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SMART IoT SYSTEM BASED PATIENT MONITORING AND MEDICINE REMINDER BASED ON REGISTRY SERVICE SELECTION SCHEME

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ABSTRACT:

In modern society, busy life has made people forget many things in day to day life. The older adults and the people victims of chronicle diseases who need to take the medicines timely without missing have dementia, forgetting things in their daily routine. Considering this situation study has been done on this. Recent technologies of home healthcare are currently used to improve this situation by reminding the scheduled of medicine, remote monitoring, and updating patient's new medicine data, which prescribers can do through the web. Therefore in this work to investigate the development of patient help framework dependent on Quality Function Deployment (QFD) in the Internet of Things (IoT) condition, in this study, with the help of IoT innovation, Registry Service Selection (RSS) strategy is utilized to fabricate quiet assistance model to accomplish the detection and reminder of patient's physical condition.

Keywords: Medicine pill,Quality Function Deployment, Internet of Things, Registry Service Selection

1. INTRODUCTION

There can be many individuals out there who need constanthelp, may it be our older adults, family members, theones who have special needs. Elders are more affected by thetiming of taking a certain drug than others. To preventany dysfunction or illness, timing is a must [1, 2].But as with aging comes poor eyesight and poor memory,what if the patient has dementia-like Alzheimer. Somepeople may forget to take the medicines at the correct time andforget the medicines they have to take. Toeliminate the factors of always needed observation like nursesor taking the risk of a missed dose, we had to find an easy,portable and efficient solution.

Pillboxes already exist, butmost of them have limited use, don't fit for elder ages, or even have a big size that makes themunsuitable to take itwith you anywhere [3, 4]. Making a useful smart pillbox had to beeasily integrated with the recent sweeping smart technologies.While at the same time, it had been fit for the elders and theirlimited knowledge and experience to implement the ease ofuse. Size and portability was also an important fact

that wehad to keep in mind [5-7].It's connected through a wireless network for it to be called smart, which enables it to be connected to the internet forfuture applications and integration.

Also, it is distinguished bythe wide range of Wi-Fi instead of Bluetooth or any otherfield communication and erase the need for any wires or wiredconnection, which enables portability in the first place [8,9].Through that same network, it's connected to the mobile phone,which with it you can set the timing interval for the dose andnotifies you in many ways when the dose time comes. Also, we added a buzzer with a LED to make a type ofphysical warning so that it leaves you no choice but toremember the pill time and take it [10, 11].

As pills have taken such an important role in everyday life,there has been the past years an increase in the number ofmedical negligence cases related to incorrect medication given topatients, such as the case of the nurse who gave a patient aperson with paralysis instead of an antacid that was prescribed by thedoctor, causing the patient's death [12-13]. After seeing so manyof these cases,the correct person must take the correct pill at the correct time, otherwisetaking an incorrect one or not taking one at all may expose thepatient to several dangerous situations, ranging from mildhealth issues up to death [14-16].

2. REGISTRY SERVICE SELECTION SCHEME BASED PATIENT MONITORING AND MEDICINE REMINDER

The Medicine reminder system consists of a pillbox provided with a set of compartments. It is designed in such a way that normal people can use it easily for their medication. The pill box's control system consists of LEDs for giving visual alerts to the patient for medicine. There is a buzzer in the system which alerts the patient in audio form. It will buzz at a particular time. Within that time, the person has to press the key by taking medicine. Otherwise, the alert will be given in the form of SMS to the patient's caretaker by GSM module that the patient has not taken medicine at the time prescribed by the doctor. The buzzer and LEDs are giving the alerts at the proper time set by the caretaker.

