Literature Review

Linda V. Green, Sergei Savin (2007): “Reducing Delays for Medical Appointments: A Queuing Approach”, Operations Research, Volume 56, No. 6, ISSN 0030-364X. This research results demonstrate the usefulness of the queuing models in providing guidance on identifying patient panel sizes for medical practices that are trying to implement a policy of “advanced access.”


Diwakar Gupta, Brian Denton (2007): “Appointment Scheduling in Health Care: Challenges and Opportunities”, IIE Transactions, Volume 40, ISSN: 0740-817X. In this paper, we summarized key issues in designing and managing patient appointment systems for health services.


Zhu Z. C., Heng B. H., Teow, K. L. (2009): “Simulation Study of the Optimal Appointment Number for Outpatient Clinics”, International Journal of Simulation Modeling, Volume 8, No. 3, ISSN 1726-4529. This paper study the appointment scheduling systems in outpatient clinics to determine the optimal number of appointments to be schedule in one session with criteria of different performance indicators and consult room configurations.


Abhijit Chakravarty (2011): “Evaluation of Service Quality of Hospital Outpatient Department Services”, Medical Journal Armed Force India, Volume 67, issue 3, DOI: http://dx.doi.org/10.1016/S0377-1237(11)60045-2. In this article study was
conducted at a peripheral service hospital to ascertain any service gap between consumer expectations and perceptions in respect of the hospital outpatient department (OPD) services.

**Srividya Bhat, Nandini S. Sidnal, Ravi S. Malashetty, Sunilkumar. S. Manvi (2011):** “Intelligent Scheduling in Health Care Domain”, International Journal of Computer Science Issues, Volume 8, Issue 5, ISSN (online) 1694-0814. The paper work integrates accessing distributed health care services in multi-agent environment to achieve better Quality of service by using java platform. This develops a framework to schedule the meeting between the patients and the relevant doctors meeting in an efficient way for routine and emergency services.

**C. Kavitha, A. Venkat Ramana, S. Sushma Raj(2012):** “Embedded Management System for Out Patient Department”, International Journal of Embedded Systems and Applications (IJESA), Volume 2, No.3, DOI : 10.5121/ijesa.2012.2305. The authors create the embedded based device to assist patients to easily locate the doctor’s cabin. The device displays the patient’s name and token number outside of the consultant’s room. Out patients who wish to consult a particular doctor finds it very difficult to locate their respective doctor’s cabin.

**G. Mageshwari, E. Grace Mary Kanaga(2012):** “Literature Review on Patient Scheduling Techniques”, International Journal on Computer Science and Engineering (IJCSE), Volume 4, No. 03, ISSN : 0975-3397. This paper researcher describes the challenges of patient scheduling and patient scheduling techniques. They provide an option of patient scheduling with Multi-agent System; Distributed Computing; Coordination.

**Neelu Puri, Anil Gupta, Arun K. Aggarwal, Vipin Kaushal, (2012):** "Outpatient Satisfaction and Quality of Health Care in North Indian Medical Institute", International Journal of Health Care Quality Assurance, Volume 25 Issue-8, doi: 10.1108/09526861211270631. The purpose of this paper is attempted to fulfill the need to monitor the quality of care and patient satisfaction for continuous quality improvement.

**Dr. Sandesh Kumar Sharma, Dr. Sudhinder Singh Chowhan (2013):** "Patient Waiting Time: It’s Impact on Hospital Outpatient Department”, International Journal Of Scientific Research, Volume : 2 , Issue : 3 , ISSN: 2277 – 8179. The paper describes
how the waiting time of patient impacts on hospital. This helps to determine various sequential movements and time taken for each movement in the OPD section and eliminate the unnecessary movement and time of patient.

**Dr. Sandesh Kumar Sharma, Dr. Sudhinder Singh Chowhan (2013)**: “Patient Survey to Measure the Quality of Care Provided by Health care Providers in OPD of Tertiary Care Hospitals”. Indian journal of research, Volume 2, Issue 2, ISSN: 2250-1991. This research paper investigated a set of dimensions that contribute to effective hospital management and sequential hospital operations. The study established reliable and valid scales and dimensions that effect hospital effectiveness and identified the gap between the optimal and actual performance perceived by outpatient visit.

**Fatma Poni Mardiah, Mursyid Hasan Basri (2013)**: “The Analysis of Appointment System to Reduce Outpatient Waiting Time at Indonesia’s Public Hospital”, Human Resource Management Research, Volume 3, No. 1, ISSN: 2169-9607. This research aims to provide a study of the major causes of patients length of time for medical treatment in an outpatient clinic at one of Indonesian public hospital and also provide recommendation on the best strategy to improve the appointment system so that can maximize the effectiveness and efficiency of resource and capacity.

