

IOT Big Data Piling up System Based Sentimental and Pharmacovigilance Analysis in Cloud for Patients

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Abstract: Cloud computing forms the future base of computing platform service due to the growth in cloud server. Cloud techniques apply in health care industry for more information and quick decision. The cloud algorithm in health care industry helps the physician, only for telemedicine application such as medical images, patient history retrieval. In this study, we propose a novel method in pharma health care to evaluate the adverse effect of drugs in cloud and IOT environment. Cloud sever store the data of physician prescription of the entire inpatients and outpatients in daily routine. The IOT environment provides access to cloud store data of prescriptions to the physician, nurse, pharmacologist and patients. However, the cloud data piling up system executes with big data algorithms. In big data Map Reduce algorithm applies for Pharmacovigilance (PHV) analysis. From the result of 100 prescriptions from inpatients and outpatients, the safety of clinical practice of PHV improves of about 80% for drug regulations. The piling system paves the way for primary data instead of secondary data collection for analysis.

Key words: Cloud computing, pharmacovigilance, IOT, big data, sentimental analysis, map reduce, adverse drug reaction

INTRODUCTION

Health care service adopts cloud technology grows rapidly due to the development of server technology. Health care service include of data storage, telemedicine, and patient history. However, for security, speed, analysis the cloud technology plays a vital role in services. Cloud technology applies not only to multiple shared resources also for dynamic allocation of many single users at a time. The users in dynamic allocation analyze the stored data as fast as a normal computer (Cai and Aliprantis, 2013). The analysis and data storage depend on the cloud server for a quick result. The cloud server should perform well for analysis even the storage of data increases rapidly Guan and Melodia (2014). Cloud technology becomes cheap due to embedded technology growth. The low power embedded technology increase the speed of analysis (Jung *et al.*, 2014). Moreover, Cloud server extends as Infrastructure as a Services (IaaS) in terms of security, networking and deploy embedded devices. Cloud server in health services (Parane *et al.*, 2014) reduces the gap between physician, nurse and patients for data sharing analysis.

Sensor cloud evolves rapid growth technology in many research areas. Sensors take place as major role applying in health care technologies. The continuous

sensor data is difficult to store, process and extract data. Cloud Computing (CC) provide infrastructure for store and retrieval of sensor data. However Correa *et al.* (2015), CC also facilitates the visualization of remote access management platform.

The PHV is one of the most important and challenging areas in part of a medical research. The basic study of PHV process help to prevent physical, mental and financial suffers from rare drug composition in medicine. To measure, the composition of the drug and reporting data is importance in PHV. The PHV process takes part in the medicine as follow:

- Monitoring the medicines in day-to-day life practice and identify Zaho (2015) Adverse Drug Effects (ADE)
- To render optimal information to medical profession and patient optimize the safe and efficient medicines
- To monitor and take actions if any affect arise
- To investigate the Drug affect and communicate the problems of finding in a timely manner

The basic and most recently used data mining approach for PHV is under the process of signal generation of adverse event effect namely spontaneous reporting system cohort studies pre-market clinical trials

post market clinical trials. Unfortunately, the above techniques are inefficient due to lack of precise drug information providing optimal adverse drug event measures. It can lead to cause some non-essential countermeasures, e.g., organ failure or death. To overcome the unaccepted organ damage and death, needs to make accurate research information about the inefficient drug composition in medicine.

To investigate and generate safety measures of medicine depend mainly on two different sources namely laboratories data and real world data, laboratory data relay proteomics and genomics. The real world data includes wearable sensor, Electronic Health Records (EHR). John and Shenoy (2014) social media, survey reports market research and the health care forum (Hausladen *et al.*, 2014). Due to the surge availability and different variety of data in healthcare system, handling such data is complex task extract absolute information. We propose a novel technique, IOT big data piling up system in real time environment to handle such data problems and future aspects of PHV (Hamblen *et al.*, 2013).

Literature review: Cloud computing has become rapidly developing in health care industry due to cost efficiency, deployment speed, scalability and also paved the way to environment of big data. The main challenge for managing variable volume of large set of health care data is to offer fast and very large element query service mechanism.