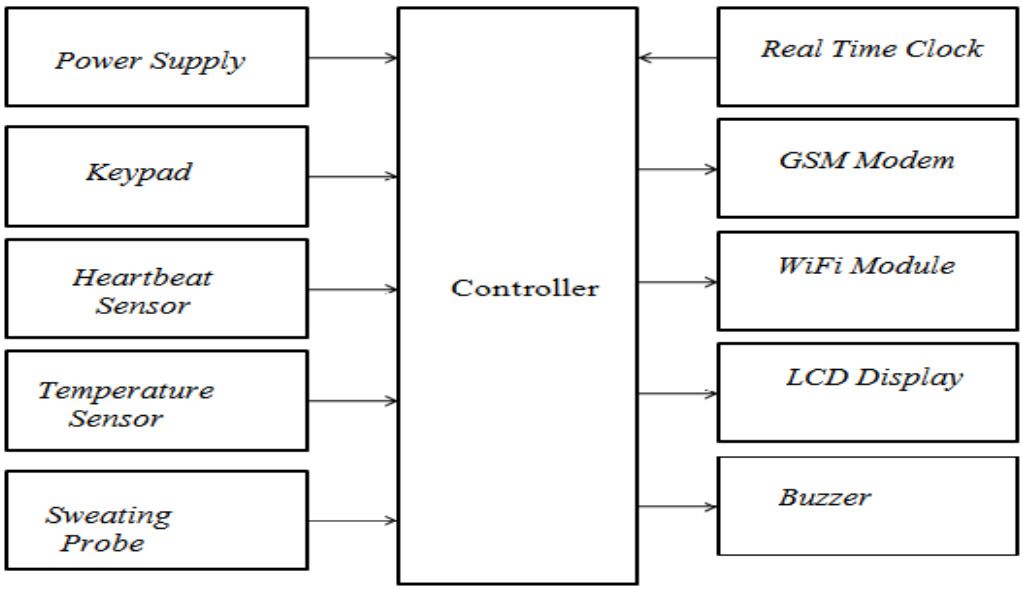

Figure 1 Block Diagram of Proposed System

The functional block diagram of the proposed system is shown in Figure 1. There are three sensors fixed in the system for monitoring the patient's health. They are the Sweating Probe, Temperature sensor and Heartbeat sensor for measuring sweat, patient temperature, and heartbeat, respectively. Temperature sensor LM35 and the sweating probe will provide the output in the Analog form given to the microcontroller and values are displayed on a website designed for monitoring purposes. The heartbeat sensor will generate the output in digital form, and it will also be given to the microcontroller. The value of the heartbeat will be displayed on the website designed.

