HEALTH CARE AND MEDICATION ASSISTIVE SYSTEM USING IOT

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Abstract:

People suffering from different diseases are not able to carry out their regular medication and physical exercise due to declining memory. Taking the correct medicine at regular slots is a challenging task for them. Hence this IOT based medication assistive system is proposed and developed to facilitate medication adherence and basic physician guidance. The proposed system incorporates features such as sending a message to medical practitioner and buzzer beep for reminding activities and medication status along with live physician consultation which are not available in existing software reminders. It can perform the task even though the internet is not available physically by using the Things Speak. It also reduces the dependency of old people on younger generations. Design can be realized at a lower price due to availability of intelligence programmable hardware at an affordable price.

Keywords: Internet of Things, PIC microcontroller, ESP8266 Wi-Fi module, Smart medicine box, old age patients, permanent diseases, setting up time table, notification, sensing capability
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I INTRODUCTION

In order to generate test sets for a patient's recovery and keep an eye on the metric, a system might be built. To help doctors in remote areas provide more effective and well-planned treatment, this initiative aims to provide them access to data on their patients. The rapid development of medical technology has contributed to a growing social trend: people are living longer. Furthermore, as the global population ages, the question of how to properly care for them becomes more pressing on a global scale. Some elderly people's family members claim that since they have moved into a long-term care facility, they would now have access to the best medical treatment available [2]. While many governments are beginning to focus on this problem, the lack of nursing resources and long-term care capabilities remains a significant obstacle. The need for technological assistance in healthcare is growing rapidly as a means of meeting these issues.

Help systems that remind people to take their drugs and medications at the appropriate times of day may enable people to circumvent this issue. In addition, the NCD discovered that the proportion of individuals who utilise assistive technology to lessen their dependency on others was eighty percent. In the current system, reminders may be sent to either mobile phones or landline phones [3]. In addition to this, research has shown that the majority of individuals often fail to remember to take their medication at the appropriate time. People are able to solve this issue with the use of assistive technologies that can remind them of the drug timings and

the medications that need to be taken at a certain time of the day [4].

The results of this study provided a useful blueprint for delivering medical treatment to individuals residing in any part of the world. Physiological parameters including temperature, heart rate, and blood pressure are measured after they have been collected. If any of the critical parameters moves outside of the typical range, a notification will be sent. We are able to construct a system to remotely monitor the movement of the patient as well as design a test kit for the patient's rehabilitation.

Healthcare data or it is termed Electronic Health Record (EHR) contains two sources of data; it may originate from Electronic Medical records (EMR) and biosensors [3]. EMR data may originate from numerous sources such as laboratory testing, Medicaments, medical imaging, and medical reports.

It is the goal of this project to make it possible for medical professionals to acquire patient data from distant places. This argues in favour of a therapy that is both effective and well-organized. In the existing system of medical treatment, it is necessary for the patient to check in at the hospital before receiving information on their health issues. Costs associated with patient transportation and counselling as well as hospital infrastructure. These expenditures are greatly cut down by the use of an intuitive and remote health evaluation approach

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This paper will consist of the following components, which have already been sketched out. In Section 2, we'll take a look at the related research on Internet of Things-based drug support systems in healthcare. We laid out the preferred approach in great detail in Section 3. The outcomes of using the proposed procedures are shown in Section 4. The article's conclusion is presented in Section 5 of the paper.

II. LITERATURE SURVEY

The Internet of Things (IoT), big data, and machine learning are emerging as some of the most promising areas of research for improving healthcare services in the present day. There is a wide variety of available solutions in the field of healthcare that are founded on data science, big data analysis, Internet of Things devices, machine learning, and data mining procedures. A number of different machine learning strategies, including SVM, DTW, and others are discussed in the literature review.

