REMOTE HEALTHCARE TECHNIQUES

JV'n KIRAN MEENA (JV-U/20/4490), *JV'n TINA SHARMA* (JV-U/20/4126)
JV'n RUPALI MAKWANA (JV-U/20/4299), *JV'n CHHABI JADON* (JV-U/20/4130)
MENTOR: - *JV'n Ms. NANDITA*, Assistant Professor
DEPARTMENT OF MEDICAL LABORATORY TECHNOLOGY

FACULTY OF PHYSIOTHERAPY AND DIAGNOSTICS

JAYOTI VIDYAPEETH WOMEN'S UNIVERSITY, Jaipur
E-mails : kiranmeena12052002@gmail.com | tinasharmabmlt@gmail.com
rupalimakwana56@gmail.com | chhabijadon102@gmail.com

ABSTRACT :

Life expectancy in most countries has been increasing continually over the several few decades thanks to significant improvements in medicine, public health, as well as personal and environmental hygiene. However, increased life expectancy combined with falling birth rates are expected to engender a large aging demographic in the near future that would impose significant burdens on the socio-economic structure of these countries. Therefore, it is essential to develop cost-effective, easy-to-use systems for the sake of elderly healthcare and well-being. In this paper, we have presented and compared several low-cost and non-invasive health and activity monitoring systems. A textile-based sensors that can potentially be used in wearable systems is also presented However, there is much more to come, and the future of healthcare technology is still in its early stages. Many great wearable healthcare monitoring devices on the market allow users to measure healthcare data accurately. The Apple Watch is known to be the most advanced smart watch on the market, but other brands are close behind. New and innovative technology is reaching new heights and allowing users to perfect their practices while monitoring their health. Wearable healthcare technology is in the beginning stages of development, and there are lots to come in the future for new and existing brands alike.

Finally, compatibility of several communication technologies as well as future perspectives and research challenges in remote monitoring systems will be discussed. We have presented a state-of-the-art survey on physiological parameters and activity monitoring systems developed in a wearable platform. The primary purpose of a wearable health monitoring system is to allow people to lead independent and active lives in their familiar home environment while ensuring continuous, non-invasive, non-intrusive, and seamless surveillance of their health and physical well-being. The enormous development of technology in the past few decades leads to manufacturing and use of miniature, low-power, low-cost sensors, actuators, electronic components, and powerful computers that paves the way to non-invasive, non-intrusive, and continuous monitoring of an individual's health condition at a very low-cost. Online presence is known to greatly benefit any business; this does not exclude medical professionals and clinics. Benefits include exposure for your practice, the ability to provide helpful information to your patients, and finally, providing convenience and time-efficiency to your patients' experience with you. Concern for the wearable healthcare system is associated with the

privacy and security of the sensitive medical information of the user. More efforts are needed in order to develop algorithms to ensure highly secured communication channels in existing low power, short range wireless platforms. We have also presented a brief review on textile-based sensors highlighting their applications in sensing physiological signs..

KEY WORDS :- Wearable sensors; Smart textile; Remote health monitoring; Body sensor network, Professional, Doctors, Rural Health, Patients, Physicians, Transportation, Vital sign monitoring; Ambulatory monitoring, healthcare, Professional, Wellness , Covid-19, Heart Rate, Smart watches.

INTRODUCTION :