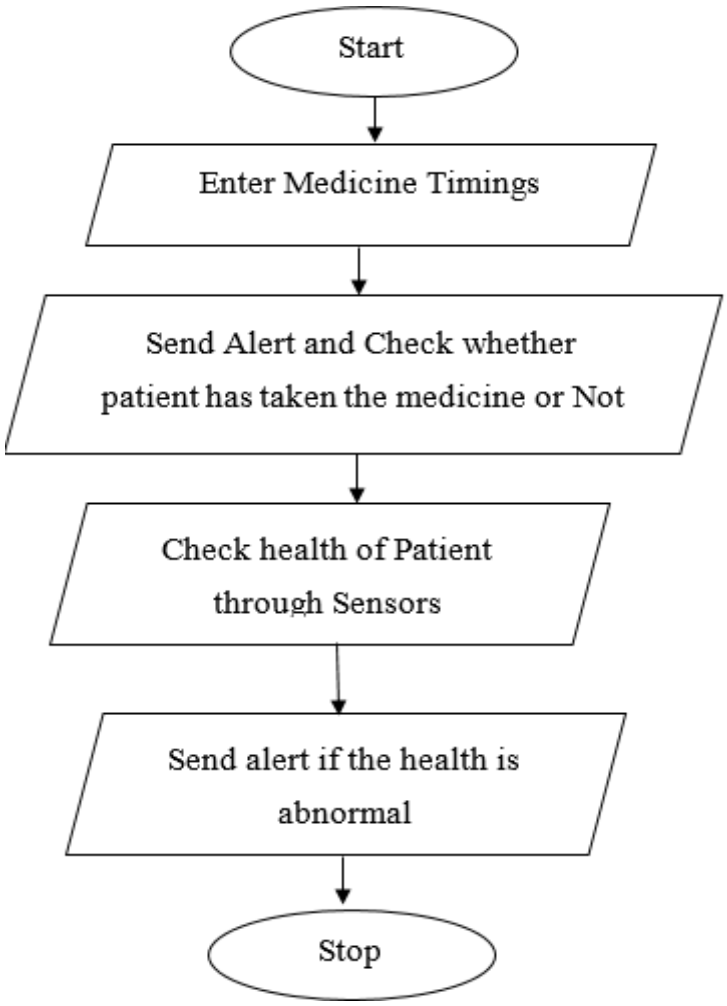

Figure 2 Flowchart of Proposed System

If the value crosses the reference values given in the program, then an alert will be given to the patient's caretaker in the form of SMS by the GSM module that the patient's health is not good.RTC DS307 is interfaced with Arduino by I2C interface, which keeps track of timings for medicine. If the power fails due to some reason,then it has the capability of automatic switching. LCD in the system will display the medicine name to the patient. The confirmation key interfaced to the microcontroller will provide digital output andbe pressed by the patient when it is taken

Wi-Fi module ESP8266 is provided for giving Wi-Fi functionality to the device to send the patient's data monitored by the sensors. It is interfaced with Arduino by using UART (Universal Asynchronous Transmitter and Receiver). GSM is also interfaced with the

controller by using a serial interface. The flowchart of the proposed system is shown in Figure 2

2.1 Registry Service Selection Algorithm for IoT security Enhancement

The proposed Registry Service Selection (RSS) security algorithm has been organized to provide close assistance to the information through distributed computing, be it in the cloud or entry. In this manner, various systems and available strategies are used to shield the primary data from unapproved parties. The recommended system is split into four phases. First, the design manages theclient's procedure of enrollment to Cloud Service Provider (CSP). The second stage operates the information in distributed storage. The third stage leads to the client validation on the data recovery request. Forward and the last step leads the registry information from the cloud by the confirmed client and sign of integrity of the recovered information, in this manner giving data back to the approved client with passing all security systems.

2.1.1 Stage 1 (Registration of cloud client to cloud specialist co-op)

The client should enroll himself with the cloud specialist co-op by providing its certifications, customer name, secret word, a versatile enlistednumber. The secret key is hashed with MD5 (apparently known Hashing procedure), and the CSP will safeguard the resultant hash code. Putting away the hash code of the watchword in the CSP database will keep the information from account capturing and inside work assault. In the wake of checking the client particulars, the CSP produces an OTP and sends it to the client, which is reentered by the client and confirmed by the CSP; this strategy keeps the client account secure unapproved individual login. At that point, clients should enter a CAPTCHA too, which makes it secure from the product intended for breaking passwords. This idea guarantees the manual entering of the client information.

2.1.2 Stage 2 (Storing of information in distributed storage)

This phase transmits and stores the information safely to the cloud in the scrambled frame. This stage is additionally isolated into three subsections: scramble data at the client's end, hash code era and encryption at the CSP end.

Encryption at client end: After the active enlistment with CSP, the information should now be exchanged to distributed storage. The client encodes the data by utilizing the Advanced Encryption Standard-based basic symmetric calculation and stores the produced open key at the customer end database itself, against the record ID designated to a scrambled document. The Advanced Encryption Standard (AES) calculation is taken because it can calculate accurately compared tothe Data Encryption Standard (DES) calculation.

Hash key generation at client end: The trustworthiness of the customer information is kept up by creating a hash code at the client's end by utilizing the MD5 hashing calculation and kept it up into a client database against a similar record ID. All hash calculations are one-way cryptographic strategies. Those produce a hash code that will be adjusted even one character is altered in the file, which is utilized to confirm the information's trustworthiness got again from distributed storage. This forestalls purposeful or incidental harm to the report.

Encryption at CSP end: The CSP receives figure content one of the sent records and applies another lopsided critical cryptographic method Rivest–Shamir–Adlema(RSA) at his end. This cryptographic method produces a couple of open and mystery keys. The figure content one is

again encoded with the general population key created by the RSA calculation, and the matched private key is transmitted in reverse to the confirmed client by the Diffie Hellman calculation in a truly secure manner which is put away by the customer in its particular database against a similar document ID. Presently, each document put away is scrambled twice, which counters the downsides of the past recommendations by a few specialists.