AlokKulkarni et.al, in this paper about healthcare internet applications, we will explore the development of the internet as well as its history, a summary of its applications, and their significance. IoT stands for the Internet of Things and refers to a network of physical objects or "things" that have been outfitted with electronics, software, sensors, and connectivity in order to enable them to achieve higher values and facilities by exchanging data with the operators of the company and other connected devices. Each object in our environment has its own embedded computing system, which makes it completely unique, yet it can still communicate with other devices and the active Internet infrastructure.

David Niewolny, His article, titled "How the Internet of Things Is Revolutionizing Healthcare," contains a discussion of the factors that led to the development of IoT as well as the designs of applications in which IoT is utilised. People have limited time, awareness, and precision, which means they won't be able to record data about networked things in the real world consistently. This is the problem. The solution is to provide machines the ability to gather data without any involvement from a human being at any point in the process. For the purpose of delivering and ensuring home healthcare, a variety of sensors are already accessible and available on the market.

S. Tozlu, et.al, In his work titled "Wi-Fi enabled sensors for internet of things," he describes a realistic strategy and provides explanations about the various sensors that are accessible. ZigBee and comparable protocols based on the IEEE 802.15.4 standard have traditionally been considered suitable for use in sensor network applications due to the energy-efficient nature of their design. On the other hand, recently developed power-efficient Wi-

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Fi components, when combined with an appropriately designed system and usage model, constitute a formidable competitor. The term "persistent computing" refers to the proliferation of intelligent devices into our everyday lives. Related words include "ubiquitous computing." For a wide variety of sensor network applications, security is an important consideration. Cryptosystems that use public keys consume a lot of resources, but they offer a great deal more functionality than just confidentiality. Researchers became interested in the mathematical component of Elliptical Curve Cryptography (ECC) as a result of the decreased key size it offered. It ensures that actual implementation possibilities can be achieved even in devices with limited resources. An earlier body of research demonstrates that public key algorithms are the optimal selection for application in wireless sensor networking, and that the benefit of smaller Cryptographic keys will be substantial in achieving greater success in achieving the goal of energy conservation.

A. Heryana,proposed a healthcare service that use wearable gadgets to monitor patients who have cardiac problems. They developed a system that operates in stages, the first of which involves the utilisation of non-invasive wireless sensors, followed by a sensor gateway that was utilised to store data to the server and is equipped with an alerting system only in the event that abnormal conditions exist in patients. The third phase involves utilising cloud computing to manage the patients' data storage in order to give them access to the service and enable them to monitor their heart states. The fourth phase is an application designed for use on mobile devices such as tablets and smartphones to track and measure various aspects of one's health.

III. PROPOSED ARCHITECTURE

The Internet of Things (IoT), machine learning, and the analysis of large data are all brought up as potential components of an advanced healthcare system in this study. The system that is being offered is a general healthcare system that includes a solution for patients and users who are visually impaired or disabled, as well as for visually impaired or disabled patients and users, to monitor their health condition and forecast prospective diseases. The study that has been presented intends to establish a real-time prediction system for health issues that is based on the analysis of large amounts of medical data in the cloud. The medical parameters are sent to Apache Spark in the scalable system that was proposed in order to extract the attributes from the data and to apply the proposed machine learning algorithm. The goal of the algorithm is to predict the healthcare risks and then send those predictions as alerts and recommendations to the users as well as the healthcare providers. In addition, the system that was proposed offered a speech recognition system by making use of a hybrid model that included SVM and DTW algorithms. This was done in order to supply a healthcare system with the best possible option for managing smart home gadgets.

