Zero Queue Maintenance System using Smart Medi Care Application for Covid-19 Pandemic Situation

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Abstract— **Many health care organizations around the world are providing treatment for people with numerous medical staff and dedicated equipments for various diseases. Many health care organizations are encountering colossal challenges and difficulties during the COVID-19 pandemic period. Many people around the globe are not even visiting the hospitals even for their periodical check up thinking that there is a huge possibility of getting the spread during the waiting time in the queue. So, in order to drive out the fear from the people and to provide a minimum staying time in the Hospital premises during the visit, research work proposes a Zero Queue Management System (ZQMS). This system also provides the people to book an appointment with the doctor based on availability of the doctor. It also supports the users to make online payment for their visit and facilitates them to cancel the appointment in case of change of plans. This system will also maintain the patient's previous visits and maintains the medical records for their easy accessibility. User can also make use of waiting list option available in the mobile application to enroll their name in waiting list in order to intimate them regarding any cancellation of appointment with their doctor by any other patients.**

Keywords— *Internet of things (IoT),Zero Queue Management System (ZQMS), android Application, Medicare, Cloud Server*

I. INTRODUCTION

An Internet of Things (IoT) system comprises of electronic devices or sensors that communicates to the cloud platform through some sort of internet connectivity. After the data reaches the cloud, it is get processed by software and takes decision based upon the outcome. IoT has a huge impact on every fields like agriculture [12,13], health care, industries [14,15], security, energy monitoring and numerous other applications.

A few decades ago, people visit the hospital only during the time of sickness. At present the people have become more knowledgeable about their healthy life style. Now most of the people seek medical advice in advance to lead a safe and healthy life. Periodical health check-ups can assist in finding the major health issues in advance and treat them before it is converted in to life threatening factor. As on January 9, 2021 there are 89,381,906 Covid-19 cases identified all over the world [1]. In India alone there are 10,432,526 confirmed cases are identified out of which 2, 21,405 are in active condition [2]. Figure 1 depicts the number of Covid-19 cases in India.
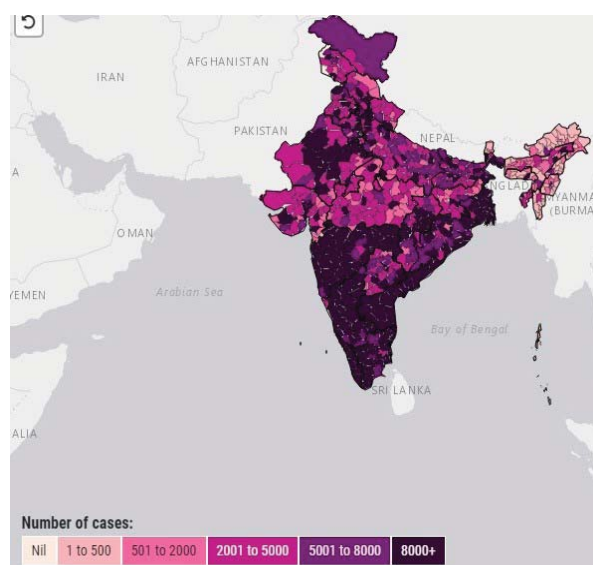

Fig.1. State wise Covid-19 current cases in India

Due to the COVID-19 pandemic impact, outpatients visit to the hospitals has reduced drastically because of the life-threatening fear created by the disease. Aged persons, pregnant women, and new born child are extremely distressed due to the pandemic. The poll was organized to find out the reluctant behavior of the people in visiting the doctor during Covid-19 situation [3]. The poll results clearly projected that nearly 43% of the respondents has cancelled their appointments during the pandemic time. This reluctant behavior is due to the fear of impact of the spread. So, in order to drive out the fear among the people, the waiting time in the queue at hospital premises before meeting the doctor has to be completely eradicated. Hence, we propose a Zero Queue Maintenance System (ZQMS) using Smart Medicare Application. This system helps in removing the waiting time concept in the hospital. This system also facilitates the user to book and cancel the appointment in advance. The payment facility is also made online so that the chance of spread of disease during the money transfer can be removed. The patient can also view their previous history and medical records any time. Patient those who are waiting to get an appointment with the doctor also smartly managed by the Cloud Server.

