



*Correspondence:
Sandhya Avasthi, Krishna
Engineering College,
Ghaziabad, India, Email:
sandhya_avasthi@yahoo.
com

Electronic Health Records and its Dynamic Implementation using Graphical Representation Methods

Sandhya Avasthi

Krishna Engineering College, Ghaziabad, India, sandhya_avasthi@yahoo.com

Abstract

Many hospitals currently using electronic health records for improving their services and usage of such Electronic Health Records have increased tremendously. The function of an Electronic Health Record is to computerize various day to day activities of the Hospital front office, and such a system is user-friendly, simple, fast, and available at a low price. It deals with the collection of patient's information, diagnosis details, medicines, etc., earlier it was done manually. The proposed system's primary function is to register, store patient details, doctor details, and retrieve these records. Keeping various files and records in the system makes retrieval and manipulation easy whenever required. To manipulate these details correctly, the user provides input, such as patient details, diagnosis details, and medicine details. At the same time, system output details in dynamic or graphical format on the user screen. The data can be retrieved or fetched easily. The data is shown in tabular form in the database. However, the graphical representation of all data is shown in the system's user interface so that the summary can easily be retrieved. The data are well protected or secured for personal use and make the data processing very fast.

Keyword: Medical Records, Patient Appointment, Electronic Health Records, Patient Record, Information Retrieval

1. Introduction

The increasing number of hospitals has implemented electronic health records (EHRs) worldwide in recent times. Dynamic EHR systems have various forms (Anderson, R., 2001) and this term can be related to a broad and wide range of digital information systems of records used in health care clinics and hospitals. EHR systems have been represented dynamically and can be used in individual organizations as inter-operating systems in reputed and well-known health care units and organizations, on a regional level,

or nationwide. Health care units that use dynamic EHRs include hospitals, pharmacies, general practitioner surgeries, and other health care providers. The implementation of hospital-wide EHR systems is a complicated matter involving a range of organizational and technical factors, including human skills and practices, organizational structure, culture, technical infrastructure, financial resources, and coordination (Nguyen, L., Bellucci, E., & Nguyen, L. T., 2014; Tiwari, B., & Kumar, A., 2015). The hospital's multiple objectives hospital are curing, caring for patients, and educating new physicians and nurses. The Dynamic project Implementation of Records of Hospital in Graph includes registration of patients, storing their details into the system graphically, computerized or digital billing and fixing appointments in the reception, digital billing in the pharmacy, and labs.

The software has the facility to automatically give every patient a unique patientID and store the details of every patient and the staff. The search facility has been included to know the current status of each room. The administrator can search the availability of a doctor and the details of a patient using the id. The Dynamic Implementation of Records of Hospital can be entered using credentials, i.e., username and password. It is accessible either by an administrator or receptionist. Only they can add data, and the data has been stored into the database. The data can be retrieved easily. The interface is very user-friendly. The data is well protected for personal use and makes the processing very fast. This system is powerful, flexible, and easy to use and is designed and developed to deliver real conceivable benefits to hospitals so that data could easily be analyzed. This system is designed for multispecialty hospitals to cover a wide range of hospital administration and management processes. It is an integrated end-to-end Hospital Records Management System that provides relevant information across the hospital to support effective decision making for patient care, hospital administration, and critical financial accounting in a consistent flow (Gans, D., Kralewski, J., Hammons, T., & Dowd, B., 2005).

2. Background

Hospital Records Management System is a software product framed designed to enhance the quality and implementation management of the hospital in the areas of clinical process analysis and activity-based costing (Van de Velde, R., 2000). Hospital Records Management System enables you to develop your organization or product and increases its effectiveness and quality of work (Kushniruk, A. W., & Borycki, E., 2008). Managing the key processes efficiently is critical to achieving the hospital's success helps you manage your processes (Singh, S., Sinha, U. S., & Sharma, N. K., 2005).