Researchers implemented a new architecture design for health care data access in cloud called “My PHR Machines”. The PHR machines prototype is control design application software. Patient access their details again back from the Remote virtual machines and analyze the details easily without live conversation. This architecture model explore as lifelong patient health care records can maintain and analyzed for future use (Islam *et al.*, 2015). IOT health care technologies more prevalent use in recent trends and help to connect various smart devices through internet. The main use of IOT technology applications increases real time data services (Xu *et al.*, 2014). The proposed IOT base emergency for system in health care with semantic data model and resource for data model. This approach makes to store, access and interpret IOT data. Mobile environment take advantage of easy access of IOT technology.

In medical research, PHV is important field of study for detecting inefficient drug composition in commercial medicines (Oztaner *et al.*, 2015). Adverse effect measures in medicines are way to improving and fault finding bad drug presents in it. The main reason for detect a defective Adverse Drug Reaction (ADR) avoid cause death in global world. Big data is fundamental feature for apply

large expanded data in health care center. Big data takes the advantage of high-speed delivery and efficient process in real time data. Present technique for detect and reporting ADR methods based on electronic health records and spontaneous reporting system (Burns and Johnson, 2015). For example, propose based on domain-driven knowledge system and EHRs system (Jin *et al.*, 2010). Some advanced machine learning method used for detecting adverse drug events.

Prior approach for investigate and safety measures for (Oztaner *et al.*, 2015) adverse event effect is not efficient for trends due fast development of new clinical medicines and various side effects (Reps *et al.*, 2014) for the patients. However, detection of optimal Adverse Drug Ratio (ADR) is a complex problem in health care, almost all recent technique are based on spontaneous reporting system, these reports are not sufficient because it causes under reporting and latent response. In contrast to related works, our novel approach is IOT big data in cloud based on consideration of latency and efficiency data handling.

MATERIALS AND METHODS

Data source: Health care data classify as Primary and secondary. In this study, we concentrate more on primary data instead of secondary data. The primary data collect through mobile apps from patients. Real time health care data from patient considered as valuable suggestion, we collect from two different hospitals, namely BR hospitals and Malar Health Care. The secondary data such as internet, web forums and social media are also considered for interpretation.

Pharmacovigilance in cloud: In Health care industry, analysis of large medical data and interpretation of data for any issues become complex. However, big data provide solution for the complexity in interpretation of data.

The study and analysis to improve the pharmacovigilance is which an important measure of the drug level in tablets and syrups. Existing methods in detecting adverse drug ratio forms more complexity, reduced accuracy level and long term process. The integration of data from real world is complicated to processes. Cloud computing is the easy way to integrate, share, store and analyze the data with efficient (Amokrane *et al.*, 2013). Thus, cloud based PHV is an efficient paragon (Nonde *et al.*, 2015) for better process of explosive growth in integrated of real world data.

The proposed method comprises of (Jiau *et al.*, 2015) mobile patients feedback app and doctors view app.