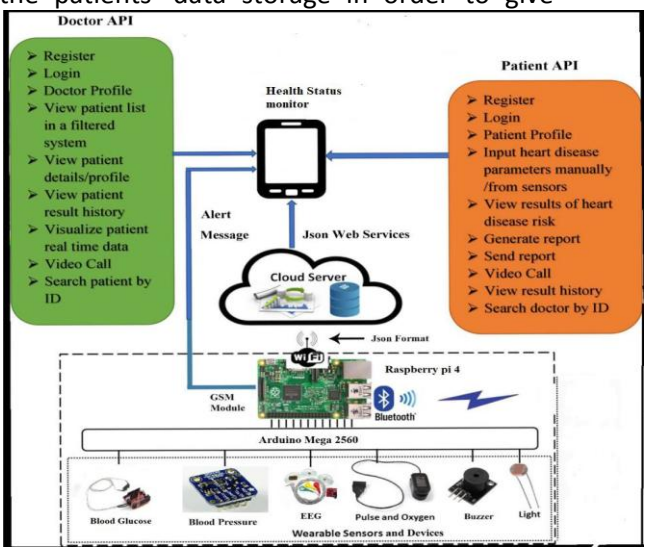

Figure 1: The proposed healthcare prototype for healthcare monitoring

The proposed method offers a remedy predicated on the utilisation of data streams from wearable's and supplies a prognosis for health difficulties in real time. Microsoft Azure was used as the cloud platform to process the data collected from the wearable devices. Microsoft Azure is just one of many tools that may be used to analyse a user's health data, and in the user profile kept in the cloud, the user's past medical history is available. Included in the user profile is information about the users and their family's medical history, including illnesses like diabetes, cancer, thrombosis, and heart disease.

Cloud-based wearable data streams were managed via Spark streaming in the suggested system. Wearable's send data to it every 30 seconds. Microsoft Power BI allows users' doctors and other healthcare practitioners to view and analyse their data. To protect sensitive medical information, the user has the option to modify access permissions at any moment.

Health data streaming

The Message Queue Telemetry Transport, or MQTT, protocol was utilised as a connection protocol in the system that was being presented in order to connect embedded sensory devices and networks with established applications and middleware. The system that has been developed provides an efficient method for transmitting health status data in the appropriate manner

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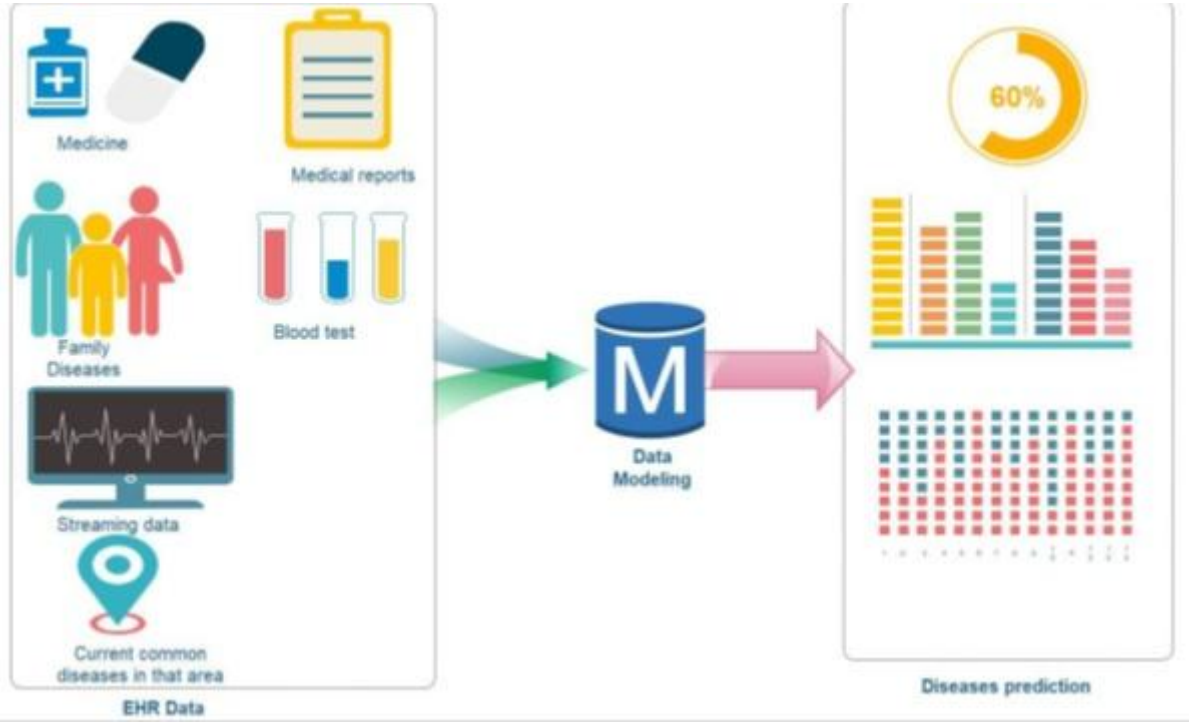