The Lack of immediate retrievals of information is very complex, considering lots of data (O'brien, J. A., & Marakas, G. M., 2005). The information or data is complicated to fetch or retrieve and to find particular information like finding out about the patient's history or any other data (Manes, S., 1998); the user has to go through various register processes (Brennan, T. A., Leape, L. L., Laird, N. M., et al., 1991). This results in

inconvenience and wastage of time. Storage is another problem in such a system. The information generated by various transactions takes time and effort to be stored in the right place (Chaudhry, B., Wang, J., Wu, S., Maglione, M., et al., 2006). Various changes to information like patient details or immunization details of children are complicated to make as paperwork manually. Manual calculations are error-prone and take much time. This may result in inaccurate information. For example, the calculation of the patient's bill is based on various treatments. This becomes a difficult task, as information about any patient is difficult to collect from various registers manually. These are the various type of works that need to be done in a Hospital by the operational staff and Doctors. The activities are described below:-

- 1) Information about Patients is done by just writing the Patients name, age, and gender. Whenever the patient comes up, his information is stored freshly.
- 2) Bills are generated by analyzing price for each facility provided to patients on a separate sheet, and at last, they all are summed up.
- 3) Diagnosis information to patients is generally recorded on the document, which contains information about the patient. It is clipped or resolved after some time to decrease the paper load in the office.
- 4) Information about various diseases. Doctors do this job by remembering various medicines on their own.

All this work is done manually by the receptionist, and other operational staff and a lot of papers are needed to be handled and taken care of. The main problems with doctors is that they have to remember various medicines available for diagnosis and sometimes miss better alternatives as they can't remember them at that time (Santos, R., Correia, M. E., & Antunes, L., 2008).The entire system mainly consists of five modules and those are admin module, user module (patient), doctor module, pharmacist module and receptionist module.

3. Methodology

Hospitals generally use a manual system for the management and maintenance of critical information. The current system requires numerous paper forms, with data stores spread throughout the hospital management infrastructure. Sometimes information is incomplete or does not follow management standards. Forms are often lost while transferring between departments requiring a comprehensive auditing process to ensure that no vital information is lost. Multiple copies of the same information are kept in the hospital and may lead to inconsistencies in data in various data stores.

3.1. Proposed system:

The Dynamic Implementation of records of hospital is designed for any hospital to replace their existing manual paper based system. This new system is used to control the information of patients, room availability, staff, operating room schedules and patient invoices. These services are to be provided in an efficient, cost effective manner, with

the aim of reducing the time and resources currently required for such type of tasks. The user who received the file will do the operations like the embedding, decryption, and decompress in their level of hierarchy etc. The flow is shown in figure 1 and system framework is given in figure 2.

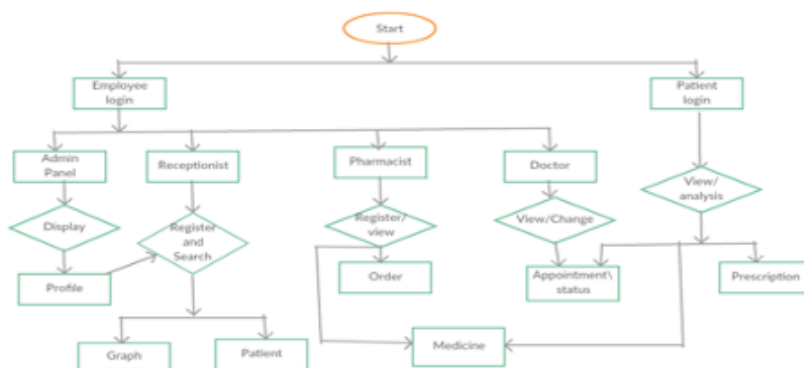


Fig. 1. Data Flow in Modules

The feasibility of the project can be analyzed in this phase and business proposal is put away with a very genuine plan for the project and some cost estimates. During system analysis of the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the organization. For feasibility analysis, some self-knowledge of the major requirements for the system is essential. Three key considerations involved in the feasibility analysis are economic feasibility, technical feasibility and operational feasibility. This study is carried out to analyze the economic impact will have on the system will have on the organization. The amount of fund that the company can provide into the research and development of the system is less or limited. The expenditures must be justified. Thus the developed system as well within the budget and this was achieved because most of the technologies which were used are freely available. Only the customized products have to be purchased. This study is takes place to observe the technical feasibility, that is, the technical requirements of the system. Any technology developed must not have a high demand on the available technical resources. This will lead to high demands which are being placed on the client. The developed system must have a modest requirement, as only minimal or null changes for the implementing this system.