More than two-thirds of Indians live in villages, but the healthcare facilities in these areas are yet to show the progress seen in urban areas. The analysis of the data available with the Ministry of Health and Family Welfare tells us that things are way worse than they used to be 17 years ago, in 2005. One of the biggest healthcare challenges rural residents face is the lack of reliable transportation. Residents in rural areas typically have to travel significantly farther distances to visit their primary care doctor or specialist. Many rural areas lack public transportation, thus patients must resort to their own means to attend doctor visits and checkups offered a remote appointment if your healthcare provider does not need to do a physical examination at this stage. Patients in rural areas have higher rates of diabetes, heart disease, and cancer but also receive bad quality of reports. Remote patient monitoring uses biomedical devices that patients use at their homes or other settings outside of a clinical setting to gather disease-specific metrics. A remote server receives patient readings from remote monitoring systems, stores them for later analysis by medical professionals, and then transmits the data back to the patient. The readings can be used in a variety of ways by home health agencies, clinicians, doctors, and informal care providers once they are made available on the server. In the future, remote healthcare techniques are likely to play an increasingly significant role in healthcare delivery. Here are some potential aspects and advancements we may see in the future. Remote Monitoring Devices, Artificial Intelligence (AI) in Diagnostics, Remote Surgeries and Robotic-Assisted Procedures, Virtual Reality (VR) for Rehabilitation, Improved Access to Healthcare .Remote healthcare techniques, also known as tele health or tele medicine, refer to the provision of medical services and healthcare remotely through the use of technology. There are several benefits associated with remote healthcare techniques: Improved access to healthcare, Convenience and flexibility, Reduced healthcare costs, Continuity of care, increased patient engagement and empowerment.

REVIEW OF LITERATURE :

The new techniques which are nowadays, rising very fast according to new community developments out of them few are mentioned as per the following:-

Sharing photos or videos

You may be asked to share a photo or video. Remote health monitoring, based on non-invasive and wearable sensors, actuators and modern communication and information technologies, offers an efficient and cost-effective solution that allows older people to continue living in their comfortable home environment rather than in expensive care facilities. These systems also allow healthcare personnel to monitor the main physiological symptoms of their patients in real time, assess health status

and provide feedback from remote facilities. Remote care monitoring allows people to stay at home instead of expensive care facilities such as hospitals or nursing homes. It therefore offers an efficient and cost-effective alternative to on-site clinical monitoring. Such systems, equipped with wearable non-invasive sensors, can be useful diagnostic tools for healthcare workers to monitor key physiological signs and patient activities in real time from a remote facility. Remote sensing technology involves monitoring things or objects without direct contact. The healthcare industry uses a variety of tools to ensure that data is corrected in a timely manner. Digital tools impact all areas of health. This includes remote advice and home monitoring as well as wearable devices and health apps. Here are some examples of how the technology is being used in the healthcare industry: Healthcare and wellness are consistently among the most promising use cases for screen sharing, video conferencing and real-time collaboration technologies. Connect patients and caregivers regardless of their respective locations through high-quality audio and video links. Additionally, the demand for tele health has increased dramatically since 2010 as hospitals and physician offices have sought to expand their reach and make patients' lives easier.

Video calls for consultations

You will receive an email or text message from your healthcare provider if you have a video appointment scheduled. This will confirm a date and time for the appointment and how you can access the video call. You may access your appointment on your smart phone, tablet or computer. You will only be video of your condition or specific symptoms before you speak with a healthcare professional. You will be sent an overview of how to do this by your healthcare provider. Photos and videos are usually sent through text messages, emails or secure uploads to an online platform. This will help your healthcare professional to understand more about your condition. Your healthcare professional can also share files or videos with you. Connecting with a provider via screen share has been a breakthrough for patients who are located very far from the nearest provider or are otherwise limited in their access, for instance because of an epidemic that makes in-person trips inadvisable. A screen share can add important context to these meetings. A physician might use the screen sharing functionality of the meeting software to show a patient a list of steps to take for their condition, like medication options A similar workflow can also improve internal collaboration for providers such as hospital systems. More specifically, assets like X-rays and biopsy results may be screen shared via special internet-connected medical equipment, so that teams can make informed decisions without having to coordinate their schedules for in-person meetings