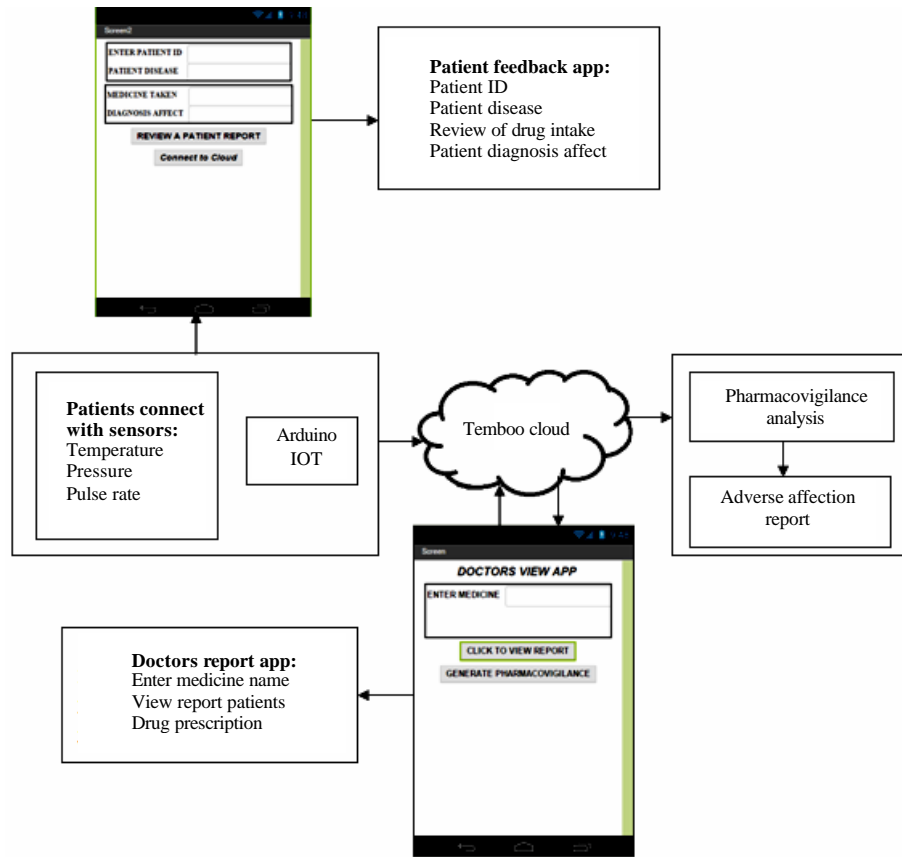


Fig. 1: Pharmacovigilance system in real time scenario

Patient feedbacks about medicine intake and specifies the disease and store in cloud for future use (Han *et al.*, 2015).

The proposed system, in Fig. 1 collects and access data from a temboo cloud. The temboo cloud stores the data of patient in form of larger, direct suggestion of 100 patients in a hospital which give valuable information for decision-making in Pharma products. Cloud computing reduces (Doraiswamy *et al.*, 2013) the process easy and quick analysis of healthcare data and patient details history. Figure 2 shows functioning elements sequence of pharmacovigilance process which results safety system in medicine products.

Big data analytics for pharmacovigilance: Big data provide a key foundation for handling, processing bulk volume of health care data. Big data help to handle significantly reduce hurdle for processing surge data (Pradhananga *et al.*, 2015). The proposed approach to investigate and better detection of inefficient adverse drug affection in IOT. Cloud app access environment as follows in Fig. 1. The collected feedback analysis in big data approuche NLP of sentimental analysis. Map reduce important component works upon core concept in big

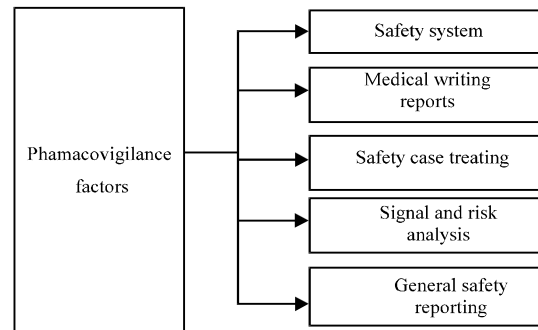


Fig. 2: Elements and capacity of pharmacovigilance process

is data. Map reduce work on large scale health care data by splitting up the data into categorical based on similarity present in a input data.

Map phase:

(K1, V1), List (K2, V2)

Split as words and form initially key value pair such as “Happy 1”.