A survey was released by Statista on March 2020 and it is found that India has less number doctors to attend the patients [16] which is depicted in figure 2. Due to this reason, the patients waiting time in Indian hospitals also increases which may lead to various outcomes which is elaborately discussed in figure 3 [17]
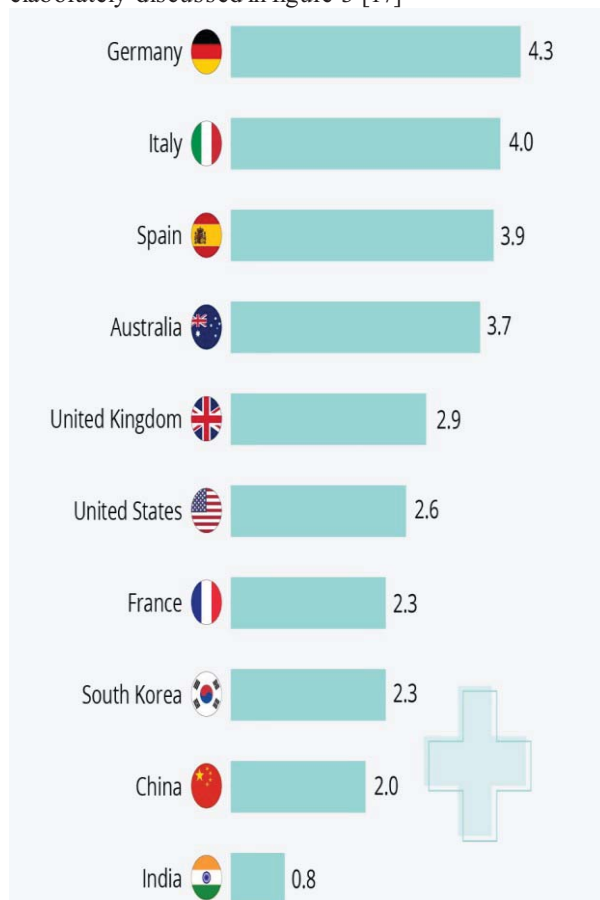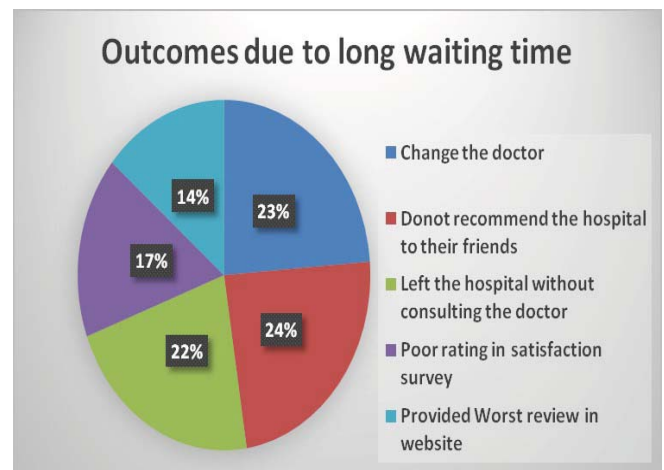

Fig.2. Number of doctors / 1000 people

Fig.3.Outcomes due to long waiting time

II. RELATED WORKS

Sumit Soman et al [4] proposed an innovative system which is used to generate a unique token for multiple hospitals for managing the queue in the hospitals. Charity Ojochogwu Egbunu et al [18] proposed a smart queue management system in which booking an appointment with the doctor and making payment for the medication received are performed using online mode. This system also uses GSM facility to send message regarding the admission booking status to the user. Chandran et al [5] proposed a multiple queue management system which maintains separate queue for each doctor and facilitates the patient to manage the waiting time effectively by confirming the time of appointment through SMS. Yashwant Borate et al [19] suggested android application-based healthcare management system which facilitates various options like booking an appointment, generating the treatment bills and maintaining the patient record. This system also supports cancelling the appointment and it is intimated through SMS. Supriya Burungale et al [6] proposed patient queue management system, which calculates the waiting time of all patients and schedule the online appointment.

Hedau et al. [7] proposed an android application for queue organization scheme, in which the appointments are booked with doctors and notification is sent through SMS in order to minimize the waiting time of patients in the hospital. Aizan et al [8] proposed a method using an android phone in which the token dispenser and alerting machine is replaced with an android phone with application and the intimation of the visit is sent through SMS. Arun et al [9] proposed a queue management system by interfacing microcontroller with PC to intimate the status of the queue with the help of GSM. Luschiet et al [10] proposed a mobile application for patients and health care staff to efficiently manage the crowd entering into hospital and to guiding the people inside the hospital through a hospital map facility. Ngorsed [11] proposed a wireless technology-based queue management system for managing the waiting time in the queue.

