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Contents

Automated Diastolic Blood Pressure (ADBP) Variation On Respiratory Pattern

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A B S T R A C T

The two components of blood pressure are systolic pressure and diastolic pressure. Systolic pressure replicates the pressure inside arteries when the heart pumps while Diastolic Blood Pressure represents the pressure when the heart relaxes between beats. However, the two components of respiration are inhalation and exhalation. Blood Pressure is established to decrease during inhalation and increase during exhalation. To effectively use this approach to reduce BP more, study of different respiratory pattern could be of important. It has been showed deep breathing exercises could reduce automated diastolic blood pressure (ADBP).This study aimed to quantitatively investigate the effect of different breathing pattern on ADBP. It involved forty healthy subjects (15males and 25 females, aged from 18 to 60 years). ADBP were measured using a clinically validated automated blood pressure device. Two repeated measurement sessions were employed for each subject. Eight ADBP measurements were performed within each session. This includes four measurements during breathing using different patterns (Pattern 1: 4.5sec of inhalation and exhalation each; Pattern 2: 6sec inhalation and 2s exhalation; Pattern 3: 2sec inhalation and 6sec exhalation; Pattern 4: 1.5s inhalation and exhalation), and additional 4 measurements from 1 min after different breathing patterns. At the beginning and end of the two measurement sessions, there were two baseline ADBP measurements under resting condition. Lastly, the effect of breathing patterns on ADBP during and after deep breathing was analysed with the baseline ADBP. Experimental results showed that overall ADBP during deep breathing in Pattern 1, 2 and 4 were decreased by 3.7 ± 5.0 mmHg, 3.7 ± 4.9 mmHg and 4.6 ± 3.9 mmHg respectively (all $p < 0.001$, except in Pattern 3 with a decrease of 1.0 ± 4.3 mmHg, $p = 0.14$).To conclude, ADBP decrease with different breathing patterns has been quantitatively demonstrated.

Keywords: *Automated, Diastolic, Blood pressure, Respiratory pattern*

1 INTRODUCTION

Deep breathing has been widely acknowledged as one of the significant features imposing a physiological change in blood pressure (Zheng et al., 2012). Breathing is the process by which air is inhaled into the lungs and is being exhaled via the nose or mouth. Two mechanisms involved in breathing are inspiration and expiration. Inspiration or inhalation involves taking oxygen into the body. During inspiration, inter costal muscles between the ribs contract, and get the ribs raised upward and outward, the ribcage is then expanded. Also, the diaphragm contracts, flattens, pulls down, and causes an increase in thorax volume. This lowers the pressure inside the thorax and gets air sucked into the lungs (Martini and Nath, 2009; Moini, 2012). Expiration or exhalation takes carbon dioxide out of the body. During exhalation, inter costal muscles relax and lower the ribs downward, causing the diaphragm to relax and move back upwards. This causes a decrease in thorax volume, which as a result, increases the pressure inside the thorax and forces air out of the lungs (Martini and Nath, 2009; Moini, 2012). Normal breathing also called apnea is involuntary and rhythmic (Moini, 2012; Martini and Bartholomew, 2007). Breathing pattern is characterized by the rate, depth, timing and consistency of breaths during inhalation and exhalation processes. It differs between individuals depending on their health condition (Thibodeau, 2010; Hubbard and Falco, 2015). Unfortunately, blood pressure measurement error could be generated from the measurements which do not follow the recommended guidelines (Fahey, Murphy and Hart, 2004). The importance of accurate and reliable BP measurement cannot be over emphasized (Mulrow, 2001; MacGregor and Kaplan, 2006). Firstly, it could systematically prevent BP overestimation, and reduce the number of patients who inappropriately receive unnecessary treatment. Secondly, it halts BP underestimation that denies access to essential treatment. Thirdly, it could reduce the incidence of alleviated cardiovascular situations in people with high BP. Fourthly, routine and accurate BP measurement helps in early prediction, prevention and treatment of high BP related diseases, including heart disease, kidney failure and stroke which have been shown to be global leading factors to death and disability. Accurate, reliable and routine BP measurement could ultimately reduce health cost for the society.To achieve accurate BP measurement, several international organisations including the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure (JNCDETHP) (1980), British Hypertension Society (BHS) (1999), European Society of Hypertension (ESH) (2003), American Heart Association (AHA) (2005),American Heart Association, 2014; European Society of Cardiology (ESC) (2015), European Respiratory Society (ERS) (2015) and Canadian Hypertension Education Program Guidelines for Blood Pressure Measurement, Diagnosis, and Assessment (2016) have produced recommended guidelines (Shapiro, et al., 1996; ACOG Committee on Obstetric Practice, 2002; Lemogoum, et al., 2003; O'Brien, et al., 2005; Pickering, et al., 2005; Krause, et al., 2011; American Heart Association, 2014; Sharman, et al., 2016).

2 METHODS

2.1 Subjects

Forty healthy subjects, 15males and 25 females, aged 18 to 60, were employed and all gave their written informed consent to participate in the study. The inclusion conditions were, normal healthy individual with no known hypertension and antihypertensive medical treatment, or cardiovascular. Subject demographic data, including age, weight, height and arm circumference is shown in Table 1.

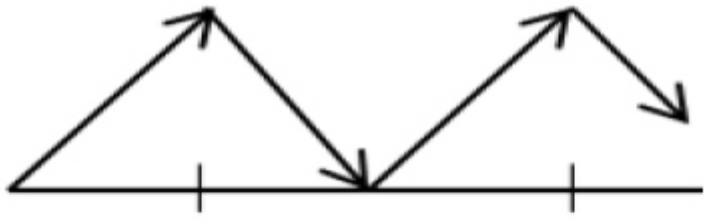
Table 1. Demographic data for the subjects studied

Data	Minimum	Maximum	Mean
Age	18	60	36
Height(cm)	150	180	169
Weight(kg)	51	108	74
Arm circumference (cm)	24	40	31

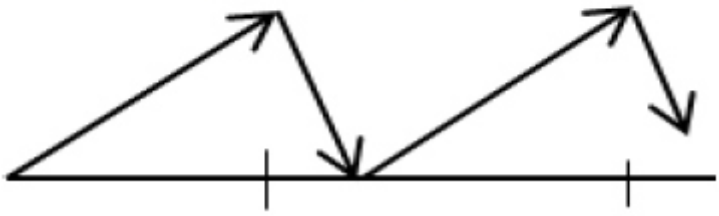
2.2. Measurement protocol and procedure

The study was conducted in a quiet, lighted, air conditioned measurement room to make subjects comfortable during the measurement process. At first, subjects were asked to rest in a seated position with no crossed hands and legs for 5 minutes before the proper ADBP measurement. ADBP were measured from the left arm using a suitable a clinically validated automated Omron, M6 Comfort, Blood Pressure that is clinically validated and approved by British Hypertension Society (2016).

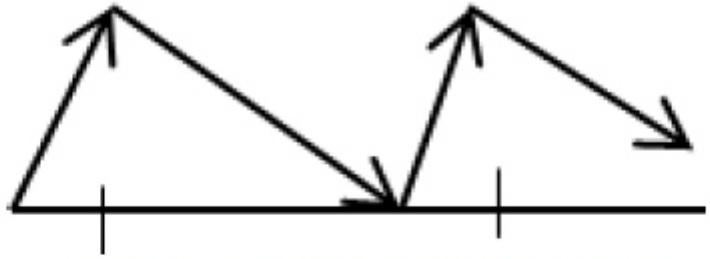
The measurement was taken for four different respiratory patterns as shown in figure 1a, b, c and d below with order of sequence randomised between subjects.



a) Pattern 1: 4.5 sec of inhalation and 4.5 sec exhalation



b) Pattern 2: 6 sec inhalation and 2 sec exhalation



c) Pattern 3: 2 sec inhalation and 6 sec exhalation

d) Pattern 4: 1.5 sec inhalation and 1.5 sec exhalation

Figure 1. a, b, c, d: Illustration of four different respiratory patterns "↗"shows inhalation while "↘" shows exhalation)

A paced breathing android application on Google Play mobile phone designed to regulate time of inhalation and exhalation and to also show graphical breathing patterns was utilized. This is to enable subjects to synchronize their breathing with each chosen pattern in the course of ADBP measurement of the four breathing patterns. Each subject was asked to rehearse to be accustomed with the four respiratory patterns before the proper experimental measurement. Two repeated measurement sessions for each subject was involved. There were two baseline ADBP measurements under resting condition at the beginning and end of the two sessions. Eight ADBP measurements were performed within each session which includes four measurements during breathing using four different respiratory patterns and additional measurements after different patterns of deep breathing with one minute rest interval. Figure 2 shows the measurement procedure in this study.

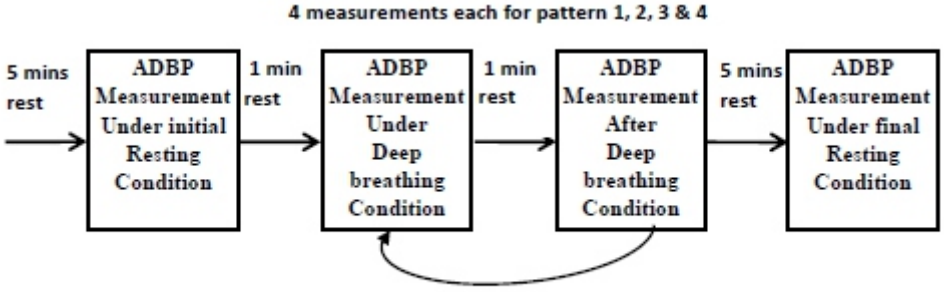


Figure 2: BP measurement procedure in this study

3 DATA AND STATISTICAL ANALYSIS

Excel Spread sheet was used to store all measured data. This was then transferred to and analysed in SPSS 20.0 statistical software The means of ADBP were calculated for baseline and for during and after

different respiratory patterns for deep breathings. Analysis of variance was also performed to investigate ADBP measurement repeatability. The effect of respiratory pattern on ADBP and its differences during and after deep breathing were also analysed. P-value beneath 0.05 was considered statistically significant.

4 RESULTS

4.1 BP measurement repeatability

With ANOVA analysis the baseline ADBP measurements showed that the beginning and end of the main measurement sessions were repeatable with p value of 0.5 ($p = 0.5$) for ADBP. Likewise, ADBP measurements during and after deep breathing were repeatable between the repeat sessions with p value of 0.2 ($p = 0.2$) for ADBP. Hence, the Baseline mean value was used for further analysis.