Virtual wards and home monitoring

Virtual wards are a care model that aims to provide hospital-level care to patients in their own homes or in community settings. Instead of being admitted to a physical hospital ward, patients are monitored remotely by a multidisciplinary healthcare team. The team may include doctors, nurses, pharmacists, and other healthcare professionals who collaborate to assess, monitor, and treat patients from a distance. The goal is to provide timely and appropriate care to patients who would otherwise require hospitalization. Home monitoring involves the use of technology to remotely track and monitor patients' health conditions from their own homes. Patients use various devices, such as wearable sensors, mobile

apps, or connected medical devices, to collect and transmit their health data to healthcare providers for analysis. This data may include vital signs, symptoms, medication adherence, or other relevant health information. Advantages of Virtual Wards: Patients can receive care in the comfort of their own homes, which can enhance their overall experience and quality of life. By providing close monitoring and proactive interventions, virtual wards can help prevent unnecessary hospital admissions and reduce the strain on hospital resources. Virtual wards can potentially lower healthcare costs by reducing the length of hospital stays and avoiding costly hospital admissions, Continuous monitoring and regular communication between healthcare providers and patients can help detect and address any changes in the patient's condition promptly, Virtual wards optimize the utilization of healthcare resources by directing them to patients who need intensive monitoring and care, while freeing up hospital beds for patients with more acute conditions. Advantages of Home Monitoring: Home monitoring enables healthcare providers to detect changes or abnormalities in patients' health status early on, allowing for timely interventions and preventing potential complications. Patients actively participate in their own care by regularly monitoring their health parameters and being more aware of their condition. Home monitoring eliminates the need for frequent hospital or clinic visits, making healthcare more accessible for patients, particularly those with mobility challenges or living in remote areas. Healthcare providers can customize treatment plans based on individual patient data, leading to more tailored and effective care. Chronic Home monitoring is particularly valuable for patients with chronic conditions who require ongoing monitoring and management. It empowers patients to take control of their health and promotes self-management. Both virtual wards and home monitoring contribute to the shift towards patient-centered care, remote healthcare delivery, and proactive management of health conditions. These approaches have the potential to improve patient outcomes, enhance convenience, and optimize the utilization of healthcare resources. In some circumstances, people can be discharged from hospital and monitored at home. A good example of this was during the COVID-19 pandemic. As hospital beds were in high demand, people who had more stable symptoms were able to go home. They continued receiving oxygen, and their symptoms and oxygen levels were monitored remotely by consultants. The aim of the models was to maintain patients safe in the right setting. Most models were led by secondary care and confirmation of COVID-19 was not required (in most cases). Monitoring was carried via online platforms, paper-based systems with telephone calls or (less frequently) through wearable sensors. Models based on phone calls were considered more inclusive. Patient-care training was identified as a determining factor of success.

Online rehabilitation and activity sessions

If you have been advised to take part in activity sessions or rehabilitation to help manage your symptoms or recovery from illness, this could be via an online class or tutorial. Classes may be delivered via video sessions where many people join and take part live. online presence is known to greatly benefit any business; this does not exclude medical professionals and clinics. Benefits include exposure for your practice, the ability to provide helpful information to your patients, and finally, providing convenience and time-efficiency to your patients' experience with you. Physicians and doctors can delegate appointments that are more suited to Virtual Care, to optimize time spent on each patient. Not all patients require a physical visit, which is resource-intensive. This way, the doctor's capacity to consult a set

number of patients in a day increases, while the stress and time investment is reduced. Doctors can manage their schedules more flexibly rather than having to adhere to a strict schedule at the clinic. A Telemedicine session is very similar to a video call. It's easier for the patient as well, to be available at a flexible time to consult the doctor. It helps the doctors to manage their calendars with lesser burnout.

