapy sessions.
- Patient Engagement and Motivation: Virtual physiotherapy sessions lack the immediate physical presence and direct guidance of a therapist.
- Physical Space and Equipment Limitations: Patients may have limited physical space at home, which can constrain the execution of certain physiotherapy exercises.

8) Applicable Regulation :

- Data Privacy and Protection
- Informed Consent
- Medical Device Regulations

9) Business Opportunity :

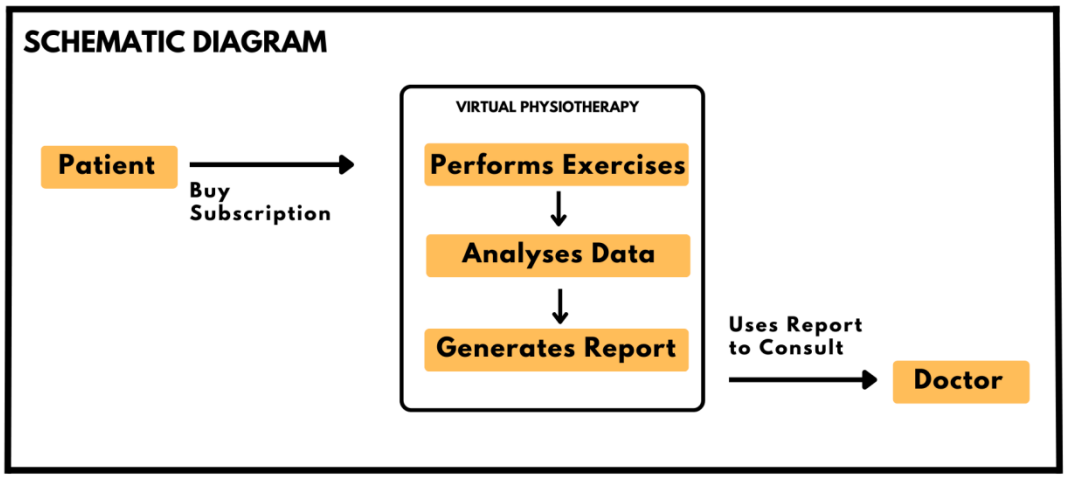
Since the the discussed service and technology is not that actively used and yes there are similar ideas in the market but are not the exact same the area of expertise is different which is the case of PORTL.So there is a great chance of this service being a very great opportunity.
There is a major community who would be interested in this service because of its cheaper rates than actual in person Physiotherapist and as it could be very time efficient to working and old age people.

10) Concept Generation :

The service which we will be providing will need the an Machine Learning model which will be trained using COCO data set. COCO data sets contains images of different categories which will help to train this model which would then identify the exercises and would help the user to do it with proper accuracy of that exercise. We can try to increase the accuracy of the model by always training it recent data of the user. This will make sure that the exercise are always updated and the user gets the proper experience.

11) Final Product Prototype :

The final product will be a service that will provide virtual assistance with physiotherapy to the patient and according to the patients performance a report will be generated. The report will contain all the information like Name of the patient, age , exercise that patient performed , amount of time that patient took to complete given exercise , how many sets and reps he performed. According to this features that would be gathered, a graph would be generated which can be very useful to track patients consistency and improvement. The same report can be used to consult with the doctor for further treatment as doctor would have an clear idea about patients progress.



The Schematic diagram shows the flow of service. The service can be monetized through giving subscriptions to the users.
Further the data collected by the product can be used to analyze and create more suitable and developed service for the users. This will give user more suitable and easy to use environment.

A) Feasibility

The feasibility of virtual physiotherapy is under evaluation for integration into modern healthcare systems. This method allows patients to receive personalized exercises and guidance remotely, promising improved accessibility and convenience. However, challenges including technology literacy, hands-on limitations, and data security require resolution. As ongoing research and telehealth advancements progress, a clearer timeframe for the full development and integration of this service within physiotherapy practices will become evident. While an exact duration cannot be pinpointed, steady efforts in the coming years are essential for realizing the potential of virtual physiotherapy on a wider scale.

B) Viability

The long-term viability of virtual physiotherapy is anchored in its potential to transcend temporal barriers. By harnessing digital platforms for remote sessions, it offers patients personalized rehabilitation, bridging geographical gaps and addressing accessibility challenges. For sustained relevance over the next 20 to 30 years, it must evolve with technological advancements, ensuring seamless user experience, data privacy, and integration with emerging healthcare paradigms. This adaptability and commitment to patient-centric care positions virtual physiotherapy as a durable solution in the evolving landscape of healthcare services.

C) Monetization

Virtual physiotherapy presents direct monetization avenues through subscription models, pay-per-session options, and tiered service packages. Patients can choose plans based on their needs, granting access to personalized exercises, virtual consultations, and progress tracking. Additionally, partnerships with insurance providers and healthcare networks can facilitate reimbursement, incentivizing widespread adoption. With clear pricing structures and value-driven offerings, virtual physiotherapy holds the potential for sustainable revenue generation while extending affordable and accessible care to a wider audience.