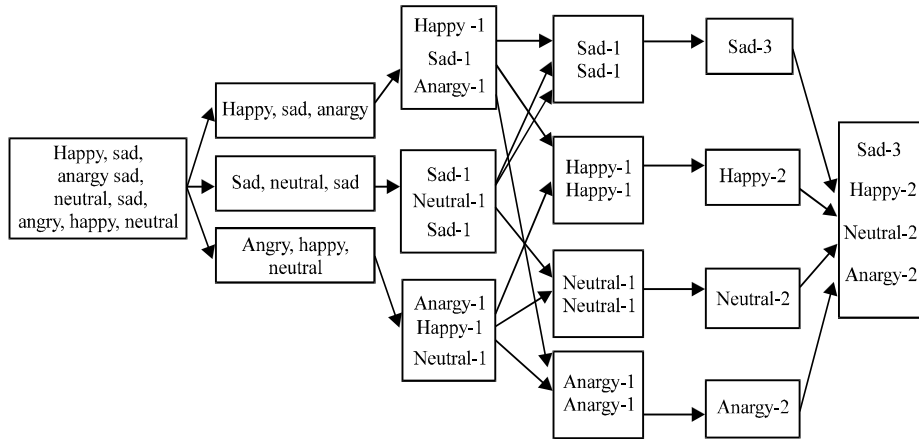


Fig. 3: Overall map reduce pharmacovigilance word count process

Reduce phase:

(K2, List(V2)), List(K3, V3)

Grouped together values for similarly keys that are added “Happy 3”.

Algorithm: For large count words

```

Class MAPPER
    MAP (fileid x, file y)
        for all term S∈file d do
            for all term k∈NEIGHBOURS(S) do
                EMIT (Pair(s, k), count 1)
Class REDUCER
    REDUCE (Pair c, count [f1, f2...])
        z ->z+f
    EMIT (pair c, count f)
    
```

Map reduce algorithm: The requirement for map reduce algorithm are:

- Input, any text files
- Test VM cloud era
- Mapper, reducer and driver programs

Algorithm model work based on word counts in sentimental analysis and works separate into two phases They are mapper: performs mapping function in all words in the document and reducer: works according to categorical counting data. The sentimental analysis is to perform in the temboo cloud and VM cloud era. The VM cloud era facilitates high security for user data. Figure 3 Shows, map reduce technique work on very large count of patient suggestion in the cloud.

Cloud data analysis in a hospital: This section illustrate, investigate of pharmacovigilance and sentimental analysis made over a cloud IOT environment in a real time emergency scenario (Moulik *et al.*, 2015). We collected a two different live admitted patient’s health data which

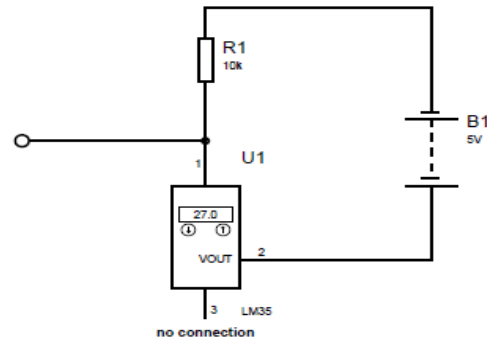


Fig. 4: LM335 temperature sensors

continuous updated in temboo cloud. Doctors can view and study analysis of continuous variable changes of patient health. To test and analysis of live patients health, here we use three types of sensors which is normally as wearable to a patients (Lee *et al.*, 2014).

Figure 4 shows LM335 analog output temperature sensor much easier to use because it is not require to additional circuitry interfaces. Figure 5 demonstrate blood pressure monitor sensor and it involve use of pressure transducer as arduino uno (Kubitza *et al.*, 2013). It is primarily use in medicals to analyze the patient’s blood pressure levels and used to prescribe as better treatment. It functions by beaming light through the finger then sensor detects oxygen level flows in the blood. And using pulse oximeter technology calculates the results and updates value that display in the screen.

Hospital A: A sentimental analysis report gathered from patients in hospital A, according to patients suggestions after medicine intake feedback. Figure 6 and 7 shows the graphical results of (good, bad and neutral). The results gathered from hospital A illustrates in Fig. 6 suggest as BAD.