4.2 ADBP changes during and after deep breathing in comparison with Baseline

In comparison with ADBP Baseline, ADBP in Patterns 1, 2 and 4 during deep breathing decreased significantly by 3.7 ± 5.0 mmHg, 3.7 ± 4.9 mmHg and 4.6 ± 3.9mmHg respectively (all $p<0.001$) ADBP in Pattern 3 did not decrease significantly in comparison with Baseline with the difference of 1.0 ± 4.3mmHg ($p = 0.14$).The results of ADBP after deep breathing show no significant changes in comparison with Baseline. ADBP in Patterns 1, 2, 3 and 4 decreased of -0.09 ± 4.15 mmHg, -0.14 ± 2.71 mmHg, 0.45 ± 2.71 mmHg and 0.46 ± 3.16 mmHg respectively (all $p > 0.05$).Figure 3 displays the ADBP baseline and ADBP measured during and after deep breathing while table 2 shows the means and standard deviation (Means± SDs) of ADBP measured during and after deep breathing, and their differences in comparison with ADBPs baseline. Figure 4 shows ADBP decrease in comparison with base line during and after deep breathings.

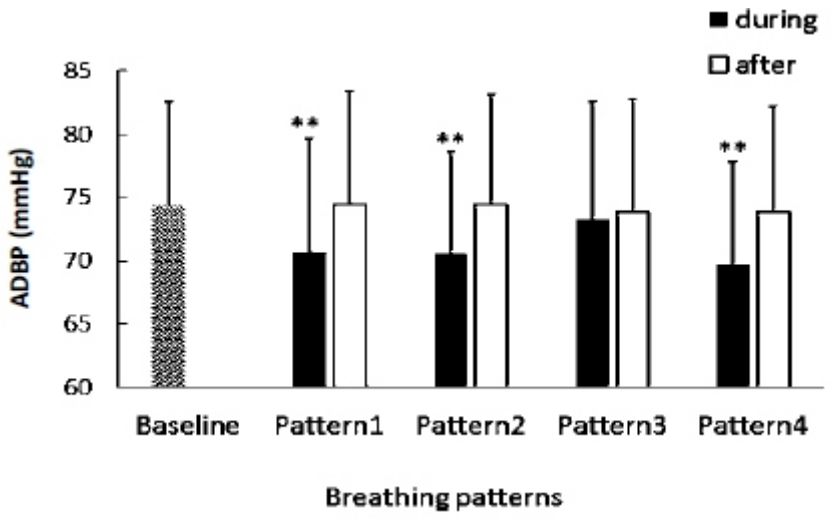


Figure 3: Means ± SDs of ADBP measured during and after deep breathing. **p< 0.001; *p< 0.05in comparison with base line ADBP shows the results from different respiratory pattern

Table 2: Means ± SDs of ADBP measured during and after deep breathing, and their differences in comparison with baseline ADBP. **p< 0.001; *p< 0.05

	Breathing Pattern	During breathing	BP decrease	After breathing	BP decrease
ADBP (mmHg)	Baseline	74.4 ± 8.2			
	Pattern 1	70.7 ± 9.0	3.7 ± 5.0 **	74.4 ± 9.0	-0.1 ± 4.1
	Pattern 2	70.7 ± 8.0	3.7 ± 4.9 **	74.5 ± 8.6	-0.1 ± 3.3
	Pattern 3	73.3 ± 9.2	1.0 ± 4.3	73.9 ± 8.8	0.5 ± 2.7
	Pattern 4	69.7 ± 8.2	4.6 ± 3.9 **	73.9 ± 8.3	0.5 ± 3.2

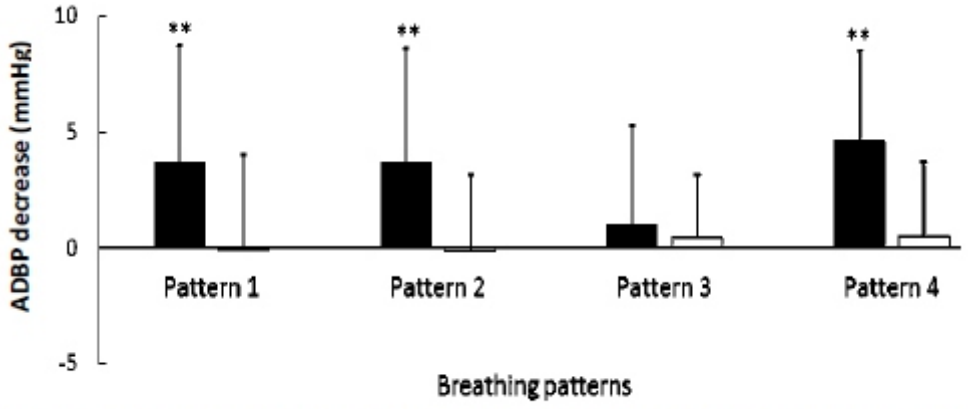


Figure 4: ADBP decrease in comparison with baseline during and after deep breathings.

5 DISCUSSION AND CONCLUSION

The effect of four different breathing patterns on ADBPs has been quantitatively demonstrated in this study. From the results Pattern 1achieved a significant decrease in ADBP by 3.7 ± 5.0 mmHg($p < 0.001$).Pattern 2 showed a significant decrease in ADBP with 3.7 ± 4.9 mmHg. Pattern 3 did not show a significant ADBP decrease (1.0 ± 4.3 mmHg). Pattern 4 showed a significant ADBP decrease of 4.6 ± 3.9 mmHg.

These results agreed with the previous studies that blood pressure was reduced due to the autonomic imbalance, which reduced the arterial bar reflex sensitivity (Linsenbardt, Thomas, and Madsen, 1992; Maryon-Davis & Stewart., 2005; Meuret, Wilhelm, and Roth, 2001; Mourya,et al., 2009; Oneda, et al., 2010; NICE guidelines., 2011; Mohamed, Hanafy, and E-Naby., 2013). For Pattern 3, the physiology of exhalation relates to relaxation of diaphragm and an increase of intra thoracic pressure that refills the left ventricle with blood that resulted in the increase (Mourya,et al., 2009; Jacob, et al., 1992; Meuret,

Wilhelm, and Roth, 2001; Anderson, McNeely, and Windham, 2010; Bhavanani, Madanmohan and Sanjay, 2012; Telles, Joshi, and Somvanshi., 2012; Prem, Sahoo, and Adhikari, 2012; Mohamed, Hanafy and E-Naby., 2013;Matthew, 2015).

However, the differences in the results of different breathing patterns ischaracterized by the rate, depth, timing and consistency of breaths during inhalation and exhalation processes (Thibodeau, 2010; Rickard, Reichand Dunn, 2014; Hubbard and Falco, 2015). In conclusion, the effect of four different breathing patterns on ADBPs has been quantitatively demonstrated in this study

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Case-based Reasoning System To Recommend Desitnation Country For Human Migrants

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A B S T R A C T

Human migration is the challenge process in Ethiopia, special illegal human migrants they across different border countries without any basic information or knowledge. Due to this, there is difficulty of getting vast amount of information to know the destination countries, simple they go without any information, also wastes more time, cost, violet their human right and also it danger for their life. Hence, the objective of this thesis is to build case based automatic recommender (CBR system in case of human migration in Ethiopia. The methodologies employed in this study are data collection tools like interview, questionnaire and assessment of existing documents. The system is tested in terms of performance the system and its user acceptance. From these perspectives, the average performance, recall and precision of the system is score 92% (4.60), 0.91 (91%) and 0.63 (63%) respectively from domain experts and system performance. Developing a recommender system in this study therefore helps migrants to have a right and clear decision about the destination countries for human migrants.

Keywords: *Migrant, Semi-Permanent, Destination Country, CBR-System*

1.1. BACKGROUND OF THE STUDY

According to IOM[1], "no commonly conventional definition for migration exists". In reality, there are a lot of definitions of human migration, and it defines in a different way. It can be define as "a process of moving, either across different border countries, or within a state; it is a peoples movement, nearby any kind of movement of peoples, whatever its length, composition, and causes; it includes migration of refugees, displaced persons, uprooted people, and economic migrants"[1]. On the other hand, Encyclopedia Britannica defines the term 'migration' as being "a permanent change of residence by an individual or group; it excludes such movements as migrant labor, travel and tourism, all of which are transitory in nature"[2]. Finally,[1], defines the migration as being a long-term movement of an individual people or group of peoples outside their place of migrant's source. In general these processes are it may be illegally or legally. As noted by [1], "since the dawn of human progress, more than 70,000 years ago, humans have migrated across different border countries to search for food, shelter, safety, and hospitable climate". The movement is continuing in the beginning of 21st century [2], but new reasons for human migration are arising too, such as job related movement[3]. Due to the great technological

advances in electronic communications and transportation, the scale of modern human migration is even bigger and more dynamic than ever before. It is a global problem of huge strength, involving people from various countries, of different age, gender, and race, belonging to various nationalities and religions, and having various social, economic and political background problems [4].

As stated in [5], illegal migration front multiple challenges or problems to countries of source, bridge and destination, as well as to migrants themselves. Migrants in illegally situation are particularly open to bias, exploitation and violence. Such migrants are also in danger of being exploited by crime organizations involved in human trafficking and migrant smuggling crimes that constitute a serious violation of the human rights of its sufferers[5].

1.2. STATEMENT OF THE PROBLEM

The current practices to control illegal migration of Ethiopia Government made to control illegal migration the first option was to prevent human trafficking, by coordinating both regional and national policy to make awareness the dangers of illegal migration in Ethiopia, by create TV program. The government monitored the activities of labour staffing agencies and closed in different agency that were facilitating the migration for danger condition. And also, make labor migration right discussion in the previous reporting period with Jordan, Kuwait, and Qatar stay in place, the government discuss new agreements in 2013 with the Governments of Djibouti, Sudan, the UAE, and Kenya. However, these agreements did not explicitly contain provisions to protect workers, such as by outlining mandatory rest periods, including grounds for filing grievance, and prohibiting recruitment fees.

One of the challenging problems in the world to control illegal migrants is the absence of [5] recorded information for analysis purposes. Ethiopia also faces this problem, since most young Ethiopians migrant follows illegal system. As a result, the country loses its young human power every year. Therefore law enforcement bodies like police need to learn the factors that constitute human migration. To control migration, there should be a need for careful migration prevention strategies and policies.

The challenging problem in Ethiopia is that most of the migrants cross the border of the countries in illegally system. They move and across different life cycles to arrive the destination countries[5]. In the midst of illegal migration, with the hope of finding better jobs, a considerable pack of nationals leave Ethiopia with the help of human traffic, and their preferred destinations are European countries. Since, in Ethiopia there is no local research to recommend destination countries for human migrants to give basic information about the migrant where they go and also make awareness for illegal migrants. So, we design a prototype CBR system to solve those problems in Ethiopia.

Based on the above stated problems, the study addresses the followings research questions:

- What are factors of human migration in Ethiopia?
- How to identify variables that help to recommend destination country?
- How to recommend?
- To what extent the recommender system gets users acceptance?

1.2.1. General Objective

The general objective of this research is to develop a knowledge based recommender system for human migrant to enhance the selection of destination countries.