III. PROPOSED SYSTEM

Our ZQMS system uses an Android Application named "Smart Medicare" which facilitates the work of both

TABLE I: Comparison of Existing Methodologies

Author	Title	Hardware used	Uses Mobile App.	Booking an Appointment	Cancelling an Appointment	Make online payment	Providing Waiting list facility	SMS alert
Sumit Soman et al [4]	Mobile-Augmented Smart Queue Management System for Hospitals	X	✓	✓	X	X	X	✓
Charity Ojochogwu Egbunu et al [18]	Queue Management in Non-Tertiary Hospitals for Improved Healthcare Service Delivery to Outpatients	GSM	✓	✓	X	✓	X	✓
Chandran et al [5]	Multiple Queue Management With Real Time Tracking For OPD Scheduling In Hospitals	X	✓	✓	✓	X	✓	✓
Yashwant Borate et al [20]	Healthcare Management System in Android – "meD4U" Application	X	✓	✓	X	X	X	✓
Hedau et al. [7]	Patient queue management system for hospitals	GSM	✓	✓	X	X	X	✓
Aizan et al [8]	'Walk-Away' Queue Management System Using MySQL and Secure Mobile Application	X	✓	✓	X	X	X	✓
Luschiet et al [10]	Careggi Smart Hospital: a mobile app for patients, citizens and healthcare staff	X	✓	✓	X	X	X	✓
Supriya Burungale et al [6]	Patient Queue Management System	GSM	X	✓	X	X	X	✓
Arun et al [9]	Smart Queue Management System Using GSM Technology	GSM	X	✓	X	X	X	✓
Ngorsed [11]	Hospital Service Queue Management System with Wireless Approach	X	X	✓	X	X	X	X

patients and hospital staff. This system was introduced mainly to reduce the time spent at hospital premises. This Application helps the patient right from appointment fixing process to online payment process. The System Architecture is explained in the figure 4. Once the doctor enters his cabin, he registers his finger print to ensure his availability in the cabin. As soon as the finger print is received, the Arduino updates the presence of the doctor to the cloud server through Wi-Fi module. The cloud server then updates the information in the website.

Similarly, when the doctor leaves the cabin (in case of emergency or personal work) he has to register his fingerprint to indicate his non availability. A Smart Medicare Android Application is used by the doctors, administrators, hospital staff and patient to execute their task in a simple way.
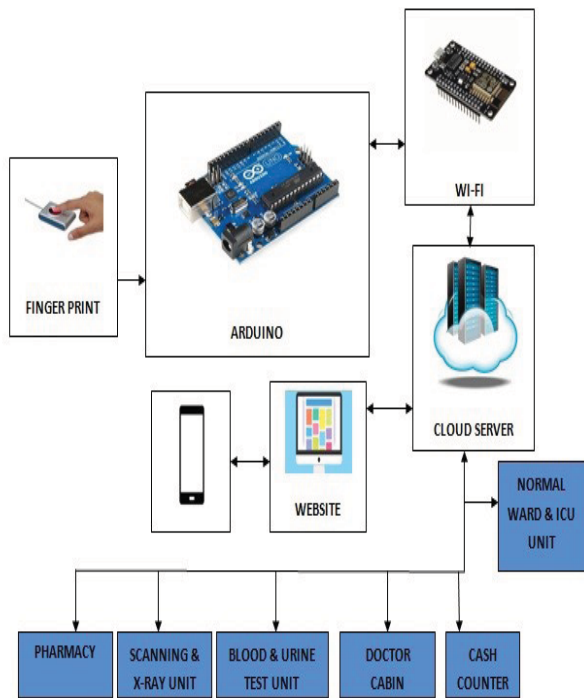
Fig.4. System Architecture of ZQMS

communicate with various units like pharmacy, Scan & X-Ray unit, urine & blood test unit, ICU unit and Cash counter for further processing after the treatment. Doctor can also allot another doctor in case of emergency work for attending his patients through the emergency call option available in the mobile application.