2.1.3 Stage 3 (User authentication on information recovery request)

The CSP must validate the client before allowing authorization for the data retrieval. The client needs to pass his login id, secret word and CAPTCHA to the cloud specialist co-op. The CSP coordinates and checks the certification to go with the subtle elements specified in its cloud catalog. After the test, the CSP sends an OTP to the client enrolled portable number. The client re-enters the OTP to the CSP to coordinate it and allows the customerto access distributed storage.

2.1.4 Stage 4 (Retrieval of information and integrity confirmation)

As communicated before, at whatever point the data is recovered from CSP, which will be in scramble mode. The confirmed client will get its particular database for the private key, hash code and open key against the brought record ID and change the data back in plain content mode. The clients vary the figure content two into figure content one by RSA private key, and after that, figure content changes to Plain content by AES symmetric key. At that point, the hash code is produced from the recovered natural material utilizing the MD5 hashing calculation. It matches it with the put-away key esteems. If it matches, else the CSP is educated on the lawful methodology, work is done.

Proposed RSS security Algorithm

Step 1: Registration of the client with CSP

(a) Enter User Particulars
(b) Choose Login_ID, PASSWORD
(c) Enter CAPTCHA, Mobile-Number

Step 2: if (Login_ID is substantial) at that point

(a) Generate a Private Key (PK) at CSP end and send it to the client by Diffie Hellman calculation User OTP← DH (PK)
(b) Enter the User OTP got on client enrolled portable
End
(c) If (Entered OTP == PK) at that point
(a) Message: New User is registered
(b) Go to step 3
End
Else If
(a) Message: Unmatched OTP and enrollment is wiped out
(b) Go to step 6
End
Else
(a) Message: Invalid Login_ID, Choose some other Login_ID
(b) Go to step 2
End

Step 3: Uploading of client record to CSP

(a) Select record FP in Plain content mode and role out an interesting document ID FID

(b) Generate a Hash code for the document

(i) HCFID← HASH CODE_MD5 (FPFID, FID)

(c) Generate asymmetric key USER Pub for FID by 3 DES calculation

(i) FC1FID←Encrpt_AES (FPFID, FID, USER Pub)

(d) Store HCFID and USER Pub in User's Database

(e) Send (FC1FID, User_ID) to CSP by means of SSL

(f) Generate a Public-Private Key match CSPPr, and CSP Pubby RSA deviated calculation

(i) FC2FID ←Encrypt_RSA (CSPPub, FC1FID, User_ID)

(ii) User ← DH (CSPPr)

(iii) Store CSPPr in User's Database

Step 4: User's Authentication Request to CSP

(a) Enter Login_ID, PWD, CAPTCHA

(b) If (Login_ID is substantial? && Password coordinated? && CAPTCHA coordinated?) at that point

(i) Generate a private key PK at the CSP end and send it to the client by Diffie Hellman calculation

(ii) User OTP← DH (PK)

(iii) Enter the User OTP got on client enlisted versatile

End

(iv) ElseIf (Entered OTP == PK) at that point

1. Message: Cloud get to is permitted
2. Send USER_ID to CSP
3. Go to step 5

End

Else

(i) Message: Invalid User Credentials, Reenter the right accreditations

(ii) Go to step 4

End

Step 5: Data recovery and Confirmation Process

(a) CSP will list all clients' document against that USER_ID

(b) The client will select FC2 FID from the rundown

(c) (FC2FID, USER_ID) will be sent back to client through SSL

(d) FC1FID←Decrypt_RSA(CSPPr, FC2FID, User_ID)

(e) FP FID←Decrpt_AES (FC1FID, USERPub, FID)

(f) NEW_HCFID ←HASH CODE_MD5 (FPFID, FID)

(g) If (NEW_HCFID == HCFID) at that point

(i) Message: File is recovered efficiently

(ii) Send ACK to CSP

End

Else

(i) Message: File is Corrupt
(ii) Send NAK to CSP and begin a lawful strategy
End

Step 6: EXIT

3. RESULTS AND DISCUSSION OF RSS WITH IOT BASED SMART HEALTHCARE SYSTEM

This section discusses the results and performance analysis of the proposed system. The designed Registry Service Selection (RSS) and Augmented Data Recognize security algorithm based IoT system and programming for medical evaluation structure have been analyzed. The performance of the proposed system is compared with the following existing methods.

a) Flexible Route Based Congestion Avoidance (FRBCA)
b) Distributed Route-Aggregation (DRA)

The enhanced methodology separates the execution of the work process into multiple stages, and at each step, data transfer capacity and assets are doled out autonomously. Furthermore, in each stage, the minimization strategy is actualized to designate the ideal number of belonging to the management complex in the present step. A calculation is expected to decide some scenes.