1.2.2. Specific Objectives

To achieve the general objective, this study targets on the following specific objectives:

1. To identify important attributes that help in constructing a model to recommend the destination country for migrants.
2. To design architecture of the recommender system and select suitable techniques.
3. To develop a prototype recommender system.
4. To create similarity functions using CBR.
5. To evaluate the performance of the prototype.

1.3. SCOPE AND LIMITATION OF THE STUDY

The main aim of this thesis is to construct knowledge-base model for develop a prototype system of recommend destination countries for migrants. This work is conducted based on the data obtained from the record office of central statically agency and MoLSA, comprising 84, 000 and 459, 810 datasets from 2000-2014 years. The selection of datasets was using clustering and random sampling techniques. The main limitation of this study of was the availability of the data in unorganized. To organize the data in suitable format for experimentation, it took a lot of time. Due to the time and financial limitations available to complete the study, the researcher is forced to use data from a single source: central statically agency found in Debre Berehan and MoLSA found in Addis Ababa. And also the system recommend only for the new migrants, is not recommend user selection destination countries.

1.4. RELATED WORKS

Here in this section, the researcher discusses different research papers that are related to case based reasoning in different areas conducted locally in Ethiopia which helps to understand on how to solve and develop case based reasoning to recommend destination countries for human migrants.

Biazen [6], has done his research with title of "application of case based recommender system in field of study selection in the case of higher education in Ethiopia". The objective of the study was to develop a prototype case base recommender system that assists the students in their field of study selection process. That helps and recommends to the students based on previously solved cases and new query given by the users/students. With the collection of 105 cases that are collected from successful students. For the implementation the author uses JCOLIBRI as an implementation tool to develop the prototype recommender system. Queries from users are used as an input for the system to provide recommendation. After accepting the input the system calculates similarity between existing case and new queries that are provided by the students and provides solution or recommendation by taking best cases to the new query this helps the students to make decisions easily. After developing the prototype of the system, testing of the prototype for case base recommender system was done to evaluate the performance of the system. Based on user acceptance of prototype testing, the average performance of the system was 77.2% and 80.2% by the domain experts and students respectively.

This study is based on a data collected from central statically agency and MoLSA office. Before implementing the Knowledge-base (CBR) system, the researcher clearly understands the migrant's factors, and has worked closely with the two dataset source.

To understand the migrant's factors to migrate legally, the first step is identifying the migrant's causes to understanding the characteristics of migration that determines migrant's goals and DM goals were set to identify and prepare data required for the study. Next, CBR system task is ready for retrieve, retain, revision and also to recommend destination country for human migrants in Ethiopia.

1.5. OVERVIEW OF MIGRATION

Migration can be defined as a process of moving, either across in different border countries, or within a State. Any kind of migration in the world and also in Ethiopia, people, whatever their pulls and push causes or factors to leave their lands [3].Migration is part of the human history since its very beginning. People have migrated from one continent to the other, from country to country or internally, inside the same country. Currently, IOM states that there are "about one billion migrants around the world" [1]. This number includes "214 million international migrants and 740 million internally displaced persons" [1].

1.5.1. Illegal Migration in the world

The range of illegal migration and forced migration in the Horn of Africa region and neighbouring countries is significant. It is estimated that there are [37]: 37 In "2014, 91,500 illegal migrants arrived in

Yemen after crossing the Red Sea from Djibouti or Somalia", the vast majority were Ethiopians intending to migrate the destination country to Saudi Arabia, some part of Somalias migrant stay in Yemen and also in "2014, around 2,000 Eritrean illegal migrants" arrived in neighbouring Ethiopia and Sudan every month.

1.5.2. Types of Migration

Migration especially in Ethiopia is the illegal movement of people from one place in the world to another for the purpose of taking up "permanent or semi-permanent residence", usually across to change their life [38]. 38 An example of "semi-permanent residence" legal or illegal migrants would be living a short time movement of migrant until they get their needs.

1.5.3. Causes for Migration

In the world in general and in Ethiopia, peoples across different borders of the countries legally or illegally for variety of reasons. The migrants they consider the "advantages and disadvantages of staying versus reasoning, as well as factors such as the distance destination countries, travel costs, travel time, transportation system, security, and cultural barriers" [2].

Push Factors: Reasons for migration because of a difficulty.

Pull Factors: Reasons for migration in different countries because of something advantageous. Several types of push and pull factors may influence people in their movements, including: environmental, political economic and cultural [2]. These could be the reasons of people to be motivated for migration especially in Ethiopia.

Description of the Initial Data

The data collected from MoLSA and central statically agency offices are using the same standard paper format and they are not directly collected for the purpose of this study. Initially the data were in record file format. The data in record file format are then exported to Microsoft Excel for further preparation and ready for as input to WEKA 3.6.9 data mining tool. This initial dataset is described and visualized using Microsoft excel. Then data preprocessing is performed to verify the quality of the dataset such as missing values, error values and to obtain high level information regarding the data mining questions. Table 3-1 shows the dataset information which is collected from the MoLSA and central statically agency office.

Table 1-1: Description of initial dataset

Data source	Categories	Total
MoLSA office	No of Instances	459, 810
	Number of Attributes	11
Central statically agency office	No of Instances	84,000
	Number of Attributes	10

As shown in Table 1-1 the initial data collected from MoLSA and central statically agency office has 11 and 10 attributes respectively.

The following Figure 1-1 shows that the selected attributes for this study after discussed with the two data source domain experts.

	Gender	Age	LevelOfQualification	Marital_status	Region	Zone	YearOfMigration	IncomeLevel	Destination
2	Male	young	College Level	Unmarried	Amhara	South Gondar	2000	Low	Israel
3	Male	young	College Level	Unmarried	Amhara	South Gondar	2000	Low	Israel
4	Male	young	College Level	Unmarried	Amhara	South Gondar	2000	Low	Israel
5	Male	young	College Level	Unmarried	Amhara	South Gondar	2000	Low	Israel
6	Male	young		Unmarried	Amhara	South Gondar	2000	Low	Israel
7	Male	young	College Level	Unmarried	Amhara	South Gondar	2000	Low	
8	Male	young	College Level	Unmarried	Amhara	South Gondar	2000	Low	Israel
9	Male		College Level	Unmarried	Amhara		2000	Low	Israel
10	Male	young	College Level	Unmarried	Amhara	South Gondar	2000	Low	Israel
11	Male	young	College Level	Unmarried		South Gondar	2000	Low	Israel
12	Male	young	College Level	Unmarried	Amhara	South Gondar	2000	Low	Israel
13	Male	young	College Level	Unmarried	Amhara	South Gondar	2000	Low	
14	Male	young	College Level	Unmarried	Amhara	South Gondar	2000	Low	Israel
15	Male	young	College Level		Amhara	South Gondar	2000	Low	Israel
16	Male	young	College Level	Unmarried	Amhara	South Gondar	2000	Low	Israel
17	Male	young		Unmarried	Amhara	South Gondar	2000	Low	Israel
18	Male	young	College Level	Unmarried		South Gondar	2000	Low	Israel
19	Male	young	College Level	Unmarried	Amhara	South Gondar	2000	Low	
20	Male	young	College Level	Unmarried	Amhara	South Gondar	2000	Low	Israel
21	Male	young	College Level	Unmarried	Amhara	South Gondar	2001	Low	Israel
22			College Level	Unmarried	Amhara		2002	Low	Israel
23	Male	young	College Level		Amhara	South Gondar	2003	Low	Israel
24	Male	young	College Level	Unmarried	Amhara	South Gondar	2004	Low	Israel

Figure 1-1: Dataset before Experimentation

1.5.4. Data Cleansing

There were numerous inconveniences in the original dataset which need additional pre-processing the migrants' data. These are:

- Attributes have so many missing values. For example, the attribute migrants region has a missing value of 51187, 8426 from MoLSA and central statically agency office respectively. The researcher removes each instance from the dataset, because had enough instance in the dataset.
- Discretize or organize an instance filter that discretizes a range of numeric attributes in the dataset into nominal attributes.
- In the original dataset, there was an error on changing the attribute values from attribute to attribute. For instance, some records had age value in sex attribute and sex value in age attribute. Like the

attribute age had a value of "M" at some place "F" in another place. Whereas, the attribute sex had a value of number in some places.

- Another problem in the dataset was that there was inconsistency or irregularly in writing, way of attributes i.e. some attribute were written in abbreviation format and some attribute in standard form. For example, in the attribute migrants region, one of its attribute regions was written as reg. in some places and the full name region in other places. These are simple tasks for the researcher to full fill these problems.

Gender Nominal	Age Nominal	LevelOfQualification Nominal	Marital_status Nominal	Region Nominal	Zone Nominal	YearOfMigration Numeric	IncomeLevel Nominal	**Destination** Nominal
Male	Adult	College Complete	Married	Amhara	East G...	2010.0	Low	Saudi Arabia
		College Complete	Married	Amhara	East G...	2010.0	Low	Saudi Arabia
Male	Adult	College Complete	Married	Amhara	East G...	2010.0	Low	Saudi Arabia
Male	Adult		Married	Amhara	East G...	2010.0	Low	Saudi Arabia
Male	Adult	College Complete	Unmarried	Amhara	East G...	2010.0	Low	Saudi Arabia
	Adult	College Complete	Married	Amhara	East G...	2010.0	Low	Saudi Arabia
Male	Adult		Married	Amhara	East G...	2010.0	Low	Saudi Arabia
Male	Adult	College Complete	Unmarried		East G...	2010.0	Low	
	Adult		Unmarried	Amhara	East G...	2010.0	Low	Peru
Male	Adult	College Complete	Unmarried	Amhara	East G...	2010.0	Low	Saudi Arabia
	Adult	College Complete	Married	Amhara	East G...	2010.0	Low	Dubai
Male	Adult		Married	Amhara	East G...	2010.0	Low	Saudi Arabia
Male	Adult	College Complete	Married	Amhara	East G...	2010.0	Low	Saudi Arabia
Male	Adult	College Complete	Unmarried		East G...	2010.0	Low	
	Adult			Amhara	East G...	2010.0	Low	Saudi Arabia
Male	Adult	College Complete	Married	Amhara	East G...	2010.0	Low	Saudi Arabia
Male	Adult	College Complete	Married	Amhara	East G...	2010.0	Low	Peru
Male	Adult		Married	Amhara	East G...		Low	Saudi Arabia
	Adult	College Complete	Married	Amhara	East G...	2010.0	Low	Saudi Arabia
Male		College Complete	Married	Amhara	East G...	2010.0	Low	
Male	Adult		Unmarried		East G...	2010.0	Low	Saudi Arabia
Male	Adult	College Complete	Married	Amhara	East G...	2010.0	Low	Saudi Arabia
Male	Adult	College Complete	Married	Amhara	East G...	2010.0	Low	Saudi Arabia
Male	Adult	College Complete	Unmarried	Amhara	East G...	2010.0	Low	Saudi Arabia
Male	Adult	College Complete	Unmarried	Amhara	East G...	2010.0	Low	Saudi Arabia
Male	Adult	College Complete	Unmarried	Amhara	East G...	2010.0	Low	Saudi Arabia
Male	Adult	College Complete	Married	Amhara	East G...	2010.0	Low	Saudi Arabia

Figure 1-2: Before Preprocessing Some Missing attribute value MoLSA Office Dataset

Some attribute names are different in different places. For instance, the attribute name "sex" in some places is and "gender" in another place. In Table 1-2 below, the total missing instance from Ethiopian MoLSA dataset. The next task of the study is to rewrite each instance. It must be reprocessing in manually system by filtering each missing attribute values, in Table 1-2 it show the number of missing after ignoring missing values. After removing, then the researcher imported the data to Microsoft Office Excel 2007 and changed to with appropriate ways as indicated in Figure 3-3.