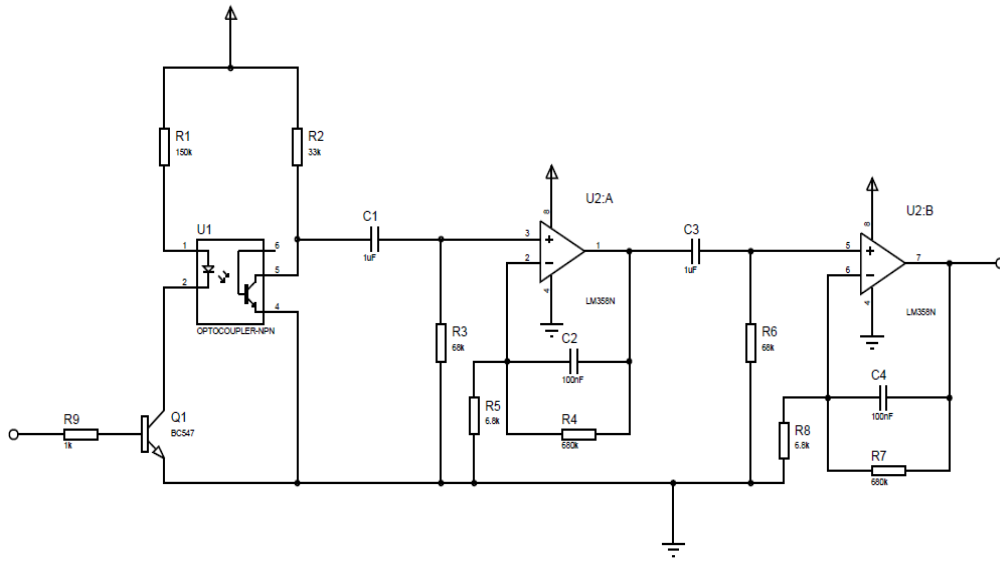


Fig. 5: Blood pressure sensor

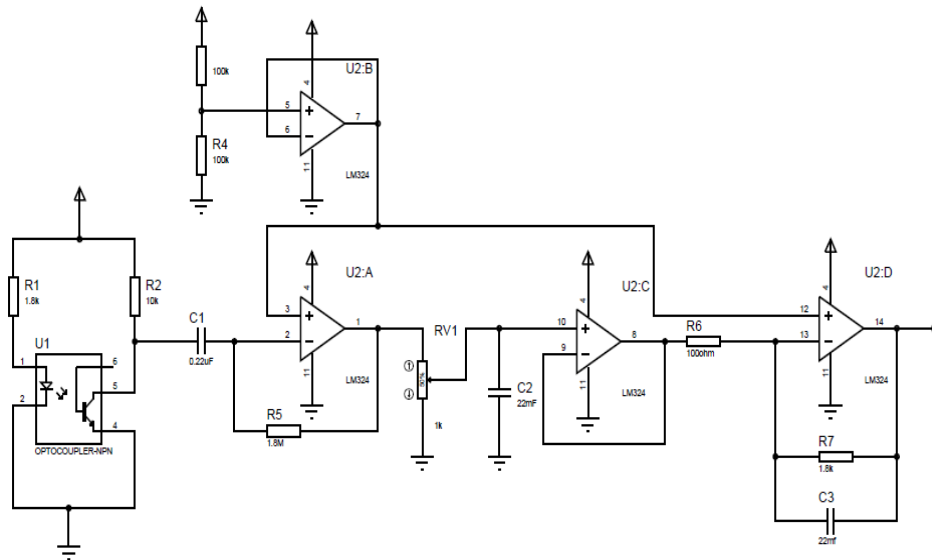


Fig. 6: Pulse oximeter

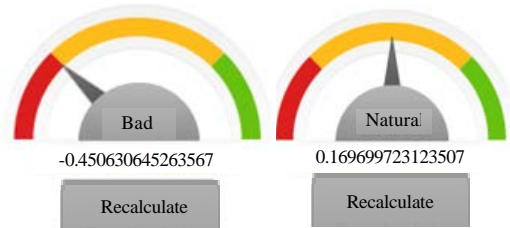


Fig. 7: Measure patient emotions about medicine

Hospital B: Similarly, sentimental analysis from hospital B gathered from several patients report formed as NUTRAL.