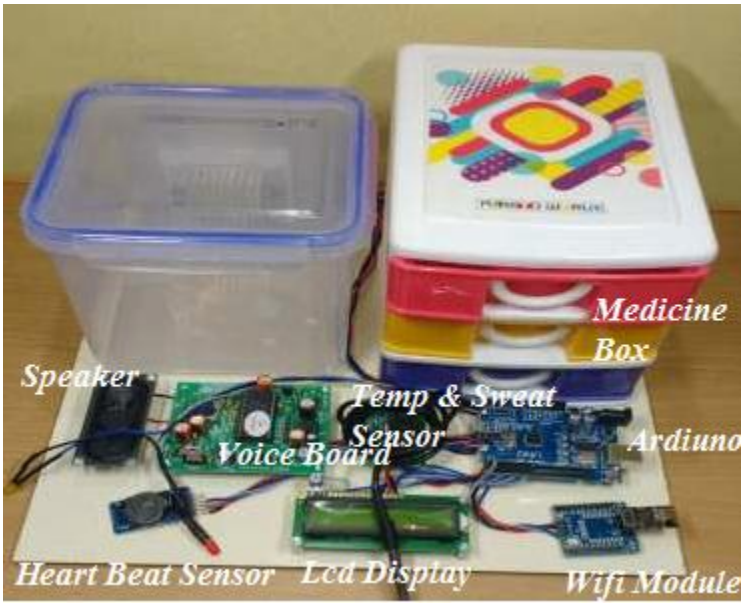

Figure 3 Prototype Model of Proposed Smart healthcare System

The Prototype Model of the Proposed Smart healthcare System is shown in Figure 3. The gadget helps in monitoring standard clinical taking exercises and lessens manual management and humanexertion. With basic hardware and exertion, the simple to-utilize and modest gadget come as an aid for the youthful and the old, a straightforward answer for moms for their teenagers, and guardians for the matured and languishing. Itcan discover its utilization in each family unit or emergency clinic with clinical oversight issues and be promoted as an effective answer.