Figure 5 explains the appointment booking process in detail. The appointment booking process has following steps.
Step 1: First the patient should enter the user name and password.
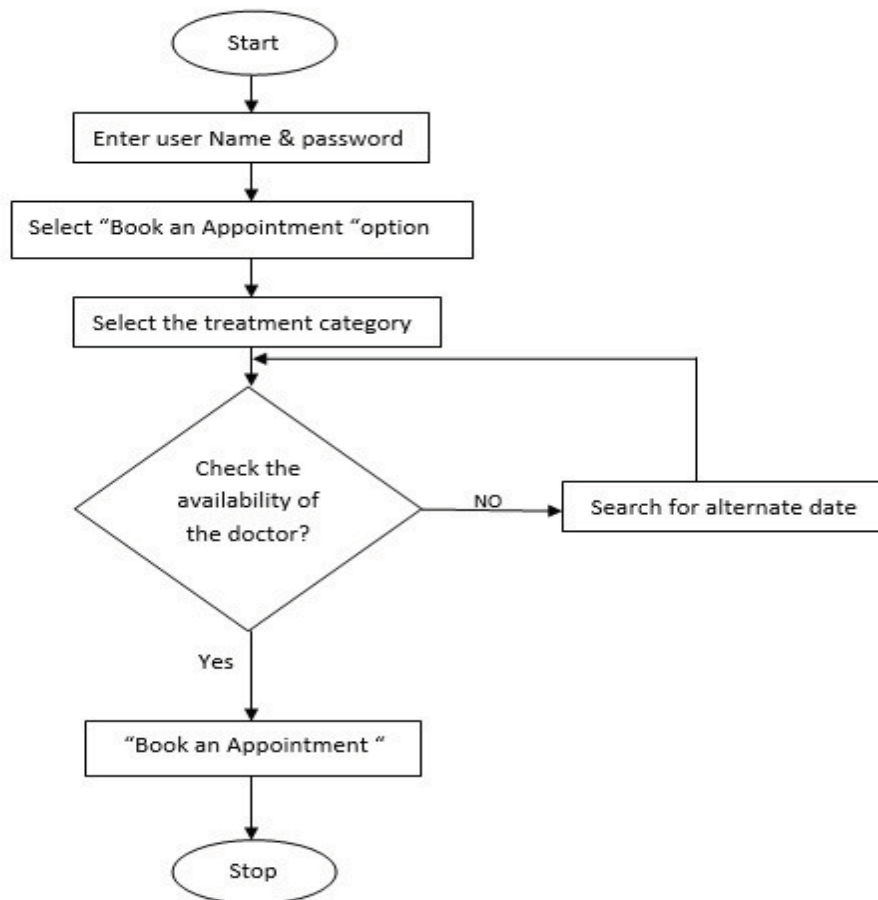Step 2: From the list of options displayed select book an appointment option.
Step 3: Then select the treatment category
Step 4: Check for doctor's availability for the specified date and time.
Step 5: If doctor is available during the specified time book the appointment or else search for another date
Figure 6 explains the appointment cancelling process in detail. The appointment cancelling process has following steps.
Step 1: First the patient should enter the user name and password.
Step 2: From the list of options displayed select cancel an appointment option

The Patient can perform various actions like book an appointment with the doctor, cancel an appointment, register his grievances, perform online payment, check doctors' availability, track any location inside the hospital and track the previous history of the visit. The doctor can