Figure 2: The proposed data modelling

The health information that has been gathered and stored in the cloud can serve as medical records that can be accessed by patients, their families, paramedics, and other medical professionals. Service-Oriented Architecture (SOA) and cloud computing are utilised to give the ideal architecture for handling the connected data in order to produce a platform of all health data such as a full profile with all past health data. This was accomplished by combining these two technologies. The display comes from the system. The health data is shown graphically on the web and mobile platforms in the form of the patient's heart rhythm as well as other characteristics. The 'alarm' function of the system will be activated in the event that there is a situation, such as an irregular heart

rhythm in individuals who need treatment and the supply of treatment.

IV. RESULT ANALYSIS

Electronic health records, also known as EHRs, are a type of record that are stored electronically and can be accessed and shared by patients. Electronic health records are either stored in a secure location or kept confidential [3]. The electronic health record provides useful information based on the user's health data history. The electronic health record (EHR) can include measures taken from wearable devices as well as other physical devices in doctors' offices. These measurements may include things like the temperature of the skin, the rate of the heart, the blood pressure, the volume of the breaths taken, the quality of the air around them, how well they sleep, and what they eat.

A solution that is based on biosensors, Arduino board and Raspberry Pi boards is provided by the framework. Arduino board is utilised in a wide variety of applications due to its extremely user-friendly nature and open-source nature as a hardware solution. In the proposed architecture, we utilised the Arduino board as the basis for the wearable gadget that monitors a person's current health status and makes predictions about diseases. The Arduino mega 2560 board is connected directly to the biosensors, which include the heart rate sensor, blood pressure sensor, EEG, ECG, and EMG, amongst others, in order to provide the streaming data from these sensors over the course of time. The Arduino platform came with a user-friendly integrated development environment (IDE) that could be used to execute the code for the attached sensors, as well as receive readings and process them on Arduino.

The Raspberry pi4 board serves as the foundation for this system. “These boards come equipped with a high-performance 64-bit quad-core processor, dual-display support at resolutions up to 4K via a pair of micro-HDMI ports, hardware video decode at up to 4Kp60, up to 4GB of RAM, dual-band 2.4/5.0 GHz wireless LAN, Bluetooth 5.0, Gigabit Ethernet, USB 3.0, and Power over Ethernet (POE) capability, and they can support up to four independent displays at resolutions up to 4”.

Sensor

The system is outfitted with three different kinds of sensors, including a voice recognition sensor, an ultrasonic sensor, and an accelerometer. In order to detect things in the user's line of sight, we utilised an HC-SR04 ultrasonic sensor.

Ultrasound Sensor

The ultrasonic sensor is a sensor that is used in extremely practical ways to detect obstacles by locating any obstruction within defined ranges. It does this by emitting sound waves that bounce off of the obstacles.

Camera

The suggested system included a camera that would take pictures in real time and broadcast them as videos, which would then be sent to the caregiver's laptop once an alert was triggered.

Biosensors

The system that was presented made use of a number of sensors in order to cut down on the number of false alarms and detect all of the human physical factors in order to deliver alarms at the appropriate running time.

Electroencephalography (EEG)

Electroencephalograms provide real-time health status updates based on brain activity, allowing for the diagnosis of health issues.