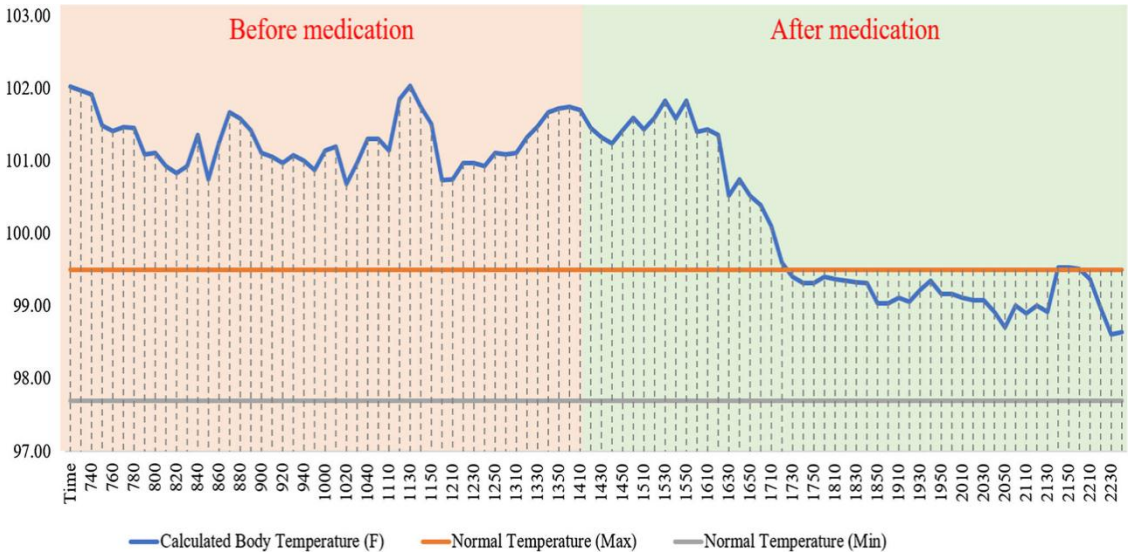

Figure 4.Measurement of Body temperature

Figure 4 shows the body temperature pattern captured by the proposed System for medication taken at12:10, which shows the body temperature before and after medication. As shown in this result, real-time body temperature is measured by the system sensors. Based on a smart set of rules, the fever medication content is specified and set for a specific time. The sensors continue to measure the temperature taken to ensure that the temperature is reduced to an acceptable leve1 even after the medication.

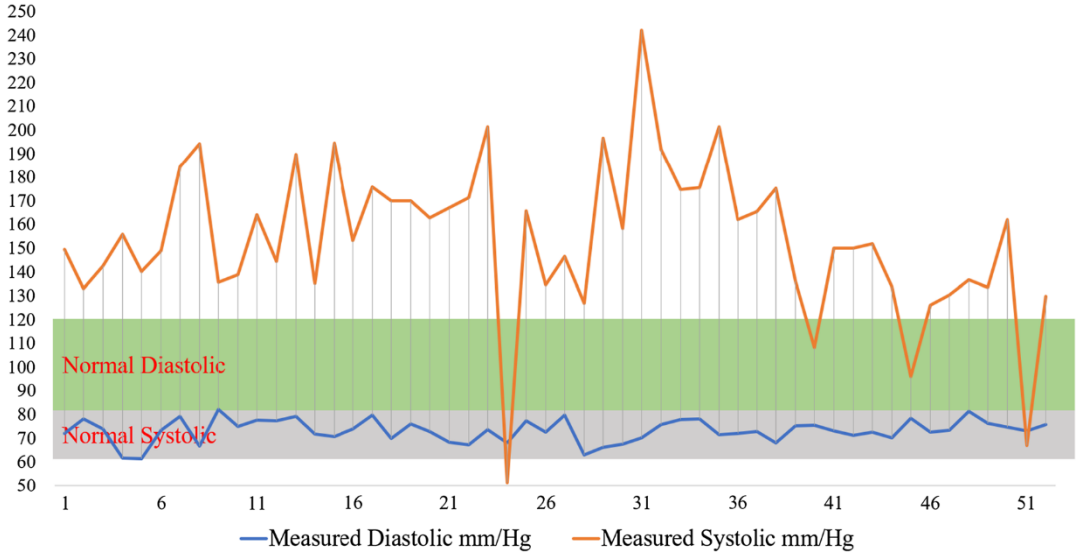

Figure 5 Measurement of Blood Pressure Measurement

Figure 5 shows the real-time measurement model, along with warnings in value in the case of blood pressure (contraction and dilation) exceeding a normal threshold. These warnings are further categorized as warning patients to take medication or alert/call for medical assistance in serious cases.