Wearable devices

Devices that you can wear, such as smart watches, can help track a range of measurements about your body. This includes heart rate, stress levels, sleep patterns, oxygen levels and activity levels. These devices are usually connected to an app on your smart phone or tablet. An app - short for 'application' - is a program that you can install on your smart phone or tablet. These systems are not usually directly connected to your healthcare provider. But it can be useful information for you to have during a consultation with your healthcare professional. wearable healthcare technology has grown in popularity over the last few years. With advancements in biosensor technology and accuracy, smaller battery sizes, and increased performance, wearable medical technology can provide users with accurate healthcare data that keeps them in charge of their own healthcare. Wearable healthcare technology refers to health monitoring devices worn on the body, such as the wrist, to help monitor the wearer's health data. These devices use biosensors to collect different data from the patient, such as heart rate, blood pressure, sleep patterns, and activity. Over the years, wearable medical devices have become increasingly popular due to the advancements in sensor technology and the ability to make sensors and batteries very small. Wearable medical technology is used for various reasons and can accurately monitor fitness, heart rate, general wellness, and disease management. They can also provide medication reminders and store patient health information. Wearable devices are popularly used to monitor health. These devices can easily track heart rate, calories burned, step counts, blood pressure, the release of biochemical, exercise time, and physical strain. A myriad of technologies related to artificial intelligence and the internet of things enables the ability to implant breasts, monitor infants, and develop smart shoes and socks. Wearable devices show meaningful insights to live our lives comfortably. They are valuable to monitor physical health and physical training along with alerting to severe medical conditions. Wearable devices are soon expected to forecast changes in health, mood, and stress as well as measure blood alcohol content, athletic performance, heart condition, and age-related diseases.

Health apps

There are many apps available to help track your health. Some include information on how to manage your condition. Others remind you to take your medication or let you track recordings from a medical device. Most apps are available to download for better results . If your healthcare provider wants to receive readings from your medical device, they will discuss this with you. They can tell you which app or platform you need to use as it will need to be connected to a hospital system. With the rise of smart phones, tablets, and wearables, healthcare apps have become part of the day-to-day for most people. Using data retrieved from patients, medical apps are now more knowledgeable, accurate, and up-to-date than doctors have been in the past. It only makes sense that medical professionals take advantage of the available information to provide better service to patients. Some apps designed for medical professionals make it easier to access patient logs, improve management workflows, and communicate

between team members and patients. Other apps use more complex tools like Artificial Intelligence to detect diseases, develop new medicines, plan and even assist during surgeries. Wearable technology incentivizes behavior that reduces hospital visits and readmissions due to poorly managed personal health 75% of users agree that wearables help them keep track of their health.

METHODS OF REMOTE HEALTH CARE :

BLOOD PRESSURE MONITORS:- The monitor is placed on the right or left arm and accurately provides the user with a blood pressure reading right to their phone. The at-home blood pressure cuff is still the most accurate device on the market, and the Quardioram Blood Pressure Monitor cuff can connect to a smart phone to store blood pressure and pulse data.

GLUCOSE METERS:- This advanced blood glucose reading device is known to be the best on the market for diabetic glucose monitoring. It offers a device placed on the upper arm and uses a phone sensor to measure the reading from the device. This device is ideal because it lessens the need for patients to "prick" their fingers, as the device can be used for up to seven days at a time.

ECG MONITORS:- Apple technology is always ahead of the competition. The Apple Watch is the only wearable device to detect abnormal heart rhythms and accurately provide ECG readings. However, although the Apple Watch technology is advanced, it cannot detect heart attacks, blood clots, strokes, or other heart-related conditions, such as congestive heart failure.

FITNESS TRACKERS:- This smart watch is known to be one of the most accurate and easiest-to-navigate fitness trackers available. This sleek and compact design accurately monitors everything from heart rate to steps and has a battery life that lasts up to 7 days. Fit bit has changed its technology over time and has very accurate and updated software to monitor and store your health and fitness information accurate.

INTEGRATED ACTIVE WEAR:- Innovative technology has now been integrated into active wear and is available in all different shapes and sizes. The brand uses mild vibrations from sensors integrated into the clothing to tell the wearer if they are practicing yoga moves accurately. This can help overall balance and lead to achieving better fitness goals.

SIGNIFICANCE OF REMOTE HEALTH CARE :

1. **Improved access to healthcare :** Remote healthcare allows individuals to receive medical care regardless of their geographic location. It is particularly beneficial for individuals living in rural or underserved areas who may have limited access to healthcare facilities. Tele health eliminates the need for long travel distances, reducing barriers to care and ensuring timely access to medical services.

2. **Convenience and flexibility :** Remote healthcare provides convenience and flexibility to both patients and healthcare providers. Patients can receive medical consultations and follow-ups from the comfort of their homes, eliminating the need for in-person visits. This saves time, reduces travel costs, and allows patients to fit healthcare appointments into their busy schedules more easily. Healthcare providers can also schedule virtual consultations more efficiently, potentially seeing more patients in a day.