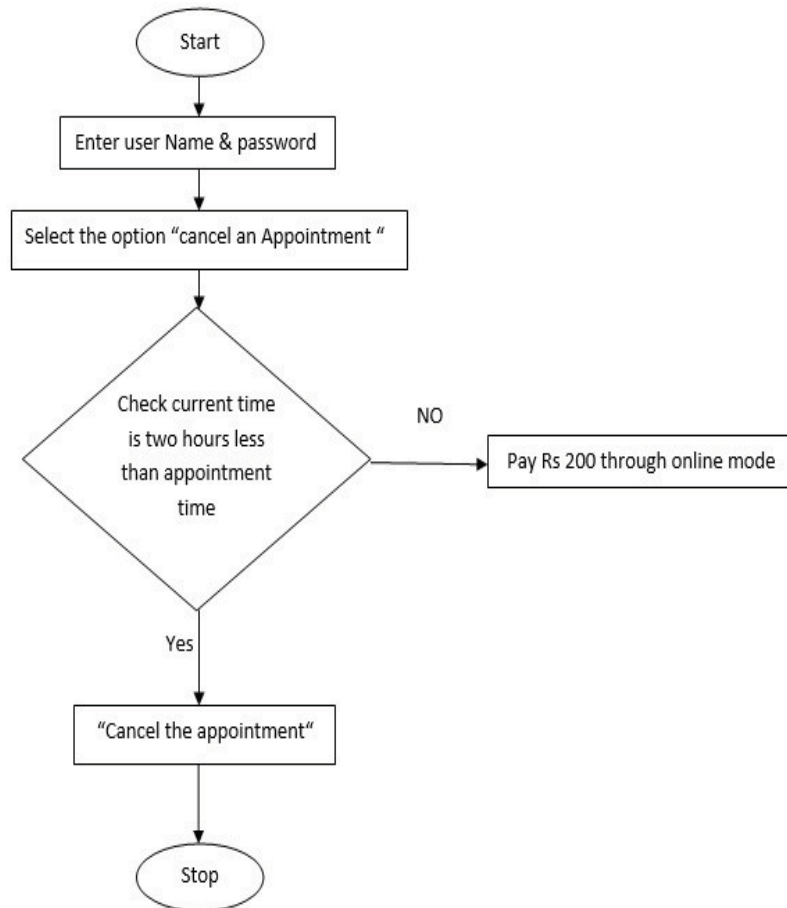**Fig.5. Appointment booking process**

Fig.6. Appointment cancelling process

Step 3: Now the current time is checked with appointment time.

Step 4: If the time difference between the current time and appointment time is less than 2 hours, cancellation of appointment is done only after the payment of Rs.200/-.

IV. RESULT & DISCUSSION

Android application is used by patients and doctors majorly in order to reduce the patient staying time in hospital premises. Here figure 7 depicts the welcome screen. By selecting the option Proceed, the application will direct the people to user selection page. The user selection page is depicted in figure 8.

Once any one of the options is selected by the users, the application will direct he users to Login Page which is depicted in figure 9. Figure 9 explains the patient login screen where the patient has to enter the user name and password to enter into application to use its facility. If the user is new, he has to select the enroll option and give his personal details. Figure 10 depicts patients option selection page. The user can perform various tasks like booking an appointment, cancelling an appointment, check the availability of the doctor, make payment after consulting, register the grievances, track any location in the hospital and view previous history of their visit.
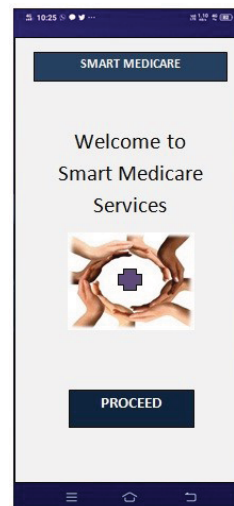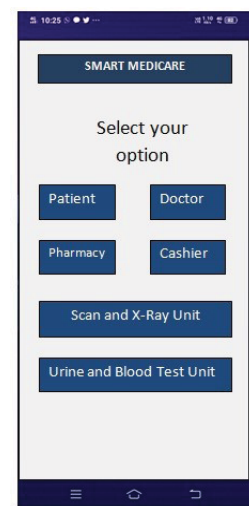

Fig.7. Welcome screen   Fig.8. User selection screen

Figure 11(a), 11(b) and 11(c) explains the appointment fixing process. First the patient has to select the treatment category. Then the patient has to select the doctors name from the list provided by the system and then the patent has to select the date and time of the appointment. If the doctor is free during the specified time then the patient can fix the appointment. After fixing the appointment,

appointment confirmation will be displayed to the patient. Here the token will be generated for the patient and the system also intimates the warning time limit for the cancellation of an appointment.
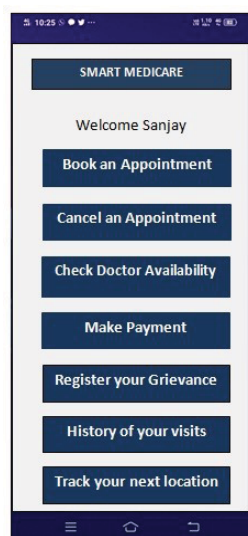

Fig.9.Patient login

Fig.10. Patient's option selection

Figure 12 (a) & 12 (b) explains the appointment cancelling process. The patient has to select cancel an appointment option. Then the system checks the time of cancellation with appointment fixed time.