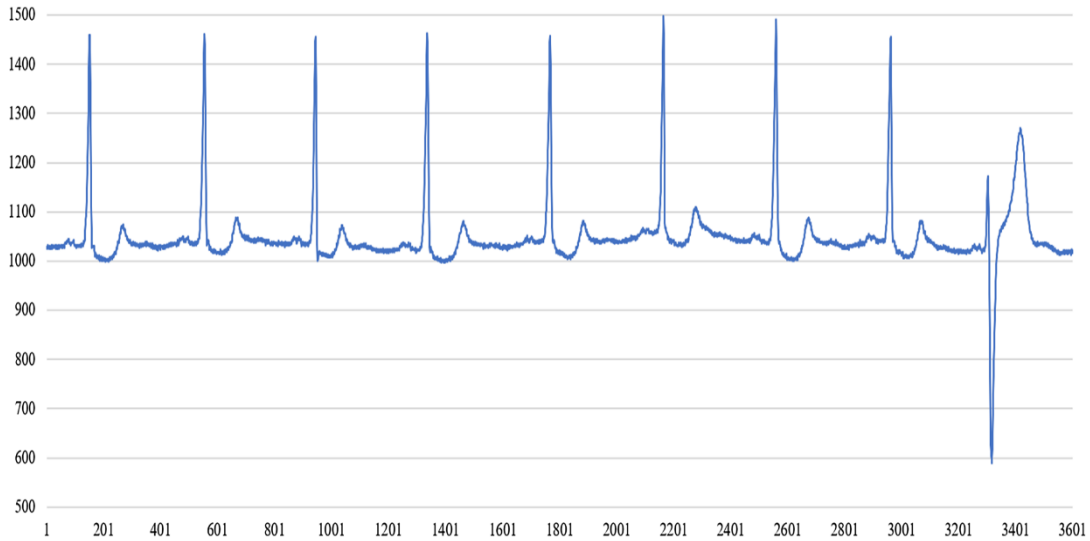

Figure 6 Measurement of ECG

Figure 6 shows the ECG model measurement. The system is well equipped to measure the ECG and take the necessary measure of emergencies and a web interface for both patients and medical staff.

Table 1 Comparison of Security Performancein (%)- RSS

Algorithms	Brute Force Attack(%)	Web-based Attack (%)	Unknown Attack(%)
FRBCA	074	072	071
DRA	081	079	076
RSS	085.5	080.2	082.3

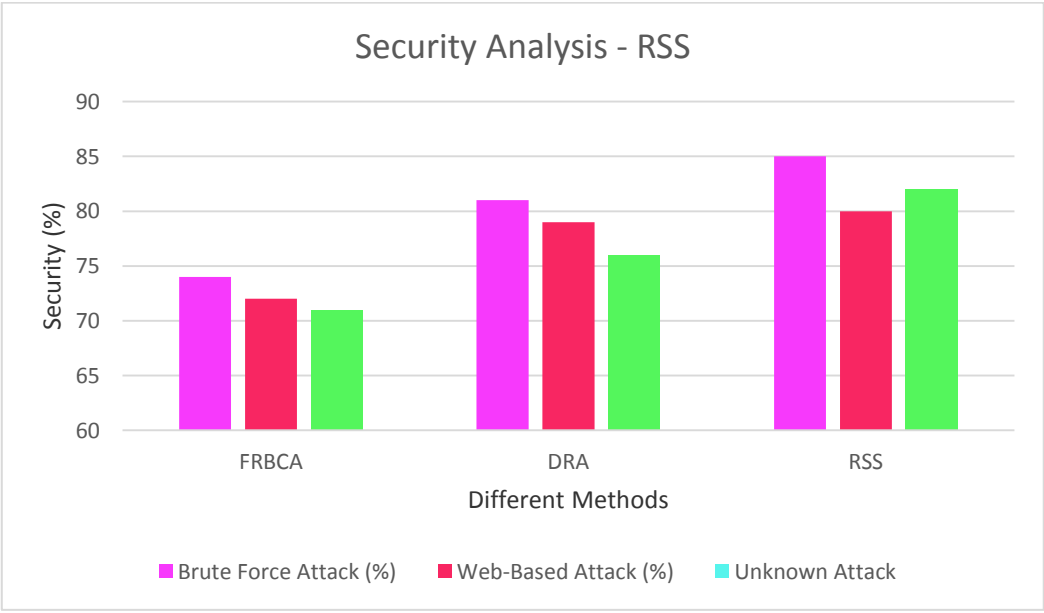

Figure 7 Comparison of security level using RSS

The performance analysis of different security attacks in the proposed RSS method with some other existing methods (FRBCA & DRA) is shown in Figure 7 and Table 1. As compared with existing Flexible Route Based Congestion Avoidance and Distributed Route-Aggregation methods, the proposed system's security level is increased. The brute force attack, web-based attack and unknown attack of the proposed RSS system are 85%, 80% and 82%.