3. **Reduced healthcare costs :** Tele health has the potential to lower healthcare costs for patients and healthcare systems. By minimizing the need for in-person visits, remote healthcare reduces transportation expenses, eliminates the need for childcare or time off work, and can prevent unnecessary emergency room visits. It also has the potential to reduce healthcare system costs by optimizing resource utilization and streamlining administrative processes.

4. **Continuity of care :** Remote healthcare techniques enable continuous monitoring and follow-up care for patients with chronic conditions. Remote patient monitoring devices can track vital signs, collect data, and transmit it to healthcare providers, allowing them to monitor patients remotely and intervene if necessary. This helps in early detection of complications, prevents hospital read missions, and promotes better disease management.

5. **Increased patient engagement and empowerment :** Remote healthcare encourages patients to become more engaged in their own health. With access to electronic health records, educational resources, and remote monitoring tools, patients can actively participate in their care management. Remote consultations also facilitate open communication between patients and healthcare providers, enabling them to ask questions, discuss concerns, and make informed decisions about their health.

6. **Reduced Infection Risk :** Especially in times of pandemics or contagious diseases, remote healthcare techniques offer a safer alternative by minimizing the need for in-person visits and reducing exposure risks for both patients and healthcare providers. It helps in preventing the spread of infections and ensures the continuation of essential healthcare services.

7. **Health Education and Preventive Care :** Telehealth platforms can be used to deliver health education, preventive care, and wellness programs to individuals, communities, and even schools. Remote healthcare techniques can empower individuals with knowledge about healthy lifestyles, disease prevention, and early intervention, promoting overall well-being and reducing healthcare disparities.

8. **Rapid access to specialized care :** Remote healthcare techniques enable patients to consult with specialists and healthcare professionals who may not be available in their local area. Through virtual consultations, patients can access expertise from various medical disciplines surging they receive the best possible care without the need for travel or lengthy referrals.

9. **Enhanced Continuity of Care :** Remote healthcare techniques facilitate continuous and coordinated care, particularly for patients with chronic conditions. Through remote monitoring devices and virtual consultations, healthcare providers can monitor patients' vital signs, track their progress, and make timely interventions, ensuring ongoing management and reducing the likelihood of hospital read missions.

FUTURE ASPECTS OF REMOTE HEALTH CARE :

Telemedicine Advancements: Telemedicine, which involves providing medical services remotely, will continue to evolve and improve. We can expect more sophisticated platforms and technologies that enhance the patient-doctor interaction, such as high-definition video consultations, remote monitoring

devices, and virtual reality applications. Remote Monitoring Devices: With the advancement of wearable technology and Internet of Things devices, remote monitoring will become more comprehensive and accurate. Patients will have access to a range of devices that can monitor vital signs, track health metrics, and transmit data to healthcare professionals in real-time. This enables early detection of health issues, better management of chronic conditions, and personalized treatment plans. Artificial Intelligence (AI) in Diagnostics: AI will play a crucial role in diagnosing and triaging patients remotely. Machine learning algorithms can analyze medical images, patient data, and symptoms to provide accurate assessments, improve diagnostic accuracy, and recommend appropriate treatments. AI-powered chat bots can also provide preliminary consultations and offer healthcare advice. Remote Surgeries and Robotic-Assisted Procedures: Advancements in robotics and haptic feedback systems will enable remote surgeries and interventions. Skilled surgeons will be able to perform complex procedures from a distant location using robotic arms and advanced surgical tools. This can improve access to specialized care in underserved areas and provide real-time expertise during emergencies. Virtual Reality (VR) for Rehabilitation: Virtual reality technology will have an expanded role in remote rehabilitation and therapy. VR can create immersive environments that simulate real-world scenarios, allowing patients to engage in therapy sessions remotely. This is especially beneficial for individuals with mobility limitations or those undergoing physical or mental rehabilitation. Health Data Security and Privacy: As remote healthcare techniques rely heavily on transmitting sensitive patient data, ensuring robust security measures and privacy protection will be a top priority. Advanced encryption techniques, block-chain technology, and strict adherence to data privacy regulations will be critical to safeguard patient information and maintain trust in remote healthcare systems. Improved Access to Healthcare: Remote healthcare techniques have the potential to bridge the gap in healthcare access, particularly for individuals in remote areas or those with limited mobility. Patients can receive medical consultations, prescriptions, and follow-up care without the need for physical travel, saving time and reducing the burden on healthcare infrastructure.