(a)

(b)

(c)

Fig.11. a, b, c Appointment Fixing process

If the time difference between the current time and appointment time is found to be more than 2 hours then the appointment can be cancelled without charging any fare. If the time difference between the current time and appointment time is less than 2 hours, cancellation of appointment is done only after the payment of Rs.200/-
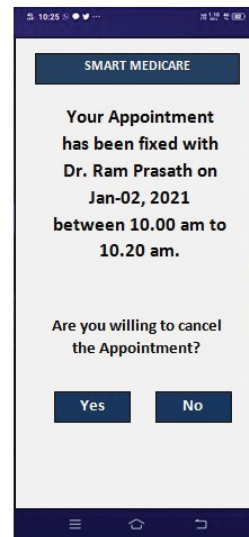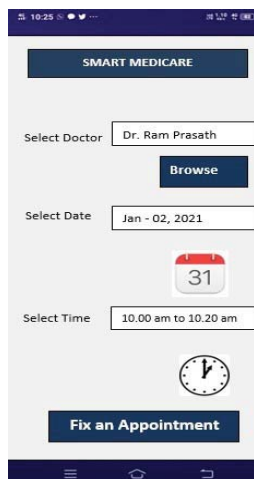

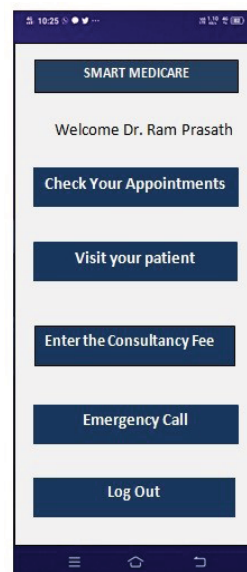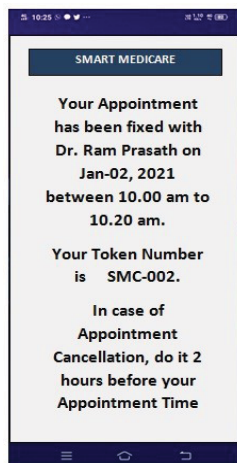(a)
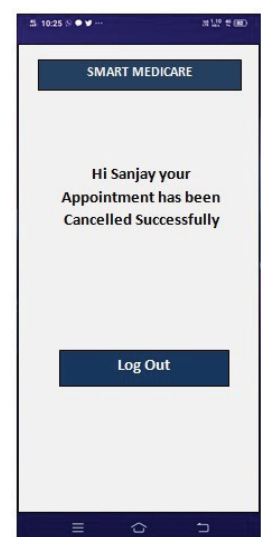
(b)

Fig.12. a, b Appointment Cancellation Process

Fig.13.Doctors option selection

Fig.14. Update of Patient Diagnosis report

Figure 13 depicts Doctors option selection page. The Doctors can perform various tasks like checking the daily appointments, Changing the duties to other doctors during emergency situation and sending the consultancy fee report to cashier. Figure 14 depicts the updating the patient diagnosis report process. Here the doctor prepares the diagnosis report of the patient and send it to various sources like pharmacy, urine & blood test unit and Scan & X-Ray unit.
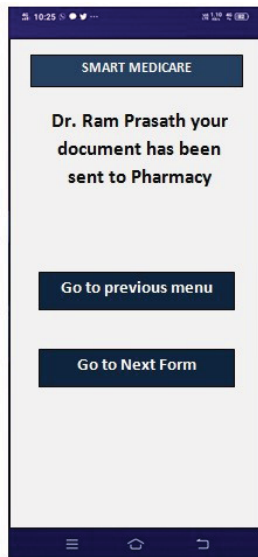
Fig.15.Diagnosis report transfer completion

Figure 15 depicts the diagnosis report transfer process. Once doctor prepares the diagnosis report, he sends it to pharmacy and to other units for further processing. When pharmacist receives the report, he packs the medicine and dispatches it to medicine collection room and updates the bill amount to cashier through online.

Cahier consolidates the amount received from various departments and prepares it as a single bill and updates it to web server. Once the bill is prepared intimation is sent to the patient through SMS regarding bill payment. After seeing the SMS, the patient will login into the application and makes payment through online.