The impact of study is to check the level of acceptance of the system by the user. This includes the training process to the user to use the system efficiently. The user must not feel threatened by the system; therefore it must accept it as a necessity. The level of acceptance by the users exclusively depends on the methods that are trained to improve the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is accepted, as he is the final user of the system

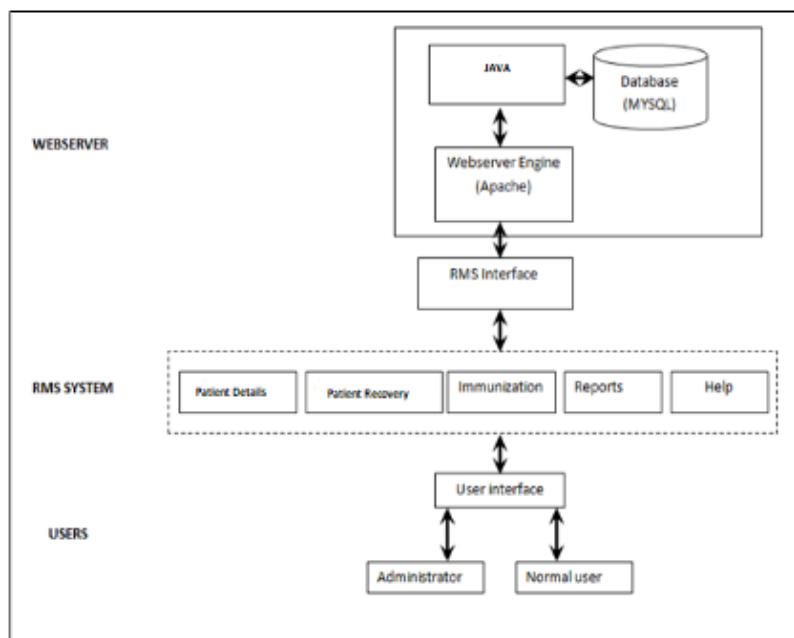


Fig. 2. System Framework

4. Experimental setup

That to be used efficiently, all computer software needs certain hardware components or the other software resources to be present on a computer. These pre-requisites are known as system requirements and are often used as a guideline as opposed to an absolute rule. Most software defines two sets of system requirements: negligible and recommended. With increasing demand for higher processing speed and resources in newer versions of software, system requirements incline to increase over time. Industry analysts suggest that this trend plays a bigger part in driving upgrades to existing computer systems than technological advancement. We have run our software using Processor Intel Dual Core i3 consuming less than 1GB RAM upto 80GB Hard Disk. Highly recommended set of requirements defined by any operating system or software application is the physical computer resources, also known as hardware. A hardware requirements list is often accompanied by a hardware compatibility list (HCL), especially in case of operating systems and other peripheral devices. This could be operated in Operating System such as Windows 7/XP/8/10. This is been made by using HTML, CSS, JAVASCRIPT, JSP and Mysql on localhost://phpmyadmin as an interface. Software Requirements deal with defining software resource requirements and pre-requisites that need to be installed on a computer to provide optimal functioning of an application. These requirements or pre-requisites are generally not included in the software installation package and need to be installed separately before the software

is installed. Sometimes for some project it might be possible that could not receive any requirements, instruction guide or documents to work with. But still there are other sources of requirements that you can consider for the requirement or information, so that you can base your software or test design on these requirements.

5. Results

Employee Login and Detail

This is the Main Employee Login Page, in which an Employee can login and perform its various operations (shown in figure 3 and 4). All employees need credentials for signing in the system. The employee such as Administrator, Receptionist, Pharmacist, and Doctor can sign in after creating their regular account.