CONCLUSION :

By all the data we have collected that in this; pandemic imposed new demands and critical pressures on our healthcare system, staff, systems and facilities. It also revealed weaknesses in delivery of care including access, equity, and continuity of care, connectivity/technology disparities and Public Health. It imposed increased business pressures drivin by dropping revenues and increased costs as well as increased pressures on staff and supplies. This plan process found that many of these can and are being addressed with telemedicine and related technologies. Deploying telemedicine can contribute significantly to preparation for, and response to, the demands of a pandemic. Moreover, telemedicine offers significant everyday benefits including: attracting new patients, providing expanded service to your market area, expanded revenue potential, and creating higher levels of patient satisfaction. However, proper assessment, preparation and having these technologies and workflows in place and in use is critical for them to be available and scalable when a pandemic strikes. The fact that telemedicine had not been broadly implemented limited provider's flexibility and ability to serve their patients.

It also identified where technology can improve care, reduce inefficiencies, reduce the demand for facilities and reduce costs. Examples:

Provide increased care and disease management in the home

Provide urgent care on-line/virtually

Provide continuity of care for chronic disease patients

Eliminate/minimize space needed for waiting rooms while reducing infection risk in these environment and reducing consumer frustrations inherent in waiting rooms and long waiting times.

REFERENCES :

1. Centers for Disease Control and Prevention. The State of Aging and Health in America 2013; Centers for Disease Control and Prevention, US Department of Health and Human Services: Atlanta, GA, USA, 2013.

2. Global Age Watch Index 2015. Available online: http://www.helpage.org/global-agewatch/ (accessed on 20 June 2016).

3. World Health Organization. Family Planning/Contraception. 2015. Available online: http://www.who.int/mediacentre/factsheets/fs351/en/ (accessed on 20 June 2016).

4. World Health Organization. Are You Ready? What You Need to Know about Ageing. World Health Day. 2012. Available online: http://www.who.int/world-health-day/2012/toolkit/background/en/ (accessed on 20 June 2016).

5. U.S. Health Care Costs Rise Faster Than Inflation. Available online: http://www.forbes.com/sites/mikepatton/2015/06/29/u-s-health-care-costs-rise-faster-than-inflation/#1384765c6ad2 (accessed on 20 June 2016).

6. Deen, M.J. Information and communications technologies for elderly ubiquitous healthcare in a smart home. Pers. Ubiquitous Comput. 2015, 19, 573-599. [Google Scholar] [CrossRef]

7. Agoulmine, N.; Deen, M.; Lee, J.-S.; Meyyappan, M. U-Health Smart Home. IEEE Nanotechnol. Mag. 2011, 5, 6-11. [Google Scholar] [CrossRef]

8. Wang, H.; Choi, H.-S.; Agoulmine, N.; Deen, M.J.; Hong, J.W.-K. Information-based sensor tasking wireless body area networks in U-health systems. In Proceedings of the 2010 International Conference on Network and Service Management, Niagara Falls, ON, Canada, 25-29 October 2010; pp. 517-522.

9. Pantelopoulos, A.; Bourbakis, N. A Survey on Wearable Sensor-Based Systems for Health Monitoring and Prognosis. IEEE Trans. Syst. Man Cybern. C 2010, 40, 1-12. [Google Scholar] [CrossRef]

10. Nemati, E.; Deen, M.; Mondal, T. A wireless wearable ECG sensor for long-term applications. IEEE Commun. Mag. 2012, 50, 36-43. [Google Scholar] [CrossRef]