Table 1-2: Missing Values in the Dataset

No	Station	Number of records	Numbers of records missing values	Number of records after Ignoring missing values
1	MoLSA office	459, 810	51187	354623
2	Central statically agency office	84,000	8426	75574

For this reason, the study takes time to correct and normalize the above stated problem of the migrants' dataset sequentially by manually system, using Microsoft Excel. After removing the missing values in the dataset, the dataset MoLSA decreased from 405, 810 rows data to 354623 rows and also decreased the dataset central statically agency from 84,000 instances to 75574 instances as indicated in above Table 1-2.

1.5.4.1. Random Sampling

In this study, the researcher already know that the number of cluster and also we, fixed in each instance to use numbers of sample in each destination country can be applied random sampling techniques. As shown in Figure 1-3, for example to select the number of sample from destination country using Microsoft Excel by selecting the total migrants and also by selecting random option and typing the number of sample we take the number of sampling as shown in Figure 1-3 organize the sample instance in each countries ready for experimentation. But if there is reputation from the sampling instance, we apply sample again and again to make clear the redundancy of the dataset. As shown in Figure 1-4, the researcher take total instance in each destination country by applying random sampling techniques, finally, after integration the two data source we used 75,920 instances or rows for experimentation.

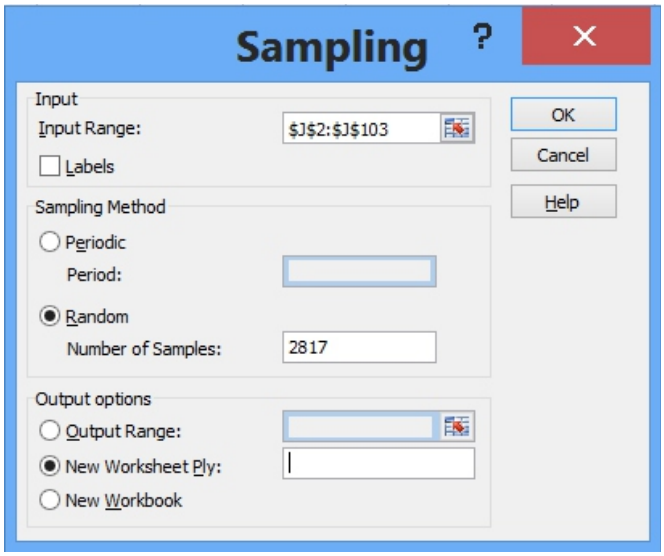

Figure 1-3: To select Number of sampl from destination country India

Gender	Age	LevelOfQualification	Marital_status	Region	Zone	YearOfMigration	IncomeLevel	Destination
Male	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Male	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Male	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Female	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Male	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Female	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Male	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Male	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Male	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Male	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Female	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Male	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Male	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Female	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Female	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Female	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Female	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Male	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Male	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Female	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India
Female	Adult	Elementary	Unmarried	SNNPR	Gurage	2010	Low	India

Figure 1-4: The selection instance from cluster destination country India

1.5.5. Attribute Selection

Attribute selection is an important task in DM researchers. The importance of reducing the numbers of attributes from hundreds to within a few dozen, not only speed up the learning process, but also prevents most of the learning algorithm from getting fooled into generating an inferior model by the presence of many irrelevant attributes. This is mainly because most practical learning algorithm is necessarily heuristic in nature, and they often are misled by the presence of manly non-essential attributes.

The researcher evaluating on all training data, attributes selection has been involved though all possible combinations of attributes in the data to find which subset of attributes works best for migration factors. To do this, determining *CFsubsetEval* method is used to assign a value to each subset of attributes by best first method techniques in WEKA. With this regards attributes selected using best first techniques are in WEKA: "ZONE", "YEAROFMIGRATION", "EDUCATIONAL LEVEL", "AGE", "REGION", "GENDER", "INCOMELEVEL" and "MARITAL STATUS".

The researcher also permeated WEKA attributes selection method using *Gainratio Attribute Eval* search method and WEKA attribute selection ranker method. The result of the ranker based on information gained largest to lowest is shown in Figure 1-3. So these attributes are the most factors of for migration in different countries.

```
=== Attribute Selection on all input data ===

Search Method:
        Attribute ranking.

Attribute Evaluator (supervised, Class (nominal): 9 Destination):
        Information Gain Ranking Filter

Ranked attributes:
 1.896    6 Zone
 1.461    7 YearOfMigration
 1.417    3 Educational Level
 1.241    2 Age
 1.207    5 Region
 0.475    1 Gender
 0.419    8 IncomeLevel
 0.418    4 Marital_status

Selected attributes: 6,7,3,2,5,1,8,4 : 8
```

Figure 1-5: Attribute selection using by Information Gain (WEKA)

1.6. CONCLUSIONS

The objective of this research was to solve the problems faced for human migrants to know basic information human migrant for destination countries. In this case, a case based reasoning would be more suitable. A case based system stores previously solved and successful cases, reasons by comparing a problem case to solved cases and retrieve human factors or causes. The solution of a CBR system can be revised by testing its success in the real world or by giving to domain experts. It also increments its knowledge by learning from its own solving experience. Recommender systems are tools and techniques providing suggestions aimed at supporting users in decision making. In this research, a case based recommender system which uses case based reasoning to suggest the destination countries for human migrants.

To undertake the from section stated problems, the researcher initiated to conduct a research having the main goal of developing a prototype CBR system to recommend destination country for human migrants.

The CBR system uses the well-known CBR cycles (Retrieval, Revise and Retain) to perform different tasks. In this recommender system, the first task is retrieval of cases by entering a new problem description (case) by using the query window. Next case similarity computation is performed and retrieves most similar cases. The retrieval task of the prototype used in this study is Nearest Neighbour retrieval algorithm.

Regarding to the evaluation process of the system, the recommender system registers encouraging retrieval performance which is an average value of 91% recall and 63% precision. The system was also evaluated from the users' side which is called user acceptance testing. Then domain experts the average user acceptance evaluation registered 92% performance by domain experts.

Furthermore, the following conclusions are drawn from the findings with regard to the research questions:

- The major attribute that have more influence to migrate: "ZONE", "YEAROFMIGRATION", "EDUCATIONAL LEVEL", "AGE", "REGION", "GENDER", "INCOMELEVEL" and "MARITAL STATUS".
- In the proposed case based recommender system learning is made for new cases by dynamically updating in the existing case base for the purpose of future use as a case base. And also the proposed system contributes in the recommendation of destination country.
- We design prototype system to make simple select optional attribute for end-users for recommend destination country human migrants in Ethiopia.

1.7. RECOMMENDATIONS

From the result of the study, the researcher is recommendations are the following:

- For this study, the researcher collected the relevant attribute from Ethiopian MoLSA office. To analysis the migrants' destination Countries and to know the factors of migrants, it needs further research by adding other important attributes such as family history, their spoken language, push and pull factors.
- It is known that most of the young Ethiopians people go across different Arabic countries to make their life better economically. So, further research must be needed to create awareness for the society by integrating Knowledge-base system into mobile application.
- Some manual processes are needed to determine human migration status in Ethiopia. So further research is needed to create a web based destination countries' recommendation system is very important to come up illegal migrants into legal migrants and for decision making, by applying a hybrid DM model to implement a recommender system prototype for analyze different factors from migrants.
- To make the system effectiveness and accurateness, it is important integrating CBR with simple k-means DM algorithm techniques for further research.

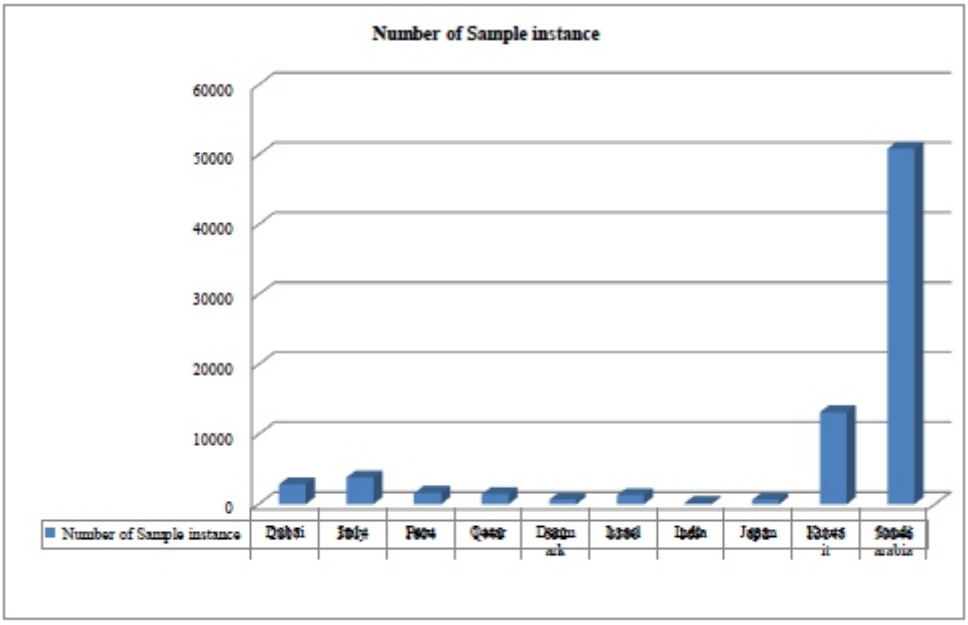

Figure 3-7: Number of Sample instance in each Country

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Iot (internet Of Things) On Android App – Android Application For Remote Monitoring System

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A B S T R A C T

This project provides the idea and method for developing the android app for connecting IoT devices. It's always a difficult task for connecting an embedded device to a mobile device and mainly creating it as an app. So the method which I used is quite easy for implementing this process and will be efficient as well. "To check the working condition of heat pump" – it's the main aim of the project and have to achieve through the android operating system platform. Heat pump is an embedded device which may be present at remote location and mainly in an industry. So to connect the heat pump to the internet the "Thingworx" platformwas used. The main theme of the app is to extract the data from the Thingworx cloud and to show in the android based mobile device.