Table 2 Comparison of Service Availability in (%) -RSS

Algorithms	1 million	2 million	3 million	4 million	5 million
FRBCA	85	80.5	78	77.12	74.26
DRA	87.96	85.14	81.01	76.56	75.89
RSS	93.12	91.02	89.56	87.24	85.10

Figure 8 Performance analysis - service availability routine using RSS

The proposed RSS method's service availability analysis with some other existing methods (FRBCA & DRA)isshown in Figure 8and Table 2compared with existing Flexible Route Based Congestion Avoidance and Distributed Route-Aggregation methods, the service availability ratio of the proposed system is increased. The service availability ratio of FRBCA, DRA and RSS is 74.2%, 75.89% and 85.10%, respectively.

Table 3 Comparison of Time Complexity in (sec) -RSS

Algorithms	10 Locations	50 Locations	100 Locations
FRBCA	3.2	2.9	2.5
DRA	2.5	2.1	1.75
RSS	2.1	1.95	1.4

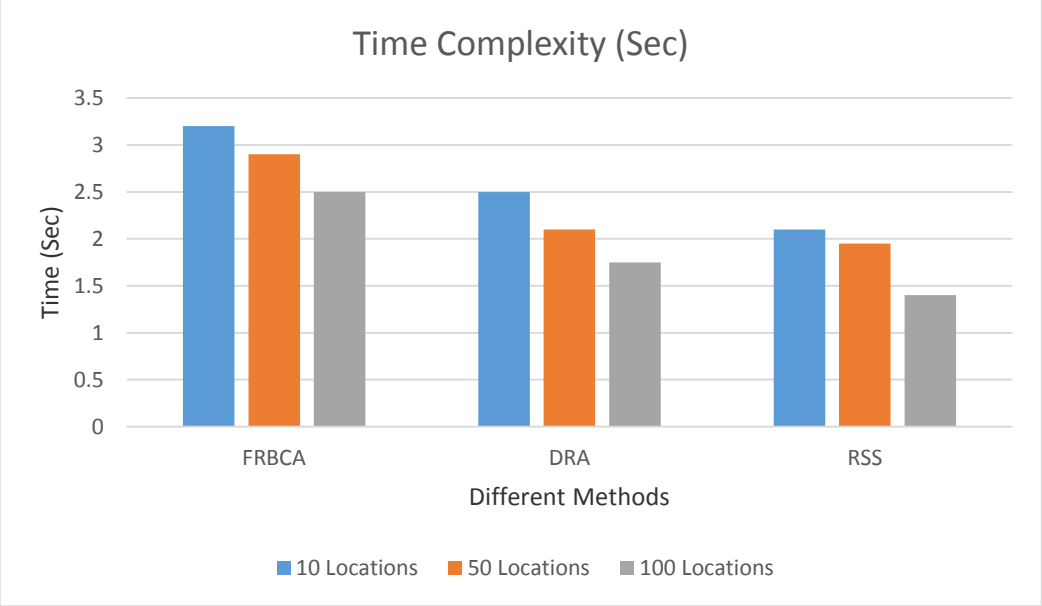

Figure 9 Time complexity of proposed RSS

Figure 9 and Table 3shows the performance analysis of Time complexity using different methods. This comparison clearly says that as compared with existing methods, the proposed RSS gives a low time complexity value against conventional methods. As compared with existing methods, the proposed RSS method takes minimum time complexity. RSS's time complexity is 2.1sec from 10 locations, the time complexity of RSS is 1.95sec from 50 locations, and the time complexity of RSS is 1.4sec from 100 locations.

4. CONCLUSION

From the consideration of all the above focuses,it is reasoned out that the primary objective of this work is to outline and arrange theweb-empowered circulated control application stage for smart health care system withPC-based control. This is the critical perspectivefor executing LAN based industrial automation with a web network to control unapproved clients for the industrial safety management system. The proposed approach enables a model-based safety framework for industrial automation systems. However, the current approach is restricted to discrete-time models. This limitation shall be addressed in future work by adopting a hybrid approach for modelling the continuous dynamics of plants and the control logic's discrete nature. It describes an IoTbased Reconfigurable smart WSNs unit for technical safety parameters monitoring. The system can collect sensor data intelligently. It is designed based on the application of wireless communication. It is very suitable for the high-speed data acquisition system's real-time and practical requirements in the IoT environment.

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