BMP180 blood pressure sensor

BMP180 is the standard instrument for measuring blood pressure in humans. Because it serves as a reference for so many different diseases and shifts in the body's equilibrium, the blood pressure is able to provide a wealth of information regarding human beings.

The proposed system has been built and tested with the help of Microsoft Azure, and it is currently being trained on the cloud platform with the help of the Microsoft Azure machine learning studio so that it can make effective use of the cloud platform's capabilities. The dataset from UCI was utilised in the testing of the suggested method. UCI is a dataset that can be accessed online and contains a wide variety of diseases. It also covers a substantial amount of database material. Downloading an open-source UCI data set is the first step in the method that

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will be utilised to accomplish this research, which will be the proposed methodology. In order to build a model for heart disease prediction, the system utilised the dataset of data pertaining to heart illness that was located in the UCI Machine Learning repository.

Table 1 compares the proposed system to other methods that were used on the dataset of heart diseases from the University of California, Irvine. The proposed system demonstrated an increase in accuracy to 90.6%, which is the highest accuracy when compared to other classifiers that meet our research target. Table 1 also compares the proposed system to other methods.

Table 1: The comparison between the proposed system and the related work

Algorithm Name	Data Set	Accuracy
Random Forest	UCI	84.1%
Naïve Bayes	UCI	84.2%
Logistic Regression (SVM)	UCI	84.8%
Proposed System	UCI	90.6%

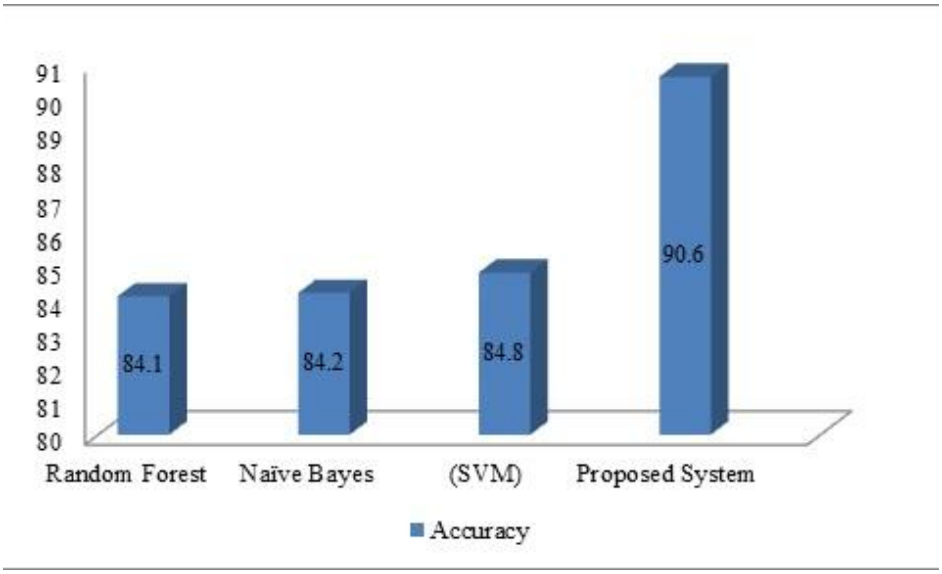

Figure3: The proposed Accuracy

V. CONCLUSION

The monitoring of patients' health states is an important part of the healthcare industry in the modern day. It is beneficial to the medical professionals who treat the disorders. Numerous platforms offer health status monitoring approaches, which can be used to obtain health data from a variety of sources, including wearable devices, fitness devices, MRT images, MRI images, medical reports, and texture analysis, amongst other things. Throughout the course of this investigation, we utilised methods of machine learning to build the suggested system. The thesis provided an overview of a general healthcare system by presenting four distinct sections. It describes the effective wearable gadget that has been proposed, which is based on the on-demand technique and uses IoT technologies. The wearable gadget that is being considered for development includes a number of biosensors, including an EEG, an ECG, a blood pressure sensor, and an accelerator.