Keywords: *IoT, Thingworx, Heat Pump, JSON, Android, Web service*

INTRODUCTION

This project focuses mainly on developing android applications for the IoT (Internet of Things) devices. (IoT is the internetworking of physical devices which is embedded with electronics, software, sensors etc. that enables these objects to collect and exchange data.)In this project, I use Thingworx platform to send and receive data from the Heat Pump. The heat pump contains the sensors from which the data are sent and received through HTTPS in time period.Thingworx is the complete development of IoT platform mainly designed as cloud (Server) to store data from the embedded system which obviously uses sensors for exchanging data. So in my app, I have to get the "thing" (A thing is the collection of properties, service and events.) and show its properties and working in android OS, so the person working in the company will easily check over the machines.

The Heat Pump will be present in the remote location and will be inside a turbine which can't be seen from outside. It has sensors present in it as I mentioned above. The sensors will send the data to the Thingworx server in an encrypted form and HTTPS format. So the data will be stored in those servers and the data can be processed and analyzed. The data then made to be displayed in the android platform as a working app. This is the main theme of the project.

RELATED WORK

There are many existing system which use thingworx platform for connecting the embedded devices and which can run as an android app. But most of the software doesn't connect with android mainly industrial equipment which has several process and very tough to execute by using a simple mobile device. The software will be run in the web browser of the company (Service based company). If there are any changes/problem/issues in the working condition of the device, the service will be made from the company like through Phone calls or through e-mail. They'll inform the person working there with the heat pump. The person will be informed and the device will be managed according to the situation.Before using the sensor, the temperature will be checked using thermometer which will have percentage error around 5%. Using the sensor will be quite accurate. It won't have any types of errors.

DRAWBACKS OF THE EXISTING SYSTEM

1. The data will be run in the desktop or in the browser, and the data will be processed or analyzed only by the technician or experienced person.
2. There are many applications to connect the IoT devices but there are no application for connecting industrial equipments with this method as it is highly efficient.

PROPOSED WORK

There are five remote things (Heat Pumps) present in the industry. These five devices have to be connected in the android application. So the connection usually starts from the sensor in the device which sends the data lively. The data which is to be sent from the sensor will be encrypted with HTTPS. The encrypted data will be sent to the thingworx server i.e. sent to the cloud. This data will be raw, so have to extract the required parameters. This process will be done in the web service, converting the parameters (data) into JSON format. The JSON data will be sent to the android device. In the android platform, required parameters will be filtered and the data are shown. JSON is the easier way for getting data from the server to the android application. The main aim is to check the working condition of the device lively and will succeed through this method. The diagram explains the overall architecture of the devices which is connected to the android application.

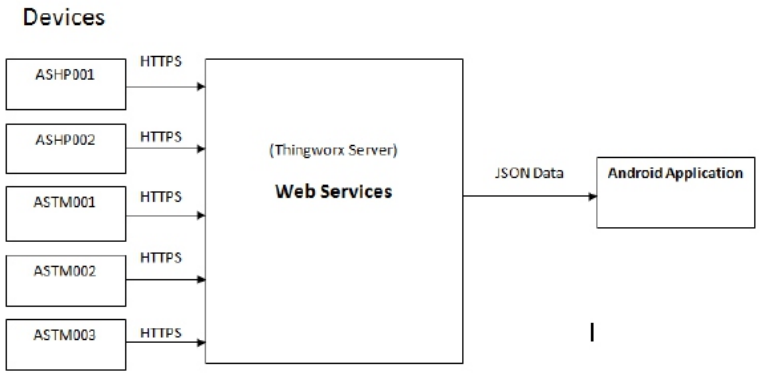


Fig. Overall Architecture of the Devices Connected to the Android Application

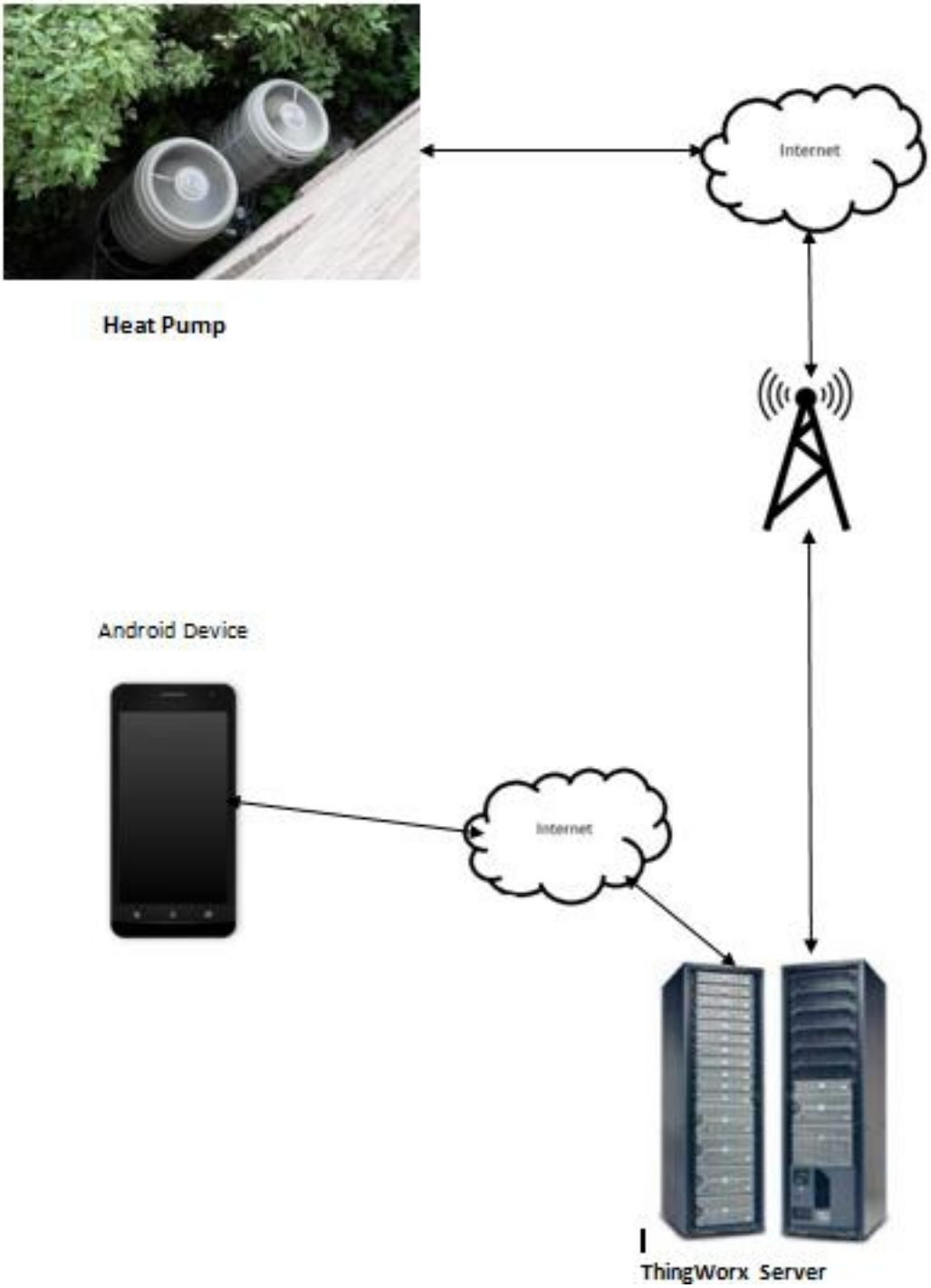


Fig. Overall Architecture Diagram of Heat Pump

Pseudo Code:

Sensor Activity:

public class sensoractivity(){

Private void

setsensorvalue(){e.setText(sensorDetails.get("JSONParameter").toString()+(char)0x00B0+"C");c.set Text(sensorDetails.get("JSONParameter").toString()+(char)0x00B0+"C");

a=String.format("%.2f",Double.valueOf(sensorDetails.get("JSONParameter").toString()));

String n=

String.format("%.2f",Double.valueOf(sensorDetails.get("JSONParameter").toString()));

String m = String.format("%.2f",

Double.valueOf(sensorDetails.get("JSONParameter").toString()));

txt1.setText(JSONParameter+" kWh");

txt2.setText(JSONParameter+" kWh");

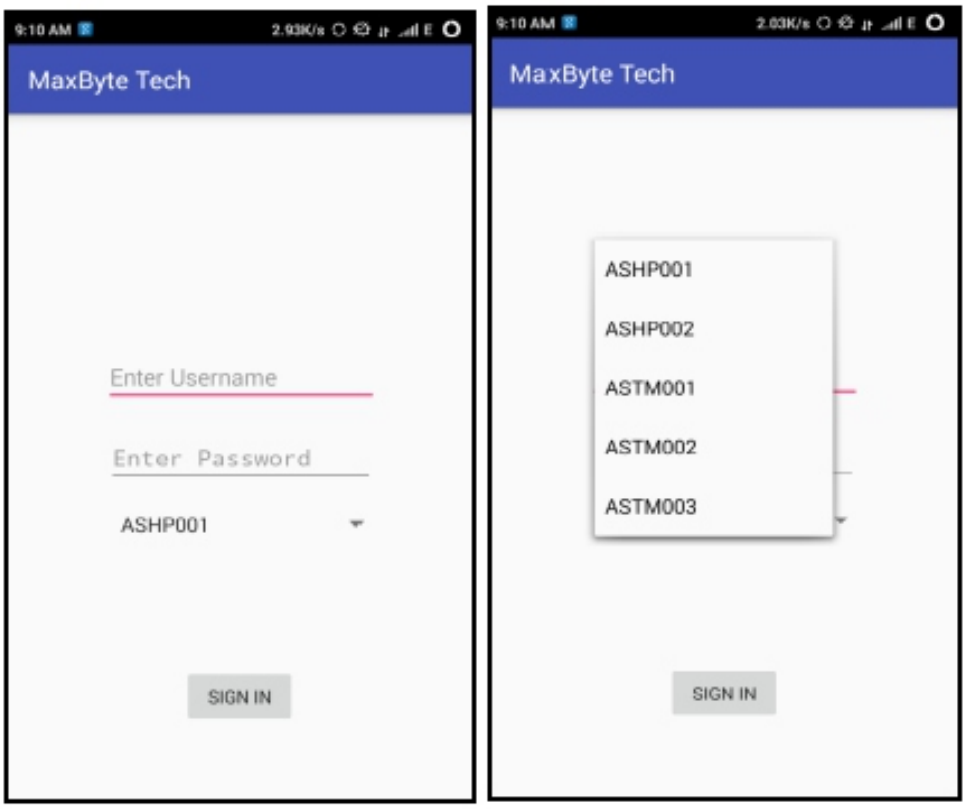
txt3.setText(JSONParameter+" kWh");