A separate login id and password is provided for patients and other hospital staff to ensure the security. In order to view the medical records, the OTP will be generated and sent to registered mobile number of the user which has to entered for further actions. By this way we can provide security to stored patient's data. This system also provides the facility for online payments through 3 different options such as internet banking, UPI payment and card payment mode. In order to provide security during payment procedure a 4 digit OTP (One Time Password) mechanism is utilized.
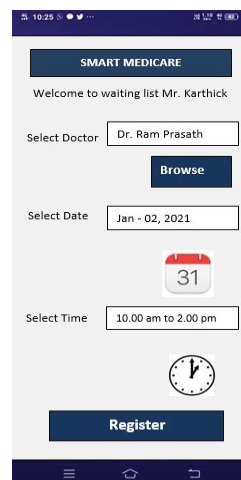

Fig.16.Waiting list enrolment

Whenever a patient cancels an appointment, our system sends SMS to patients those who have enrolled in waiting list option available in the application for an appointment with the doctor. The waiting list enrolment is explained in figure 16. Once the time slot is available, the system sends message to patient as explained in figure 17.

Fig.17.Free Slot intimation

Our system also sends alert message to patients regarding their hospital visit. This is explained in figure 18.
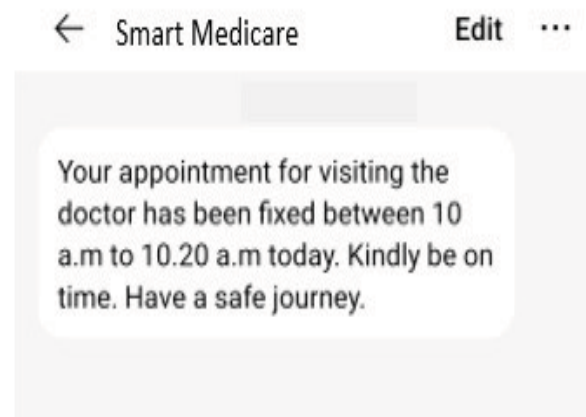

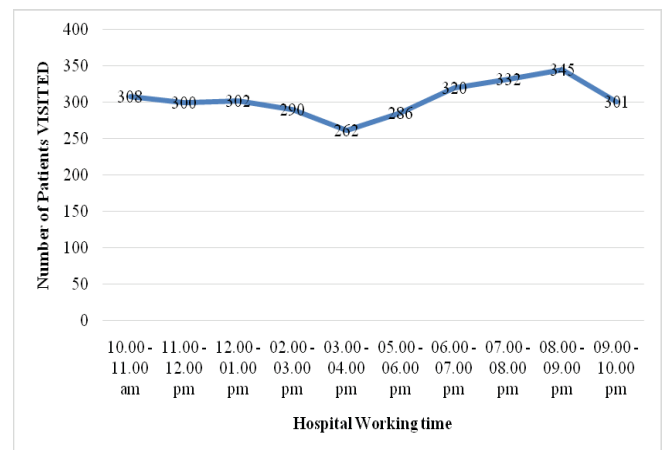**Fig.18.Alert message to patient**

Fig.19. Patient visited details

Figure 19 explains the patient visited details. The number of patients visited various departments for the period of one week is depicted in the figure. The time spent by a single patient in the hospital during his visits to the hospital is depicted using the figure 20.
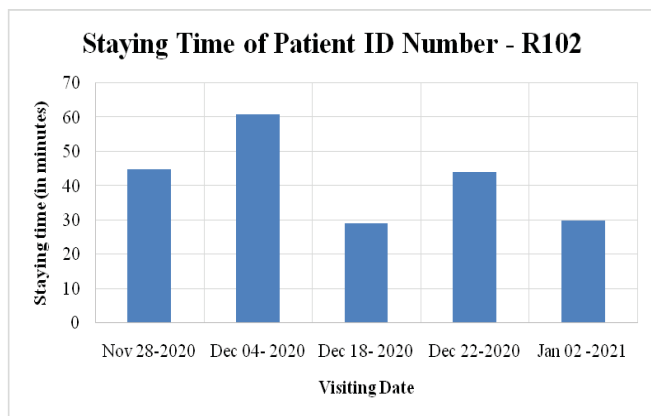
Fig.20.Patient staying time details

V.   CONCLUSION

ZQMS system uses Smart Medicare mobile application for maintaining the visiting time of the patients. Patient can book the appointment with the help of this mobile application. This system also supports the user to make online payment for their visit and facilitates them to cancel the appointment in case of change of plans. This system will also maintain the patient's previous visits and maintains the medical records for their easy accessibility. User can also make use of waiting list option available in the mobile application to enroll their name in waiting list in order to intimate them regarding any cancellation of appointment with their doctor by any other patients. By implementing this system, the people can visit the hospital without any fear since the system removes all practical difficulties related to waiting time faced by the people during their visit.