References

1. Junaid Mohammed, AbhinavThakral, Adrian FilipOcneanu, Colin Jones, Chung-Horng Lung, Andy Adler "Internet of Things: Remote Patient Monitoring Using Web Services and Cloud Computing" 2014 IEEE International Conference on Internet of Things (iThings 2014), Green Computing and Communications (GreenCom2014), and Cyber-Physical-Social Computing (CPSCom 2014),P.P 978-1-4799-5967-9/14.
2. BoyiXu, Li Da Xu, Senior Member, IEEE, HongmingCai, Cheng Xie, Jingyuan Hu, and Fenglin Bu "Ubiquitous Data Accessing Method in IoT-Based Information System for Emergency Medical Services" IEEE TRANSACTIONS ON INDUSTRIAL INFORMATICS, VOL. 10, NO. 2, MAY 2014, P.P1551-3203.
3. P. K. Sahoo, S. K. Mohapatra, and S. L. Wu. Analyzing healthcare big data with prediction for future health condition. IEEE Access, 4:9786–9799, 2016. ISSN 2169-3536.
4. S. Tyagi, A. Agarwal, and P. Maheshwari. A conceptual framework for iot-based healthcare system using cloud computing. In 2016 6th International Conference - Cloud System and Big Data Engineering (Confluence), pages 503–507, Jan 2016
5. B. G. Ahn, Y. H. Noh, and D. U. Jeong. Smart chair based on multi heart rate detection system. In 2015 IEEE SENSORS, pages 1–4, Nov 2015.
6. I. Chiuchisan, H. N. Costin, and O. Geman. Adopting the internet of things technologies in health care systems. In 2014 International Conference and Exposition on Electrical and Power Engineering (EPE), pages 532– 535, Oct 2014.
7. A. Dwivedi, R. K. Bali, M. A. Belsis, R. N. G. Naguib,P. Every, and N. S. Nassar. Towards a practical healthcare information security model for healthcare institutions. In 4th International IEEE EMBS Special Topic Conference on Information Technology Applications in Biomedicine, 2003., pages 114–117, April 2003.
8. S. C. Li, L. D. Xu, and X. H. Wang, "Compressed sensing signal and data acquisition in wireless sensor networks and Internet of Things," IEEE Trans. Ind. Infomart. vol. 9, no. 4, pp. 2177–2186, 2013.
9. B. Nath, F. Reynolds, and R. Want, "RFID technology and applications," Pervasive Computing. vol. 5, no. 1, pp. 22–24, Jan. /Mar. 2006.
10. P. Mohan, D. Marin, S. Sultan, and A. Deen, "Medinet: Personalizing the self-care process for patients with diabetes, and cardiovascular disease using mobile telephony, IEEE Engineering in Medicine" in Proc. 30th Ann. Int. Conf. Biology Society, 2008.
11. CharalamposDoukas, IliasMaglogiannis "Bringing IoT and Cloud Computing towards Pervasive Healthcare" 2012 Sixth International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing, P.P 978-0-7695-4684-1/12
12. VandanaMilindRohokale, NeeliRashmi Prasad, Ramjee Prasad "A Cooperative Internet of Things (IoT) for RuralHealthcare Monitoring and Control" 2011 Center for TeleInFrastuktur, Aalborg University, Denmark, P.P 978-1-4577-0787-2/11
13. Vishal Gupta, Akshay Ingle, DhanashreeGaikwad, Mahesh Vibhute. "Patient Healt IOT and Machine Learning", 4th International Conference on Inventive Communication and Computational Technologies (ICICCT 2020), IEEE, 28–29 May 2020.
14. Manukonda Praveen Kumar, Usha Rani Nelakuditi. "IOT and I2C Protocol Based System for Elderly People", VFSTR, Vadlamudi, A.P. INDIA-522213, IEEE, 13-15 Dec 2019.