@override

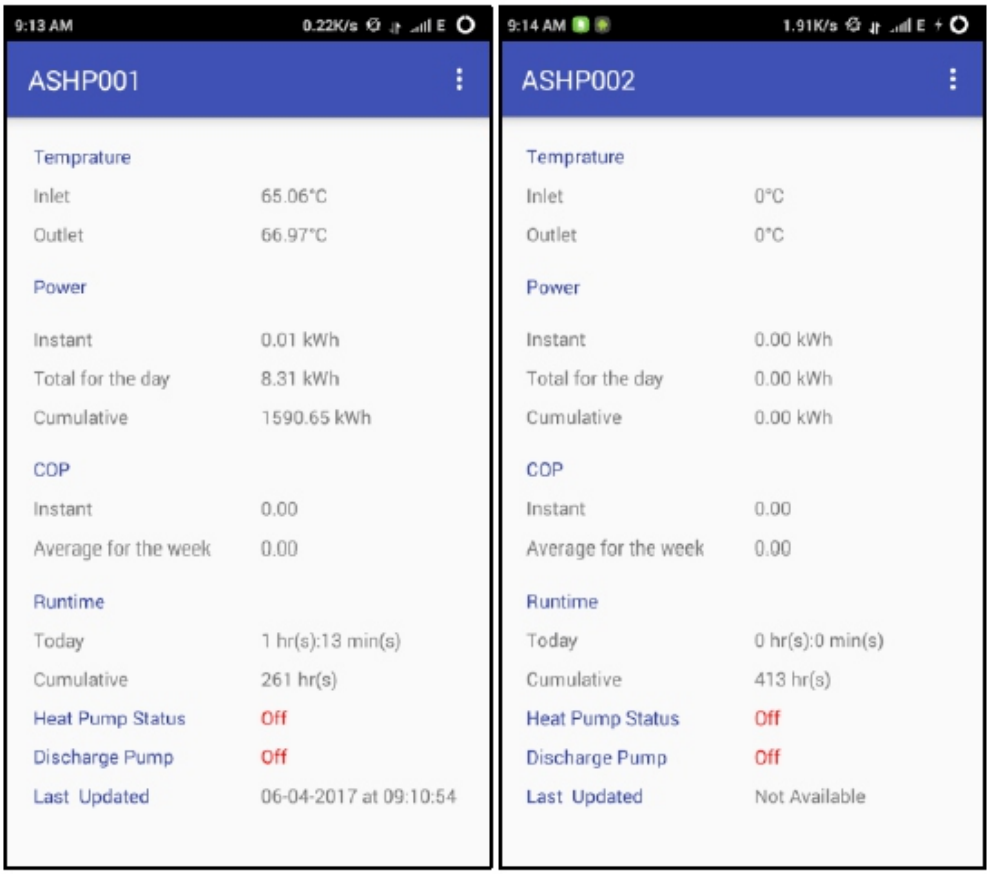
Protected void Execute(JSONObject object){ //set sensor details }}}

RESULT

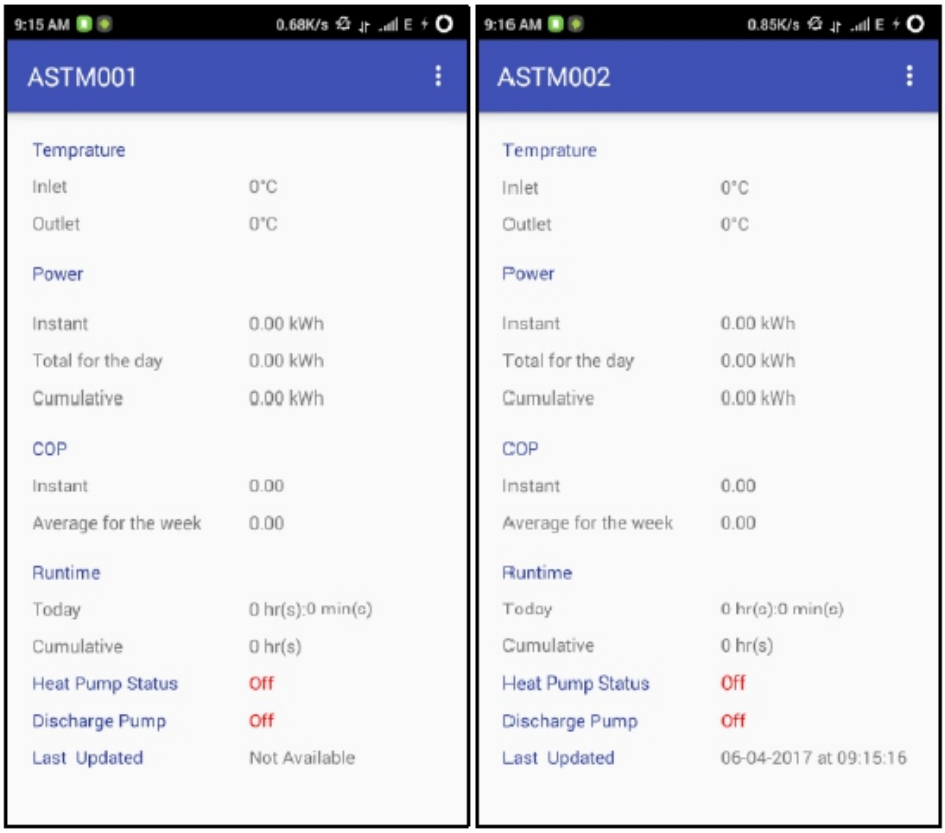
Login Activity: List of Devices:



Device 1-ASHP001 Device-2 ASHP002



Device-3 ASTM001Device-4 ASTM002



Device-3 ASTM003

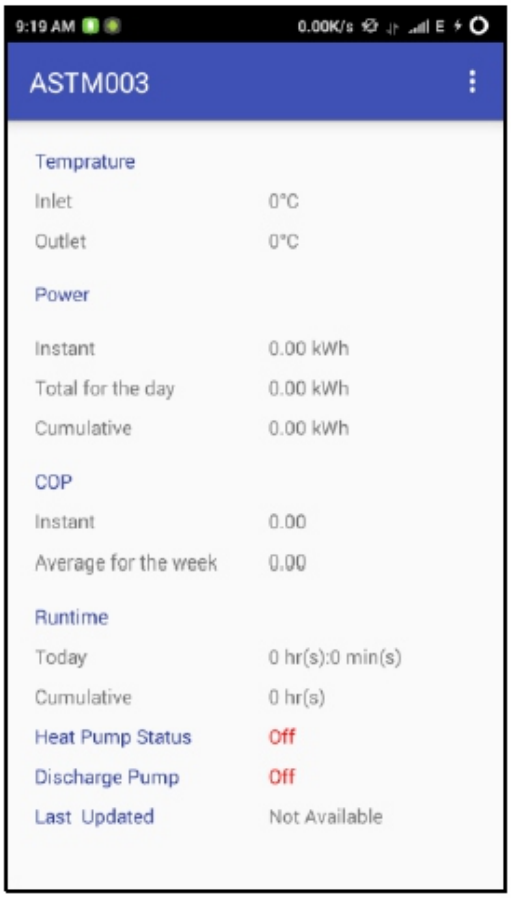


Table 1. Temperature from the Heat Pump Sensor

S. No.	Time (mins)	Temperature (^{0}C)
1	T1	46.5
2	T2	50
3	T3	55
4	T4	59
5	T5	65
6	T6	69
7	T7	74
8	T8	80
9	T9	83
10	T10	84
11	T11	85
12	T12	85.5
13	T13	85
14	T14	84
15	T15	85

To find the average(fx) for the temperature according to the time period.

fx= Σ(x) / N = 72.67℃

Σ represents the summation

X represents the sum of the temperature.

N represents the total number of temperature.

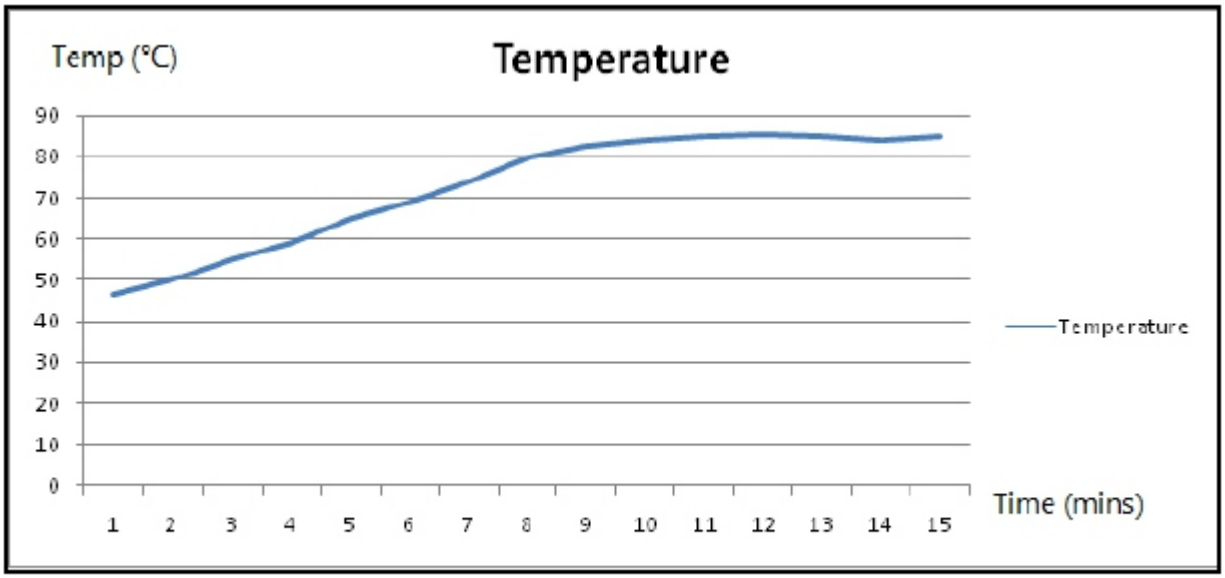


Fig. Graph for the Temperature from the Heat Pump Sensor

CONCLUSION

The app will be used by the person who works in the industry and who does not have the proper knowledge of handling data. So it's easy to view the working condition of the heat pump which is present inside the turbine. So if there is any issue on the device, it can be easily verified by the industrial worker. And it also saves the time of service team as they need not have to track the device condition and inform to the industrial people about the device. The app is just enough for noting the overall working condition of the heat pump. . The heat pump produces temperature around 80 – 85 degree Celsius.