In order to enhance the security for our system, it can be implemented using blockchain so that the data can be effectively managed.

REFERENCE

[1] https://www.worldometers.info/coronavirus/
[2] https://fieldmaps.in/covid19/
[3] https://www.hospitalmanagement.net/news/covid-19-impact-on-routine-appointments-to-hospitals-doctors/
[4] Sumit Soman; Sudeep Rai;Priyesh Ranjan; Amarjeet Singh Cheema; Praveen K Srivastava " Mobile-Augmented Smart Queue Management System for Hospitals", International Symposium on Computer-Based Medical Systems (CBMS), September 2020
[5] Prof. D. V. Chandran, Divya Patil, Pooja Galande, AratiGhutukade, " Multiple Queue Management With Real Time Tracking For OPD Scheduling In Hospitals", International Journal for Research in Engineering Application & Management, Volume 3, isuue 2, April 2017
[6] SupriyaBurungale, Komal Kurane, Sakshe Mhatre, " Patient Queue Management System" ,*International Journal of Engineering Science Invention, voume 7, issue 2, February 2018*
[7] K. Hedau, N. Dhakare, S. Bhongle, S. Hedau, V. Gadigone, andN. Titarmare, "Patient queue management system,"International Journal of Scientific Research in Computer Science, Engineering and Information Technology, Volume 3, Issue 3- 2018.
[8] L. Aizan, A. Z. Mukhtar, K. A. A. Bashah, N. L. Ahmad, and M. K.A. M. Ali, "'walk-away'queue management system using mysql andsecure mobile application," Journal of Electrical Power and ElectronicSystems, vol. 1, no. 1, 2019.
[9] R. Arun and P. Priyesh, "Smart queue management system using GSMtechnology," Advanced in Electronic and Electric Engineering, vol. 3,no. 8, pp. 941–950, 2013.
[10] Luschiet, A. Belardinelli, L. Marzi, F. Frosini, R. Miniati, " Careggi Smart Hospital: a mobile app for patients, citizens andhealthcare staff", IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI), 2014
[11] M. Ngorsed and P. Suesaowaluk, "Hospital service queue managementsystem with wireless approach," in Frontier Computing. Springer, 2016,pp. 627–637.
[12] R. Santhana Krishnan , E. Golden Julie , Y. Harold Robinson , S. Raja , Raghvendra Kumar , Pham Huy Thong , Le Hoang Son "Fuzzy Logic based Smart Irrigation System using Internet of Things", Journal of Cleaner Production, Volume 252, 10 April 2020, 119902
[13] C Ramasamy Sankar Ram, S Ravimaran, R Santhana Krishnan , E Golden Julie , Y Harold Robinson , Raghvendra Kumar , Le Hoang Son, Pham Huy Thong, Nguyen Quang Thanh and Mahmoud Ismail "Internet of Green Things with autonomous wireless wheel robots against green houses and farms", International Journal of Distributed Sensor Networks, Volume 16, Issue 6, June 2020
[14] Divya K.Lakshmi Narayanan, G.P.Ramesh "Robust and Brittle Secured Video for IoT" in International Journal of Engineering and Technology, 7 2.20, 93-96, 2018.
[15] K.Lakshmi Narayanan, Mr.J.Ganesan, Mr.Kasinathaguru, "Intranet Based Multiple Equipment Controller with Text Panel", Irish Interdisciplinary Journal of Science & Research, Vol.4, Iss.3, Pages 120-126, July-September 2020.
[16] https://www.statista.com/chart/21168/doctors-per-1000-inhabitants-in-selected-countries/
[17] https://www.softwareadvice.com/resources/reducing-patient-wait-times/
[18] Charity Ojochogwu Egbunu, Oluoha Onyekwere and Sonter Pascal Atsanan, "Queue Management in Non-Tertiary Hospitals for Improved Healthcare Service Delivery to Outpatients", International Journal of Applied Information Systems (IJAIS), Volume 12– No.31, July 2020
[19] Yashwant Borate, Parag Patel, Jinal Kelshikar, Ravindra Sangle, "Healthcare Management System in Android – meD4U Application ", International Research Journal of Engineering and Technology, Volume: 07 Issue: 10, Oct 2020.