*e*ISSN 1303-5150

15. Mahesh Vibhute, AnkushDeshmukh, DivyaGodse. "Patient Monitoring using IoT and Medical Sensor", 5th International Conference on Computing Communication Control and Automation (ICCUBEA), IEEE, 19-21 Sept 2019.
16. Dipika S. Vasava, Nisarg M. Vasavada and Dhwani P. Sametriya. "Design and WoSystem: An Embedded Approach", International Conference on WiSPNET, IEEE, 22-24 March 2017.
17. SinduDivakaran, LavanyaManukonda, N Sravya, Melinda Morais M, Janani P. "Monitoring and Diagnosis System", IEEE International Conference on Power, CoEngineering (ICPCSI-2017), IEEE, 21-22 Sept 2017.
18. N. Patel, "Internet of things in healthcare: applications, benefits, and challenges." Internet: https://www.peerbits.com/blog/internet-of things-healthcare-applications-benefits-and-challenges.html III.
19. H. Bauer, M. Patel, J. Vieira, "The Internet of Things: sizing up the opportunity." Internet: IV. https://www.mckinsey.com/industries/semiconductors/our V. insights/the-internet-of-things-sizing-up-the-opportunity, December VI. 2014.
20. D. V. Dimitrov. (2016, Jul). "Medical Internet of Things and Big Data in Healthcare." Health Inform Res. [Online]. 22(3), pp. 156-16Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4981575/ VIII. [Jul. 31, 2016].
21. L. Zhang. "Applications of the Internet of Things in the Medical Industry." Internet: https://dzone.com/articles/applications-of-the X. internet-of-things-in-the-media-1, Jun. 24, 2018. XI.
22. G. Alex, B. Varghese, J. G Jose, A. M. Abraham. (2016), "A Modern Health Care System Using IoT and Android". International Journal on Computer Science and Engineering (IJCSE), vol.8. Issue.4, [Online]. Available URL: http://www.enggjournals.com/ijcse/doc/IJCSE16-08- XII. 04-031.pdf. [Accessed: 11-Nov-2018]
23. Z. Penge, "Technologies and architectures of the (IoT) for health and well-being," Ph.D. dissertation, Dept. Electron. Syst., School Inf. Commun. Technol., Royal Inst. Technology (KTH), Stockholm, Sweden, 2013
24. L. Li and W. Benton, "Hospital technology and nurse staffing management decisions," J. Oper. Manag., vol. 24, no. 5, pp. 676–691, 2006. XV.
25. L. Li and C. Markovski, "An analysis of hospital capacity management patterns using Miles," Int. J. Manag. Enterp. Dev., vol. 3, no. 4, pp. 312–338, 2006. XVI.
26. E. Becker, V. Metsis, R. Arora, J. Vinjumur, Y. Xu, F. Makedon, "SmartDrawer: RFID-Based Smart Medicine Drawer for Assistive Environments," Proceedings of the 2nd International Conference on Pervasive Technologies Related to Assistive Environments, PETRA, 2009, DOI: 10.1145/1579114.1579163
27. S. Bhati, H. Soni, V. Zala, P. Vyas, Y. Sharma. (2017, April) "Smart Medicine Reminder Box," International Journal of Science Technology & Engineering. [Online]. 3 (10). Available: http://www.ijste.org/articles/IJSTEV3I10093.pdf
28. N. U. Nyapathi, B. Pendlimarri, Karishma, Kavya," (2016, May) "Smart Medicine Box using ARM 7 Microcontroller", International Research Journal of Engineering and Technology (IRJET). [Online]. 3 (5). Available: https://www.irjet.net/archives/V3/i5/IRJET V3I5569.pdf.
29. V. Shah, J. Shah, N. Singhal, H. Shah & P. Upadhyay. (2016) "Smart Medicine Box," 2 (5). Available: https://www.irjet.net/archives/V3/i5/IRJET-V3I5569.pdf