Step 3: Business Modeling

1. Pricing Tiers:

Offer multiple subscription tiers to cater to different needs and budgets. Each tier could provide varying levels of access and features, allowing customers to choose the plan that best suits them.

2. Basic Subscription:

Personalized Exercise Plans: Tailored workout routines based on individual conditions and goals.
Progress Tracking: Tools to monitor improvements and set milestones.
Access to Pre-recorded Content: Library of instructional videos for exercises and self-care.

3. Premium Subscription:

All Basic features
Virtual Consultations: Scheduled video sessions with experienced physiotherapists for guidance and adjustments.
Dedicated Support: Chat or email support for inquiries and assistance.
Advanced Progress Analytics: In-depth tracking and analysis of progress over time.

4. Pro Subscription:

All Premium features
Unlimited Virtual Consultations: Increased frequency of virtual sessions for more intensive support.
Customized Plans: Bespoke exercise routines and treatment plans adjusted as needed.
Priority Support: Dedicated customer service for prompt issue resolution.

5. Monthly and Annual Billing:
Offer flexibility with both monthly and annual subscription options. Annual subscribers could enjoy a discount compared to the total monthly cost.

6. Free Trial Period:
Provide a limited-time free trial period (e.g., 7 days) for potential subscribers to experience the service's value before committing.

7. Specialized Plans:
Introduce specialized plans for specific conditions or demographics, such as "Senior Wellness" or "Post-Injury Recovery," to cater to different target audiences.

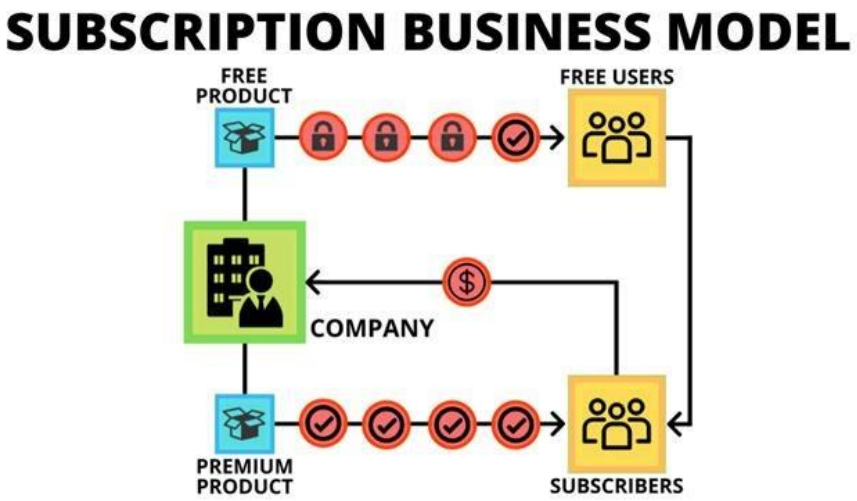
8. Content Updates:
Regularly update the library of pre-recorded content and exercises to keep subscribers engaged and motivated.

9. User-Friendly Platform:
Invest in a user-friendly app or website interface that allows subscribers to easily access their exercise routines, track progress, schedule virtual sessions, and communicate with physiotherapists.

10. Data Privacy:
Ensure rigorous data security measures to protect user information and maintain trust.

11. Marketing and Promotions:
Promote the subscription model through targeted online advertising, social media, collaborations with fitness influencers, and partnerships with healthcare providers.

12. Customer Feedback and Improvement:
Regularly gather feedback from subscribers to enhance the service, address pain points, and introduce new features.



Step 4: Financial Modelling

For an exponentially growing market trend, the financial model equation can be represented as:

Equation :

y = m*x(t)*e^(kt)+c

Total Profit (y) = Pricing of Subscription (m) × Total Sales (x(t)) × e^(kt) + Fixed Costs (c)

Where:
y: Total Profit
m: Pricing of the Virtual Physiotherapy Service
x(t): Total Sales (Market as a function of time)
e: The base of the natural logarithm (approximately 2.71828)
k: Growth rate constant
t: Time period
c: Fixed Costs including production, maintenance, operational expenses

Let us suppose if the user buys subscription of Rs.499 and and company did 50 sales and base price that is fixed cost is 50 for each subscription to keep services active.Let us assume the time period to be of 2 years and growth rate constant is 40% that is 0.04.
Then the profit that company will make will be

y = 499*50*e^(0.04*2)+50
y = 27,078.012

So the company will be making profit of Rs.27,078 for 50 sales in 2 years with 40% of growth rate .
Again with increase in the no of sales the net profit will also increase.

12) Conclusion :

So to conclude my report with each passing day advancement in technology moves one step further and in this era of advancements I would like to take a step further and implement my idea of Virtual Physiotherapy. Through thorough research and information available online the idea of virtual assistance in fitness industry through implementing AI seems very brilliant and can be implemented with proper guidance and technological knowledge.
This report does not contain the complete plan to implement this idea but with proper guidance and technical help with considerable amount of work and efforts, the idea can become reality and can be achieved.