FUTURE WORK

The app can be further developed by increasing the number of process done by the sensor. It can be designed to control the whole device from the app. Like, for example: If we switch-on the heat pump from the app, the heat pump will be switched-on and starts working in the industry and vice versa. So with the addition of parameters in the thingworx, and the process to be added in the sensors, then we can change it in app too. So there is more future scope in the IoT field and mainly to bring the device working on the mobile app. IoT is the trending technologies. And to control from the mobile app, it is totally useful.

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Reactive Power Compensation Using 500kv, 180km Line To Maintain Substantially Flat Voltage Profile At All Levels Of Ac Transmission System

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ABSTRACT

The global economic recession has contributed in o small measure, in the increasing number of blackouts throughout the world as a result of voltage instability and collapse. The environmental consideration has also contributed by arresting the commission of new power stations and transmission lines, thus resulting in overload of the existing system. This calls for a change to a new direction by using the power system tool-box in MATLAB to stem down the tide. The results showed a balanced system, as confirmed by a substantial flat voltage profiles at all levels during transmission.

Keywords: *Reactive Power, Compensation, Power System Tool-Box, Transmission Line, Voltage Collapse, Instability, Balanced System.*

INTRODUCTION

The function of power system is to provide every consumer, an electricity supply within tight bounds of frequency and voltage level while allowing them to switch appliances at will any time. The consumers also expect a reliable and secure supply of electricity even though they (consumers) are widely scattered and linked by extensive network of lines, cables and transformers which supply the electricity from distant power stations [1]. To meet these tasks, the power utility companies are faced with difficult technical problems coupled and complicated by financial constraints. Going memory lane, the turning points of these problems have been the 1973 – 4 oil crisis which besides leading to a dramatic increase of fuel prices had set off a world-wide economic recession that severely curtailed the growth of electricity demand [8]. The financial repercussions have severely constrained the electric utilities in their outlays on the power networks, at the very time when fuel costs radically altered generation patterns, leading to much higher loading on the interconnections within the transmission grid. Since this global economic recession, difficulties have emerged and worsened as environmental considerations have delayed or resisted the commissioning of new power stations and transmission lines [8].

All these factors have contributed to the changing modes of power system operation, where each utility had been self sufficient before but are now interdependent on neighbours because of heavy power interchanges. Although, there have been advances in the operational control of power system [4], these have not kept pace with the growing operational complexities. The results of these difficulties have been the increasing number of blackouts throughout the world, many due to system voltage instability. This calls for the need for a new direction in power system control to overcome the present technical difficulties as well as gaining economies for the power utilities. Reactive power compensation by employing the power system tool-box offers an opportunity to develop a new direction for power system control.

2.0 REACTIVE POWER COMPENSATION

Reactive power compensation can be defined as the management of reactive power to improve the ac power system performance. It is the supply of reactive power in a transmission system to increase the transmittable power, thereby making it compatible with the prevailing load demand. Therefore dynamic compensation is the reactive power compensation that is able to adjust its reactive power automatically so that the concerned system power factors are maintained within the desirable limits. The concepts of Volt Ampere Reactive (VAR) compensation embraces a wide and diverse field of both system and consumer problems, especially related with power quality issues since most of the power quality problems can be attenuated or solved with adequate control of reactive power [3]. The above topic tries to analyze the need for reactive power balance and voltage control in ac transmission lines with a view of contributing its own quota in solving one of the major problems and challenges in power system engineering. In general, the problem of reactive power compensation can be viewed from two perspectives (i) Load compensation and (ii) Voltage support. In load compensation, the objective is to increase the value of the system power factor to balance the real power drawn from the a.c. supply, compensate voltage regulation and eliminate current harmonic components produced by large and fluctuating nonlinear industrial loads [6]. Voltage support is generally required to reduce voltage fluctuation at a given terminal of a transmission line in order to balance the system. Reactive power compensation in a transmission line improves the stability of a.c. system by increasing the maximum active power that can be transmitted. It also helps to maintain a substantially flat voltage profile at all levels of power transmission, increases transmission efficiency, controls steady-state and temporary over voltage [3], and can avoid disastrous blackouts [2].

3.0 VOLTAGE COLLAPSE OR VOLTAGE INSTABILITY

Voltage collapse or instability is the process by which instability leads to loss of voltage in the significant part of the system. Here voltage may be lost due to "angle stability as well. Voltage instability is of

increasing importance to utility companies and instability and collapse incidents have been reported in the literature [6], for instance:-

I. In the US pacific northwest, transient stability including transient damping) have usually limited power transfer capability.
II. Also in recent years, the BC hydro has experienced limitations in power transfer capability in its service area of Vancouver, BC, during heavy winter load.
III. Again coming home, voltage stability is also a major concern in Lagos or Abuja area, the rapidly growing metropolitan communities in Nigeria, where peak power demands are increasing.

Also from the available literature and background studies, voltage instability or collapse or sag are characterized by the progressive fall of voltage which can take several forms [6].

- The inability of the network to meet a demand of the reactive power.
- Instability may be triggered by some form of disturbance, resulting in changes of the reactive power requirements.
- Disturbance may result from either small or large changes of essential load.

3.1 Detection and Prevention of Voltage Collapse or SAG

The process by which instability leads to loss of voltage in the significant parts of the system is the voltage collapse. While voltages may be lost due to "angle stability" as well, the phenomenon in many instances may be due to a deficit in reactive power generation, loss of critical lines, or degradation of control on key buses [5]. This calls for a new direction in power system to maintain substantially flat voltage profiles at all levels of ac transmission system, using the power system tool-box organized by Hadi sadat. The results indicated a balanced system. However, other preventive measures include, the use of optimal power flow strategy etc to minimize the voltage deviation.

4.0 LINE PERFORMANCE FOR 500KV, 180KM TRANSMISSION LINE ON NO-LOAD CONDITION, USING POWER SYSTEM TOOL-BOX

The power system tool box is that containing a set of M-files and was developed by Hadi Sadat to assist in typical power system analysis. Some of the programs, such as power flow, optimization, short-circuit and stability analysis were originated and developed by him for a main frame computer while working with power system consulting firms many years ago. These programs have been refined and standardized for interactive use with MATLAB for many problems related to the operations and analysis of power systems. The software modules are structured in such a way that the user may mix them for other power system analyses.

The M-files for typical power system analysis are designed to work in synergy and communicate with each other through the use of some global variables.

Line Performance Program

A program called Line Perf is developed for the complete analysis and compensation of a transmission line. The command Line Perf displays a menu with five options for the compensation of the parameters of the models and transmission constants.

(I) Computer Analysis and Details for, 500kv, 180km Line Using Power System Tool-Box in Matlab for No-Load (Open-Circuited) with Shunt Reactor Compensation

3Φ line, 180KM long; Vs = 500KV (L – L); f = 50Hz.

Line parameters are as follows:

r = 0.016Ω/Km, L = 0.97mH/Km, C = 0.0115μF/Km.

Assume a lossless line.

The command:

>> LinPerf, displays the following menu

Transmission Line Model

Type of parameters for input	*Select*
Parameters per unit length	
r(ohms), g(siemens) L(mH) & C (micro F)	1
Complex z and y per unit length	
r+j*x (ohms/length), g+j*b (siemens/length)	2
Nominal pi or Eq. pi model	3
A, B, C, D constants	4
Conductor configuration and dimension	5
To quit	0

Select number of menu --> 1

Enter Line length = 30

Enter Frequency in Hz = 50

Enter line resistance/phase in ohms per unit length r = 0.016

Enter line inductance/phase in millihenry per unit length L= 0.97

Enter line capacitance/phase in micro F per unit length C=0.0115

Enter line conductance/phase in siemens per unit length g= 0

Enter 1 for Medium line or 2 for long line --> 1

Nominal pi model

Z = 0.48 + j 9.14203 ohms

Y = 0 + j 0.000108385 Siemens

$$ABCD = \begin{matrix} 0.9995 + j\ 2.6012e\text{-}005 & 0.48 + j\ 9.142 \\ -1.4097e\text{-}009 + j\ 0.00010836 & 0.9995 + j\ 2.6012e\text{-}005 \end{matrix}$$

Hit return to continue

At this point the program list menu is automatically loaded and displays the following menu

Transmission Line Performance

Analysis	**Select**
To calculate sending end quantities for specified receiving end MW, Mvar	1
To calculate receiving end quantities for specified sending end MW, Mvar	2
To calculate sending end quantities when load impedance is specified	3
Open-end line & inductive compensation	4
Short-circuited line	5
Capacitive compensation	6
Receiving end circle diagram	7
Loadability curve and voltage profile	8
To quit	0

Select number of menu --> 4

Enter sending end line-line voltage kV = 500

Enter receiving end voltage phase angleø (for Ref. enter 0) = 0

Open line and shunt reactor compensation

Vs = 500 kV (L-L) at 0ø

Vr = 500.248 kV (L-L) at -2.60253e-005ø

Is = 31.2958 A at 89.9993ø PFs = 1.30159e-005 leading

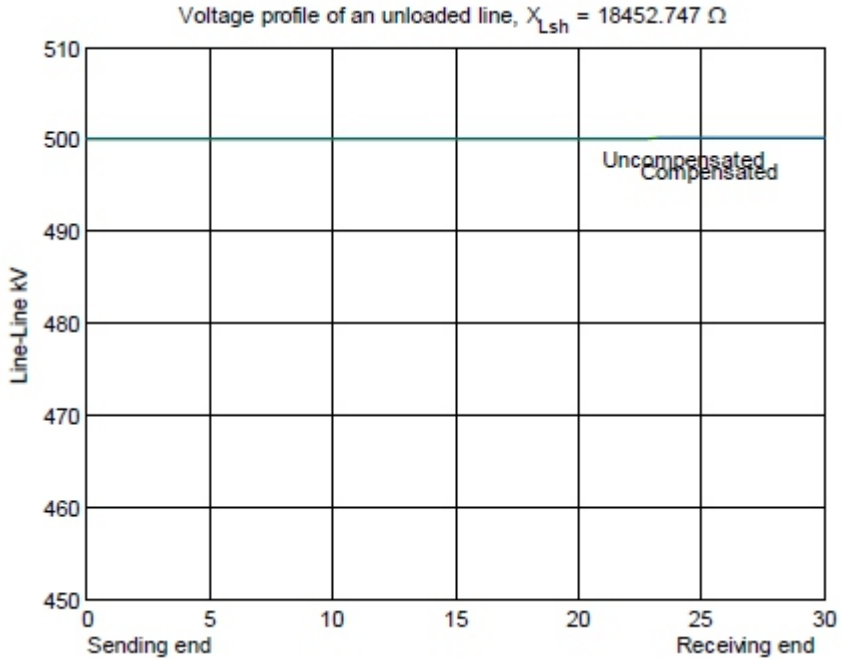
Desired no load receiving end voltage with shunt reactor compensation kV (L-L) = 500