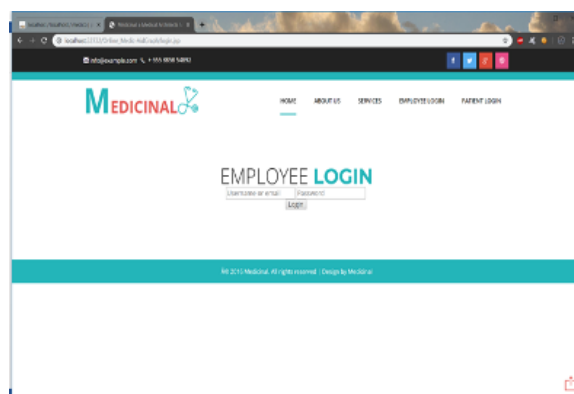


Fig. 3. Employee Login Interface

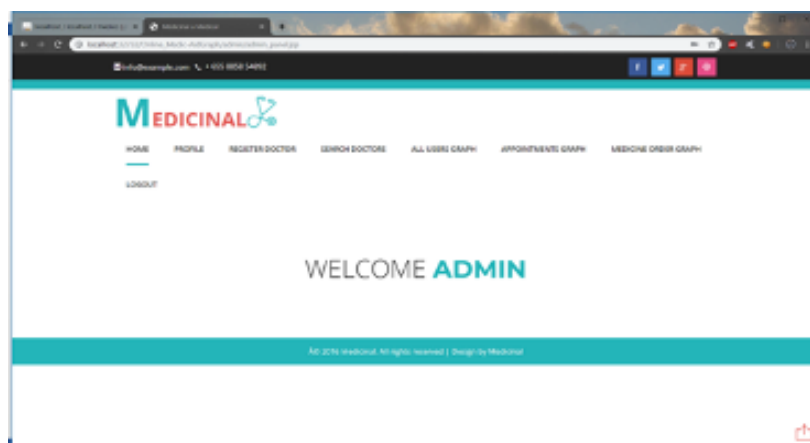


Fig. 4. Admin Interface

This is the Employee Detail Page, in which an administrator can see the details, register doctor, Search Doctor, and can access all the Graphs such as: All users

Graph, Appointments Graph, Medicine Order Graph.

Appointment Graph:

This is the Appointment Graph Page (shown in figure 5), in which all the appointments which were fixed are been in dynamic form both in Pie Chart and Bar Chart. A user can easily analyze by looking at the Pie chart generated.

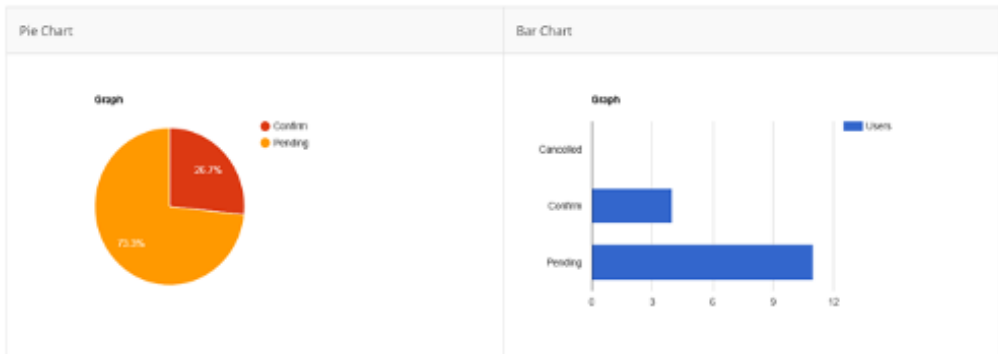


Fig. 5. Pie chart and Bar Chart describing percentage of average rate of Appointments

Register Doctor:

This Page is under Administrator Panel in which admin can register new doctor, though it is the registration page to register a new doctor. A registered doctor can retrieve a patient records or any other information related to a patient treatment.

