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Smart Healthcare Based Living Extending Smart Home Using Internet of Things

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Abstract

In the last few years, it has been noticed that the people are moving their attention to the idea of a smart home. But the main challenges are privacy, uninterrupted connectivity, ensuring safety of the data, making the right decision and of course identifying and authenticating the right person and right device. The existing automation system is targeting one or two of these issues whereas the actual need of the time is to stay fit along with all the smart facilities. In the present era of rat-race, it has become a very tough job to take care of one's own health. Now a days, people get easily effected with various diseases as the immunity power is very low. In this research paper, we are trying to present a novel idea of that smart home which not only uses machine learning algorithm to make intelligent decisions or using block chain technology to ensure authentication or identification of the IoT devices perfect but will also help people to stay fit. This smart healthcare based living extending smart home using internet of things can easily be controlled by your voice or can also be operated by your smartphone or smart watch. With a lot of fitness activity options, it will help people to take care of their own health at their house with very minimum amount of time. This easy to use healthcare equipment can be included at the home by simple optimization of the existing furniture.

Keywords: *IoT, Smart Healthcare, Smart Home, AI, Voice Recognition*

1.0 Introduction

The ever changing global scenario and evolution in the field of technology has created urgent need for intelligent system. IOT field hence started getting a lot of attraction. The term was coined by Kevin Ashton in 1999, which is basically interconnection of all devices in an environment, where they do information exchange and resource sharing without human intervention.

Smart homes are integral part of IoT. This is although an old concept which dates to 1975.when a Scotland based company first deigned a home automation system called X10. Smart homes are basically system which uses internet to control and automate all devices which are needed on daily basis. For example, Light bulbs, Doorbells, locks, Speakers, home appliances (oven, microwave etc.), Televisions, Security and Health monitoring system. Smart homes use mainly wireless communication protocol like Zig-bee, Z-wave and Wi-Fi[6].

Smart homes also provide health care facilities and voice assistance. Smart home healthcare reduces the occupants need for frequent hospital visit, which saves time, energy and

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cost. The smart home healthcare has advanced sensors, which collect data of live record of patients every moment and inform nearby hospital in-case of any emergency. The AI powered voice assistance like Alexa, Siri and Google Assistance also help the patients maintain their health by answering live queries, analyzing and predicting about the future health conditions based on present available data. It also helps setup reminder for medications and appointments[7].

2.0 Methodological Aspects

Here we choose an analysis in the form of textual and empirical methodology. We try to set up an environment of AI and design thinking for the users. So that they can take care of their heath in their homes itself and operated by their voice assistance command.

At first, in design process we must interview with the property owner/user to full fill two prospective (a) solve out space management questions along with the features or smart services which user's wants to have in their home.

Secondly, we have to research market on the upcoming/ renovating technologies which can fullfill the user's demand.

Third Step, we paused our research and suggest a new layer of "advanced technologies" that will be installed to the specific space according to the design.

In technology part we use the AI to manage the total healthcare machinery along with the voice command also.

For example : On user demand we installed a tread mill at their home for walking and along with a smart monitor also will be their which will show the user "Steps", "Bp", "Heart Ratings", "Body Hydrate Percentage" And "Calorie Deficiency Percentage". This treadmill will be operated by voice command, whose feature will make it more special.

In case of working algorithm that will be like – at first, we store the voice of the user and make a database and attach with AI functionality. For that we need Supervised Learning. This is the same for features," Steps", "Bp", "Heart Rating", "Body Hydrate Percentage", "Calorie Deficiency Percentage". Not only that it will store the daily basis data whenever uses it/operates it.

3.0 Case Study

A. Smart Home System

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

Embedded on automation technology, smart home is the residence that has numerous automated appliances like air conditioning, lighting, entertainment system, security system and many more which are capable to communicate with each other and can also be controlled remotely by a simple time schedule or by the smartphone in our hand. Basically the system consists of advanced sensors and switches which are connected to the central hub and is controlled by the resident with moving unit or wall-mounted devices which are tethered to the internet cloud services. Energy efficient and convenient to use, this smart home provides security and requires very low operating costs. Installation of smart devices not only saves time but also saves our money. Besides, such system are very adjustable and adaptive to meet the changing requirements at the home. In most of the cases, the required infrastructure to set up a smart home is highly flexible to integrate with a wide variety of devices with different standards and providers. Its basic architecture is the latest technology which utilizes micro controller enabled sensors to measure home condition and monitors home embedded devices to take action accordingly. As it has become a part of the cost-reducing trend and modernization, the popularity of smart home concept is expanding in a good pace. Smart home technology can also be referred to as the home automation as it ensures convenience, comfort, energy efficiency and of course security by allowing the user to control the system with smart devices in their hands.