**Hyun-Jung Oh, Ana Muriel, Hari Balasubramanian, Katherine Atkinson, Thomas Ptaszkiewicz (2013)**: “Guidelines for Scheduling in Primary Care Under Different Patient Types and Stochastic Nurse and Provider Service Times”, IIE Transactions on Healthcare Systems Engineering, Volume 3, ISSN: 1948-8300. This research present a study to propose a new patient classification scheme and formulate a stochastic program to model the appointment sequencing and scheduling problem under the new classification.

**Ishan P Lade, Sandeep A Chowriwar, Pranay B Sawaitul (2013)**: “Simulation of Queuing Analysis in Hospital”, International Journal of Mechanical Engineering and Robotics Research, Volume 2, No. 3, ISSN: 2278 – 0149. This paper helps to the scheduling system of the department. Queuing theory can be used to predict some of the important parameters like total waiting time, average waiting time of patients, average queue length.

**Ananya Roy, Aparajita De, Abhranil Tah (2013)**: “Autonomous Hospital Management System Using Bluetooth Technology Developed on Python”, International
This describes the detail of project develop with Bluetooth support which in reality will help to reduce the manpower and in the efficient management of the hospital.

**Priyanka Patil, Sruthi Kunhiraman, Rohini Temkar (2013):** “Functional Description of Online Medical Management System Using Modern Technology”, International Journal of Engineering Science and Innovative Technology, Volume 2, Issue 6, ISSN: 2319-5967. This paper describes idea about web based platform to support making online, cloud computing and android program for hospital and medical system. This manages the schedule of doctors, maintaining the records of patient etc.


**Yeo Symey, Suresh Sankaranarayanan, Siti Nuraffifah binti Sait (2013):** “Application of Smart Technologies for Mobile Patient Appointment System”, International Journal of Advanced Trends in Computer Science and Engineering, Volume 2, No.4,ISSN: 2278-3091. This describes patient management system. It is an android application which reduces the patient waiting time towards appointment and collection of patient data. It describes the general patient flow through the outpatient services up to the moment of consultation.


**Vidisha M. Shah, Dimple S. Mehta (2014):** “Drug Utilization Pattern at Medicine O.P.D at Tertiary Care Hospital at Surendranagar”, International Journal of Biomedical And Advance Research, Journal, ISSN: 2229-3809(online). This research article evaluate factors related to the prescribing, dispensing, administering and taking of Medication at medicine OPD at tertiary care teaching hospital.
Yi-Horng Lai (2014): “A Study on the Attitude of Use the Mobile Clinic Registration System in Taiwan”, International Journal of Computer and Information Technology, Volume 03, Issue 04, ISSN: 2279-0764. This research present a study investigated the inclination of consumers to use mobile registration system from the viewpoint of patients’ decision influence factors.

Sam Afrane, Alex Appah (2014):”Queuing Theory and the Management of Waiting-Time in Hospitals: The case of Anglo Gold Ashanti Hospital in Ghana”, International Journal of Academic Research in Business and Social Sciences, Volume 4, No. 2 ISSN: 2222-6990. This paper investigates the application of queuing theory and modeling to the queuing problem at the out-patient department.

Ayanthi Saranga Jayawardena (2014): “The Electronic Hospital Information System Implemented at the District General Hospital Trincomalee - An Experience of Business Process Re-Engineering”, an open access journal, ISSN: 2161-0711. In this article researcher describe about computer based electronic information system to build and maintain a patient database for analysis of data and to facilitate evidence-based decision making process. Some objectives are to have properly maintained hospital health statistics, to have a paperless hospital information system and to reduce costs and improve the accuracy and timeliness of hospital information system.


Aswar Nandkeshav R, Kale Kalpana M, Rewatkar Mangesh P, Jain Akanksha, Barure Balaji S (2014): “Patients’ Waiting Time and Their Satisfaction of Health Care Services Provided at Outpatient Department of Government Medical College, Nanded (Maharashtra, India)”, International Journal of Health Sciences and Research, Volume 4, Issue 4, ISSN: 2249-9571. This describes the improvement of patient’s satisfaction towards health care services by reducing their waiting time, attending the patient in time and sympathetic approach will create a positive image of hospital in the mind of people and also will help hospital image building in the community.