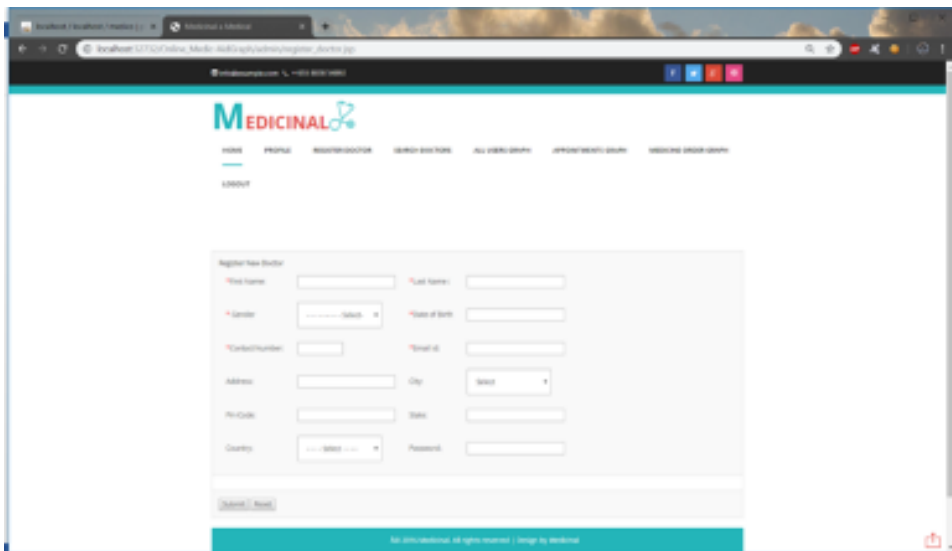


Fig.6. Doctor Registration Interface

Medicine Status

This is the Medicine Status Page, in which all the medicines that are in stock are shown in tabular form with Class, Drug Type, Composition, Expiry Date, Cost, View Medicine.

Medicine ID	Medicine Name	Class	Drug Type	Composition	Date of Expiry	MFG	COB	View Medicine
1	Digoxin	A	Adult	Adult	22/12/2019	140202014	5	View Medicine
2	Alprazolam	A	None	Adult	20/10/2019	201902013	10	View Medicine
3	AM7.4	B	Dangerous	Adult	14/04/2019	140202014	20	View Medicine
4	AM7.4	B	Dangerous	Adult	14/04/2019	140202014	20	View Medicine
5	AM7.4	B	Dangerous	Adult	14/04/2019	140202014	20	View Medicine
6	AM7.4	A	Adult	Adult	12/02/2018	121102011	10	View Medicine
7	AM7.4	A	Adult	Adult	12/02/2018	121102011	10	View Medicine

Fig. 7. Medicine Information Table

Medicine Order UI and Graph:

This is Medicine Order Panel in which the Pharmacist can place the order and verify. This features helps in maintaining history of all ordered medicine in last few months with details like medicine ordered, time of order, personal information, doctor and quantity. The bill details can also be included that could contribute in future analysis related to medicine. This is the Medicine Order Graph, in which the medicines which are been ordered because of less in stock

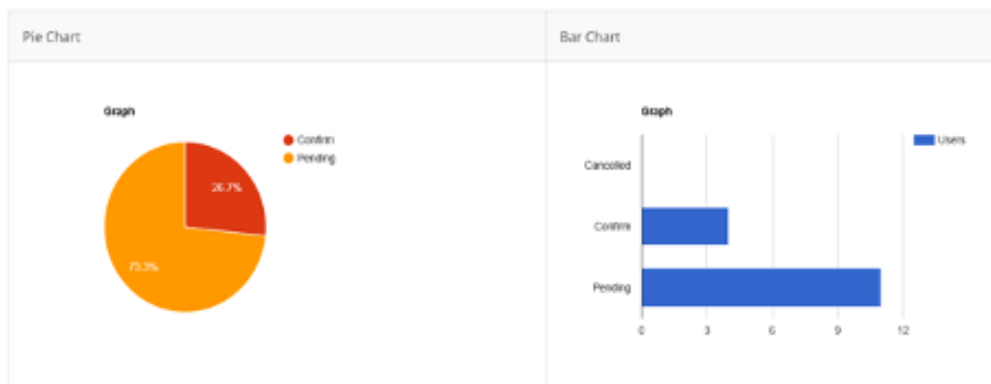


Fig. 8. Pie chart and Bar Chart describing percentage of status Medicine of Appointments

Order ID	Person Medicine ID	Person ID	Total Cost	Status	Order Date	Order Time	Confirm
1	2 Item Details	1	50	Confirm	18/02/2018	14:23:54	confirm
2	2 Item Details	1	50	Confirm	18/02/2018	14:23:54	confirm
3	2 Item Details	2	50	Confirm	18/02/2018	16:18:05	confirm
4	2 Item Details	2	50	pending	18/02/2018	16:18:05	confirm
5	2 Item Details	2	50	Confirm	18/02/2018	16:18:07	confirm
6	2 Item Details	1	50	pending	18/02/2018	16:23:51	confirm
7	2 Item Details	2	50	pending	18/02/2018	16:23:52	confirm
8	2 Item Details	2	50	pending	18/02/2018	16:23:54	confirm
9	2 Item Details	2	50	pending	18/02/2018	16:23:54	confirm
10	2 Item Details	2	50	pending	18/02/2018	16:23:54	confirm
11	2 Item Details	2	50	pending	18/02/2018	16:23:55	confirm
12	2 Item Details	2	50	pending	18/02/2018	17:01:05	confirm
13	2 Item Details	2	50	pending	18/02/2018	17:01:05	confirm
14	2 Item Details	1	50	pending	18/02/2018	17:01:25	confirm
15	2 Item Details	2	50	pending	18/02/2018	16:24:25	confirm