Need for Smart Home

1. All the home devices need to be managed from one place.
2. Flexibility to integrate with wide variety of devices with different standards
3. Ensuring maximum security for the home
4. All the home function can be controlled remotely
5. Enhancing the functionality of the appliances
6. Improve energy efficiency



The smart folding bed system will not only save your floor space but will also help to elevate the look of the room and will convert it to bedroom in few seconds.



The folding system of the table will enhance your room decor and will help to keep it spacious.



B. Smart Home with Intelligent Health Care System

In case-study I we observed the design of smart home. But in this second one we will introduce smart home with healthcare system along with voice command system too.

In this scenario we discuss how Space is utilized in a smart room by placing the hydraulic system in the wall. By which the space is available as well as the system can be used by user whenever he/she wants it to be used.

After, that treadmill can also be operated by the user using voice command. The user can turn on/turn off treadmill or speedup/speed down treadmill using speech command. For this, we will use "voice receiver" which receives the voice and for recognition perform the work as per instruction for which we use "AI-supervised learning". The data collected will also be stored in a database.

In this treadmill system certain smart devices are used for healthcare activities

(a) Smart insole: It is used for Gait analysis, which is an important feature for diabetic foot monitoring system. The wearable foot sensors easily detect vGRF(vertical ground reaction Force), joint movement, acceleration and many gait variables. It also does constant monitoring and displaying the diabetic chart.

(b) Blood pressure: It is important to monitor blood pressure as it leads to variety of diseases. It uses Photo plethy smogram (PPG) signals, where it is measured by amount of light reflected or absorbed by blood vessel of living tissues. PPG signals are then assessed based on quality, PPG signals are then divided into two set for training and testing models. The feature extraction is then done and based on the extraction. These features and their techniques are used to train the ML-algorithm model for accurate prediction.

(c) Heart-attack detection: Heart attacks are one of major reasons for premature deaths. The traditional route of ECG is both tiresome and not instant effective. Hence in recent years the quest for real-time ECG has led to many ML algorithms develop portable models based on linear classification and some Support Vector Model which also provides accuracy. This wearable system helps monitor the heart all the time and also inform nearby hospital in-case of any heart attack risk or emergency.



Some main point:

1. Mp3 speaker with AUX port and cable
2. LCD display – heart rate, time, speed, calories burned
3. Wheels for easy transportation
4. Cooling fan, auto inclination, auto lubrication, foldable and changeable workout modes
5. Hydraulic drop-down system for easy mobility

According to the top immunologists, gym is one of those places where people are most likely to be exposed. Going to the gym is always might not be possible. But this equipment can be installed at our home without much hassle to stay fit.



4.0 Case Result

By comparing both the case studies we observe that in "case study 1" we only discuss about "smart home" where we solve residential house issue's using smart technology.

But in "case study 2" we observe that we not only solve the residential house related issue with smart technologies also incorporates the "health care" product too. A healthcare product is also attached in a room is a better idea for good health.

So, we can take the decision from here that "case study 2" is more efficient than "case study 1". Because "case study 2" we can get a combination of "smart home" along with "health care" system.

5.0 Challenges and Security

In the IOT system, architecture plays a major role to develop and ensure security as safety has become a major issue at present days. By using this system, any criminal activity can be done without much effort. So the system must be protected from any unethical activities.

Smart home certainly gives relaxation to the users but developing the functionality to support all the applications is not that much easier. It is very challenging to design and develop a fully automated smart home system that can work well in every situation.

When data is stored in cloud or access and exchange on cloud, it means it is done publically. Yes, storing data on cloud allows us to access it globally but always there is a risk for the data of getting hacked. So precaution must be taken to prevent any unauthorized attempt to steal the data. The same instruction follows for the smart home automation system that ensure security from unauthorized access. Increase in IOT devices can the synonym of increase in security which can be taken through different ways and keep the home secure. Apart from the authentication of the password, it can also be done by a simple addition of extra verification that may include receiving a code on the phone or a call on entering the password to keep the applications free from the hackers.