Adebowo Peter Idowu1, Olajide Olusegun Adeosun, Kehinde Oladipo Williams (2014): “Dependable Online Appointment Booking System for Nhis Outpatient in
Nigerian Teaching Hospitals”, International Journal of Computer Science & Information Technology, Volume 6, No. 4, DOI:10.5121/ijcsit.2014.6405. This research present an online outpatient medical appointment booking system where patient can access and view any available personnel or doctor schedule in order to book an appointment with corresponding time as specified by the available doctor.

Dr Nirmalya Manna, Dr Md Samsuzzaman, Dr Saikat Das (2014): “A Time Motion Study in the OPD Clinic of a Rural Hospital of West Bengal”, IOSR Journal of Dental and Medical Sciences, Volume 13, Issue 7, ISSN: 2279-0861. The author conduct the time motion study to know the time taken in different service delivery point in OPD and to assess the perception of beneficiaries regarding the total time spent in the OPD. Time Motion study is required for proper time management in different health care delivery system and subsequent remedial steps can be taken accordingly.

Swabik Musa Abdulla Wani, Suresh Sankaranarayanan (2014): “Intelligent Mobile Hospital Appointment Scheduling and Medicine Collection”, International Journal of Computer and Communication System Engineering, Volume 1 No. 02, ISSN: 2312-7694. In this research android based patient appoint scheduling and medicine collection system is developed. This system is not supporting for walk in patients as well as cancellation and rescheduling of appointment.

Sreekala P, Arpita Dan, Elizabeth M Varghese (2015): “Patient Waiting Time in Emergency Department”, International Journal of Scientific and Research Publications, Volume 5, Issue 5, ISSN 2250-3153. This research paper present study to determine the average waiting time of patients reported in the emergency department and to assess the factors responsible for the waiting period of patients in emergency department.

S. Sri Gowthem1, K.P. Kaliyamurthie (2015): “Smart Appointment Reservation System”, International Journal of Innovative Research in Science, Engineering and Technology, Volume 4, Issue 6, ISSN: 2347-6710. This research represents an electronic paper less application designed with high flexibility and ease of usage for patients to book their appointment within the scheduled appointment slots according to their preference. This system serves in managing appointments and provides patient to cancel or reschedule appointment by integrating distributed clinical systems into a set of consistent and convenient services accessible via a web browser.

Pradipti Verma, Dr. Risha Saxena(2015): “An Effective Time Motion Study (Tms) On Opd Patients Of A Tertiary Care Hospital In September 2015 In Goa”, International Journal Of Research Science & Management, Volume 2, No. 12, ISSN: 2349- 5197. The paper is based upon the monitoring the waiting time of patient visiting the Outpatient department of a hospital using the concept of Time and Motion study.


Tochukwu A. Ikwunne, Moses O. Onyesolu (2016): “Optimality Test for Multi-Sever Queuing Model with Homogenous Server in the Out-Patient Department (OPD) of Nigeria Teaching Hospitals”, I.J. Modern Education and Computer Science, Volume 9, DOI: 10.5815/ijmecs.2016.04.02. In this the author analyzed the queuing of patients in different hospital .The results of the analysis showed that average queue length, congestion and waiting time of patients in the system and queue could be cut down when the service capacity level of doctors at the hospitals are increased at a lowest expected total costs.

Irin Sherly. S, Mahalakshmi. A, Menaka. D, Sujatha. R (2016): “Online Appointment Reservation and Scheduling for Healthcare- A Detailed Study”, International Journal of Innovative Research in Computer and Communication Engineering, Volume 4, Issue 2, ISSN 2320-9798. This research represent online Appointment reservation and scheduling systems in healthcare are used to maintain and manage the access to the hospitals. This system allows individuals to securely and safely make their appointment reservations online.

This research presents an efficient queuing model for proper appointment system to give the solution to the long waiting times in the hospitals. This system provides better utilization of resources and reduces patients waiting times in the general OPD before consultation with the Doctor.

Nidhi Malik, O. K. Belwal (2016): “Application of Queuing Theory to Patient Satisfaction at Combined Hospital, Srinagar Garhwal Uttarakhand”, International Journal of Science and Research, Volume 5, Issues 4, ISSN: 2319-7064. This paper given a complete idea about the patients' demographic characteristics, nature of their illness, time they spent before reaching the hospital, on the queue to see the doctor and with the doctor. It also describe the patient’s view about queue and their behavior in the queue.
Research Problem

In the real world the patient are facing numbers of significant problems during the OPD related to appointment, registration, searching OPD location and waiting for doctor checkup. The researcher develop mobile computing simulation model to improve the OPD services in the hospital.