Fig. 9. Order Information Interface

Patient Registration UI

This is a Patient Registration panel, in which receptionist can register new patient and can fix the appointment with the respective doctor.

Register New Patient

* First Name: * Last Name: * Date of Appointment:

* Sex: * Date of Birth:

* Email: * Password:

Address: Treatment Department:

Fig. 10. Patient Registration Interface

All Users Graphical Representation:

This is the All Users Graph Panel, in which all the users such as Admin, Doctor,

Pharmacist, Receptionist data is been shown in a graphical form or dynamically.



Fig. 11. All user representation

6. Conclusion

Medical records form an important part of a patient management. It is important for the doctor and medical establishment to properly maintain the records of the patient for two important reasons. First one is that it helps in proper evaluation of the patient and to plan treatment protocol. Second is that the legal system relies mainly on documentary evidence in cases of medical negligence. Since we are entering details of the patients electronically in the "Hospital Records Management System", data will be secured and shown up precisely. Using this application we can fetch patient's history or details with a single click. Thus processing information will be faster. It guarantees accurate maintenance of Patient details. It easily reduces the book keeping task and thus reduces the human effort and increases accuracy speed. In Future we would include prediction and Statistical analysis with help of graphical representation.

References

- Anderson, R. Security Engineering: A Guide to Building Dependable Distributed Systems. 2001: Jonh Wiley & Sons. Inc., New York.
- Brennan, T. A., Leape, L. L., Laird, N. M., et al. (1991). Incidence of adverse events and negligence in hospitalized patients: results of the Harvard Medical Practice Study I. *New England journal of medicine*, 324(6), 370-376.
- Chaudhry, B., Wang, J., Wu, S., Maglione, M., et al. (2006). Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. *Annals of internal medicine*, 144(10), 742-752.
- Gans, D., Kralewski, J., Hammons, T., & Dowd, B. (2005). Medical groups' adoption of electronic health records and information systems. *Health affairs*, 24(5), 1323-1333.
- Kushniruk, A. W., & Borycki, E. (2008). *Human, social, and organizational aspects of*

health information systems. Hershey: Medical Information Science Reference.

Manes, S. (1998). Time and technology threaten digital archives... but with lack and diligence treasure-troves of data can be preserved. *New York Times*.

Michelson, A., and Jeff Rothenberg. (1992). Exploring the Impact of Changes in the Research Process on Archives. *American Archivist* 55(2).

Nguyen, L., Bellucci, E., & Nguyen, L. T. (2014). Electronic health records implementation: an evaluation of information system impact and contingency factors. *International journal of medical informatics*, 83(11), 779-796.

O'brien, J. A., & Marakas, G. M. (2005). *Introduction to information systems* (Vol. 13). New York City, USA: McGraw-Hill/Irwin.

Roberts, D. (1994). Defining electronic records, documents and data. *Archives & Manuscripts [1955-2011]*, 14-26.

Santos, R., Correia, M. E., & Antunes, L. (2008, October). Securing a health information system with a government issued digital identification card. In *2008 42nd Annual IEEE International Carnahan Conference on Security Technology* (pp. 135-141). IEEE.

Singh, S., Sinha, U. S., & Sharma, N. K. (2005). Preservation of medical records-An essential part of health care delivery. *Indian Internet Journal of Forensic Medicine & Toxicology*, 3(4).

Tiwari, B., & Kumar, A. (2015). Role-based access control through on-demand classification of electronic health record. *International journal of electronic healthcare*, 8(1), 9-24.

Van de Velde, R. (2000). Framework for a clinical information system. *International journal of medical informatics*, 57(1), 57-72.

Submitted 19.01.2020

Accepted 22.05.2020