In addition, all the devices must be updated with the latest version to keep the intruders or dangerous malware away from the devices and to ensure maximum safety. An auto configuration procedure can also be implemented to simplify the installation process as well as the maintenance of the system.

Additionally, data should be accessed through a secure protocol. To keep the transition of the data encrypted, SSL certificate must be installed on the servers. All the passwords should be in encrypted format and authorization should be done on every HTTPs request among the server and devices. Over and above that, the web application which are used to control the appliances must be password protected.

6.0. Conclusion

In today's era everyone wants to live with denationalization. A smart home can change the daily life very easy and comfortable. A smart home can be controlled from anywhere. With a smart home if we get healthcare machinery to maintain our health it will be the best solution to a busy life schedule. In near future AI and Machine Learning will be the part of our daily live in the form of smart home or health care system.

7.0. References

1. Y. Nakamura, Y. Arakawa, T. Kanehira, M. Fujiwara, and K. Yasumoto, (2017): "SenStick: comprehensive sensing platform with an ultra tiny all-in-one sensor board for IoT research," *Journal of Sensors*, vol. 2017, Article ID 6308302, 16 pages.
2. Mordorintelligence, (2022): "Global smart homes market –growth, analysis, forecast to 2022," https://www.mordorintelligence. com/industry-reports/global-smart-homes-market-industry? gclid=CIjd6MXjydYCFYYDKgod4ZQFaw.
3. V. Ricquebourg, D. Menga, D. Durand, B. Marhic, L. Delahoche, and C. Loge, (2006): "The smart home concept: our immediate future," in 2006 1ST IEEE International Conference on E-Learning in Industrial

Electronics, pp. 23–28, Hammamet, Tunisia, 2006, IEEE.
4. https://www.hindawi.com/journals/sp/2020/4579291/?utm_source=google&u tm_medium=cpc&u tm_campaign=HDW_MRKT_GBL _SUB_ADWO_PAI_DY NA_JOUR_X_PJ_GROUP 3&gclid=Cj0KCQjw—2aBhD5ARIsALiRlwDbXHBlXw5fPX1Quk_4VyldOM4Re1Acq-FR-JJP3Y6VXoqozPQYd_8aAuo_EALw_wcB
5. smart-home-in-cut-view51531690.html&do cid=fYdOi1sAfz8WMM&tbnid=D1pOqavXyjkhHM&vet=1&w=600&h=448&itg=1&hl=en-IN&source=sh/x/im
6. Healthcare in the Smart Home: A Study of Past, Present and Future Jamie Bennett*, Osvaldas Rokas and Liming Chen School of Computer Science and Informatics, De Montfort University, Leicester LE1 9BH, UK; pp.
7. Smart Home Systems Based on Internet of Things Menachem Domb, pp
8. https://hiconsumption.com/best-home-gym-equipment/
9. W. Wang, (2011): "The internet of things for resident health in- formation service platform research," in Proceedings of the IET International Conference on Communication Technology and Application (ICCTA 2011), Beijing, China, May.
10. E. Agu, (2013): "The smartphone as a medical device: assessing enablers, beneûts and challenges," in Proceedings of the 2013 IEEE International Workshop of Internet-of-Things Net- working and Control (IoT-NC), pp. 48–52, New Orleans, LA, USA, June.
11. H.Ota, M.Chao, Y.Gao et al.,(2017): "3D printed "earable" smart devices for real-time detection of core body temperature," ACS Sensors, vol.2, no.7, pp.990–997.
12. N. A. Zakaria, (2018): "IoT (Internet of Things) based infant body temperature monitoring," in Proceedings of the 2018 2nd International Conference on Biosignal Analysis, Processing and Systems (ICBAPS), pp. 148–153, Kuching, Malaysia, July.
13. A. Dinh, (2017): "Blood pressure measurement using ûnger ECG and photoplethysmogram for IoT," in International Conference on the Development of Biomedical Engineering in Vietnam, pp. 83–89, Springer, Berlin, Germany.
14 P. S. Pandey, (2017): "Machine learning and IoT for prediction and detection of stress," in Proceedings of the 2017 17th International Conference on Computational Science and its Applications (ICCSA), pp. 1–5, Trieste, Italy, July.
15 U. Garg, (2018): "Design and implementation of smart wheelchair for quadriplegia patients using IoT," in Proceedings of the 2018 First International Conference on Secure Cyber Computing and Communication (ICSCCC), pp. 106–110, Jalandhar, India, December.