RESULTS AND DISCUSSION

Figure 8 illustrates Parallax Data Acquisition (PLX-DAQ) is a software connectivity tool which is add on a Excel data sheet that shows a real time data analysis on the updated collecting data in the field. The PLX-DAQ have the capacity to full fill 26 columns and it supports baud rate as 128 k. The detected sensor values update in the cloud data base server. When, the threshold value is crossed the limit, it gives alert message to the concerned doctor through the mobile apps with an IOT such information about human temperature, pressure and heart beat rate.



Fig. 8: Sensor data cloud connector

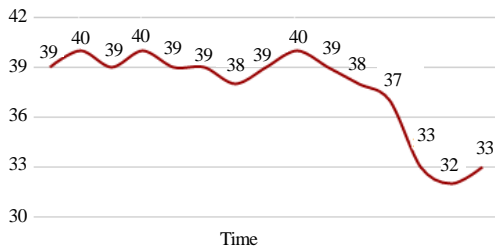


Fig. 9: Sensors live updates of patient temperature in Cloud

Table 1: Sensor values update cloud

Time	Total (T)	Body temperature	Blood pressure
12:26:44	0.02	39	130
12:26:46	1.98	40	128
12:26:48	3.98	39	128
12:26:50	5.98	40	128
12:26:52	7.99	39	127
12:26:54	9.99	39	127
12:26:56	11.98	38	127
12:26:58	13.98	39	128
12:27:00	16.00	40	127
12:27:02	17.99	39	126
12:27:04	19.99	38	123
12:27:06	22.00	37	121
12:27:08	24.00	33	122
12:27:10	26.00	32	120
12:27:12	28.01	33	120

Sensor health data for patients update in temboo cloud. The extraction of samples is shown in Table 1. Figure 9 shows patient body temperature indication that updated in the cloud server and generates alert messages, when emergency reached through apps to doctors. Similarly, Fig. 10 shows body temperature of patient illustrates real data value is connected to a cloud server which make decision of continuous flow of sensor values.

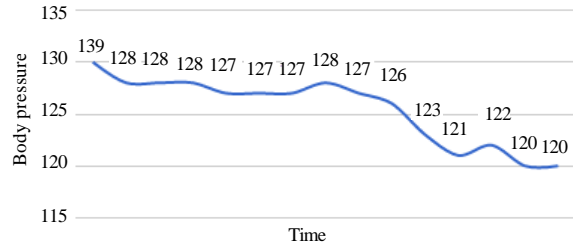


Fig. 10: Sensors live updates of patient pressure in cloud

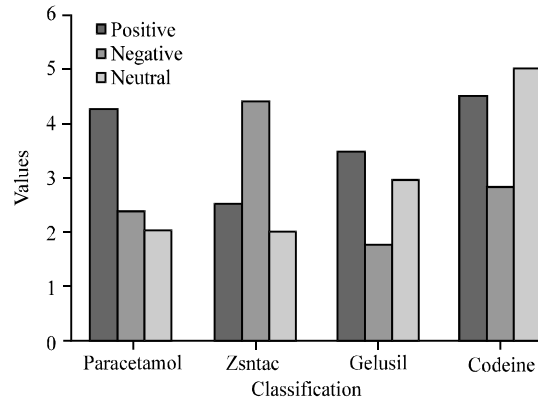


Fig. 11: Sentimental classification from patient feedback

Performance measure: Figure 11 shows the sample of medicine in-taken and result of adverse drug event various patient feedbacks which is processed and analysis from big data cloud server. Therefore, our works attain the quality of service and avoid latency.

CONCLUSION

In this study, we have introduced a novel method in the pharma health for the problem of adverse effect of drugs in medicine. The method allows two enhanced capabilities improve health care in IOT cloud:

- Cloud data store data of prescriptions by physician also feedbacks of medicine taken by patient
- Patient sensor data about health updates in cloud

The introduced model in based on the sentimental and pharmacovigilance analysis in cloud for patients. The effective method of big data piling system in cloud provides high scalability, efficiency and multi tenancy support. We argue that pharmacovigilance analysis in IOT cloud environment management need to provide both efficient monitoring and conventional support of health care data.

RECOMMENDATIONS

As part of future research, we plan to integration of various hospitals of patient suggestions regards adverse event of drugs in medicine in IOT cloud System.

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