Desired no load receiving end voltage = 500 kV

Shunt reactor reactance = 18452.7 ohm

Shunt reactor rating = 13.5481 Mvar

Hit return to continue



Similar other values and voltage profiles were obtained for: 60km

Open line and shunt reactor compensation

Vs = 500 kV (L-L) at 0ø

Vr = 500.993 kV (L-L) at -0.000104256ø

Is = 62.6382 A at 89.997ø PFs = 5.21798e-005 capacitive leading

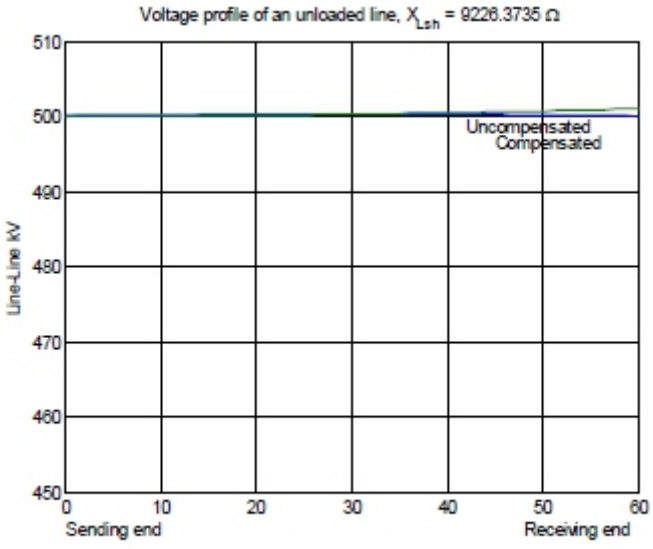
Desired no load receiving end voltage with shunt reactor compensation kV (L-L) = 500

Desired no load receiving end voltage = 500 kV

Shunt reactor reactance = 9226.37 ohm

Shunt reactor rating = 27.0962 Mvar

Hit return to continue



90km

Open line and shunt reactor compensation

Vs = 500 kV (L-L) at 0ø

Vr = 502.239 kV (L-L) at -0.00023516ø

Is = 94.0743 A at 89.9932ø PFs = 0.000117843 leading

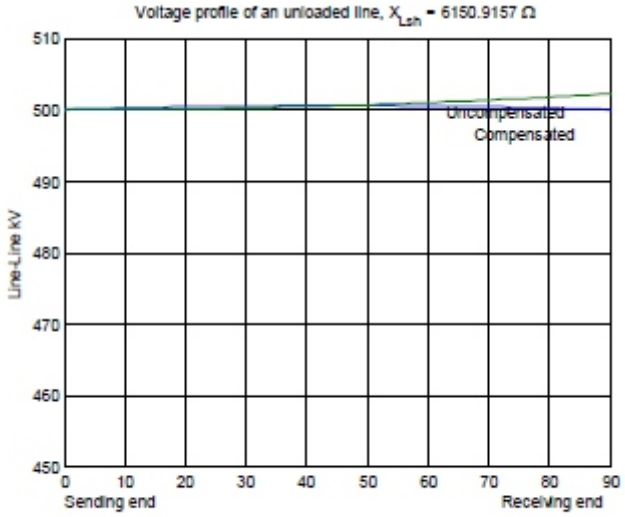
Desired no load receiving end voltage with shunt reactor compensation kV (L-L) = 500

Desired no load receiving end voltage = 500 kV

Shunt reactor reactance = 6150.92 ohm

Shunt reactor rating = 40.6444 Mvar

Hit return to continue



120km

Open line and shunt reactor compensation

Vs = 500 kV (L-L) at 0ø

Vr = 503.995 kV (L-L) at -0.000419524ø

Is = 125.652 A at 89.9879ø PFs = 0.000210597 leading

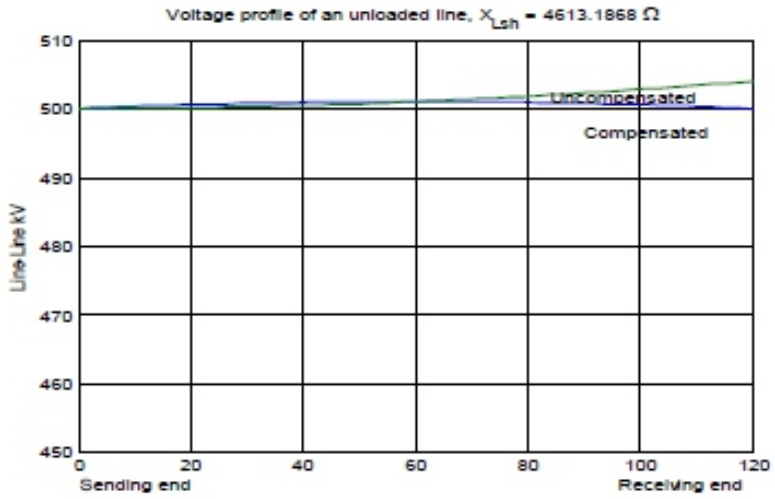
Desired no load receiving end voltage with shunt reactor compensation kV (L-L) = 500

Desired no load receiving end voltage = 500 kV

Shunt reactor reactance = 4613.19 ohm

Shunt reactor rating = 54.1925 Mvar

Hit return to continue



150km

Open line and shunt reactor compensation

Vs = 500 kV (L-L) at 0ø

Vr = 506.27 kV (L-L) at -0.000658465ø

Is = 157.421 A at 89.981ø PFs = 0.000331284 leading

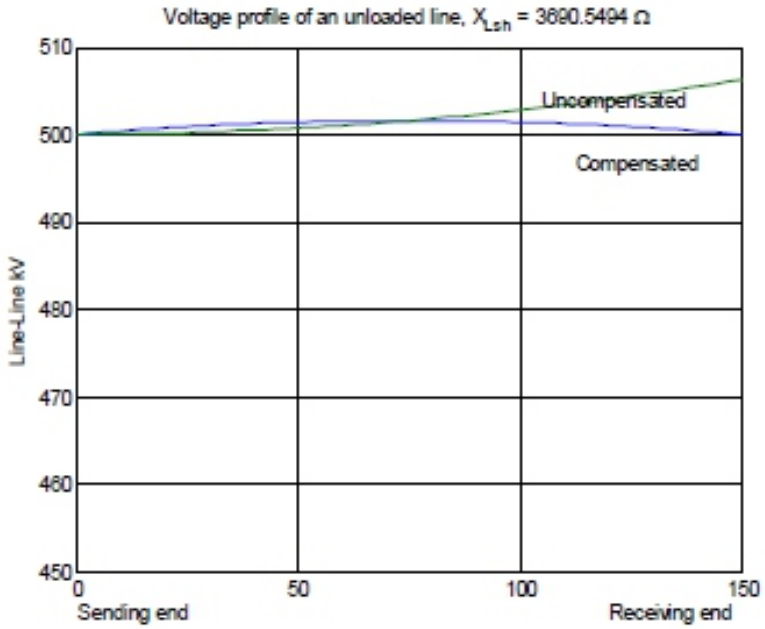
Desired no load receiving end voltage with shunt reactor compensation kV (L-L) = 500

Desired no load receiving end voltage = 500 kV

Shunt reactor reactance = 3690.55 ohm

Shunt reactor rating = 67.7406 Mvar

Hit return to continue



180km

Open line and shunt reactor compensation

Vs = 500 kV (L-L) at 0ø

Vr = 509.079 kV (L-L) at -0.000953451ø

Is = 189.433 A at 89.9724ø PFs = 0.000481015 leading

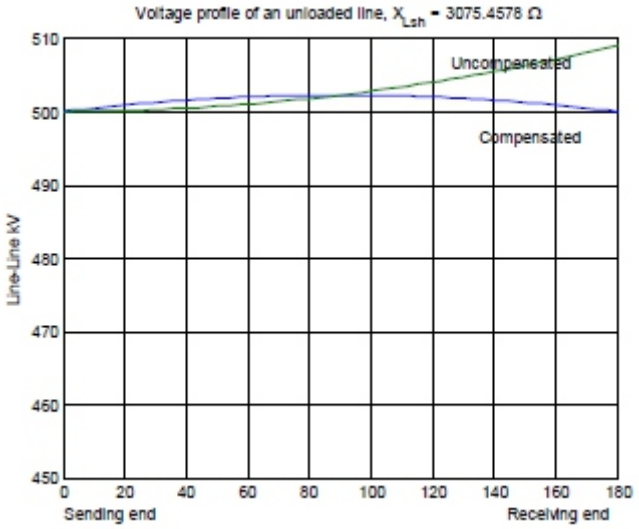
Desired no load receiving end voltage with shunt reactor compensation kV (L-L) = 500

Desired no load receiving end voltage = 500 kV

Shunt reactor reactance = 3075.46 ohm

Shunt reactor rating = 81.2887 Mvar

Hit return to continue



(II) Results

Table 4.1: Showing the results of shunt reactor compensation details for 500KV, unloaded 180KM line (open circuited).

Line Performance for Specified Receiving end Quantities

BEFORE COMPENSATION			AFTER COMPENSATION					
TRANS= MISSION DISTANCE		TR. LINE PARAMETERS				DESIRED N0 LOAD	SHUNT REACTOR	SHUNT
LENGTH OF LINE	CUMU-LATIVE LENGTH OF LINE	PER PHASE r = 0.016Ω/KM L=0.97`MH/KM C=0.0115μl/KM				RECEV. END VOLTAGE	REACTANCE X_{LSH}	REACTOR RATING
(K_M)	(K_M)	V_S (KV)	I_S(A)	V_R(K_V)	I_R(A)	(K_V)	(Ω)	(M_{VAR})
0	30	500	$21.31\angle 90^0$	500.248	0	500	18446.83	13.550
30								
	60	500	$62.66\angle 90^0$	500.992	0	500	9223.69	27.104
60								
	90	500	$91.15\angle 90^0$	502.238	0	500	6146.02	40.677
90								
	120	500	$125.83\angle 90^0$	503.990	0	500	4606.63	54.270
120								
	150	500	$157.75\angle 90^0$	506.528	0	500	3682.87	67.882
150								
	180	500	$190.00\angle 90^0$	509.050	0	500	3066.72	81.520
180								

(III) Observations

The voltage profiles of the compensated lines are substantially flat, almost at all levels of the transmission line, although beyond 120km or more, experienced little divergence. This can be eliminated by ensuring that the var demand of the load must be met locally by employing positive var generator (Condenser).

Again from table 4.1, Mvar demand (reactive power) increase as the line length increases, and if the var demand is large, the voltage profile at that point tends to sag rather sharply while the compensated and uncompensated profiles diverge more and more as the line length increases.

Moreover, with the constant sending-end voltage (Vs) at 500KV (see the table), the receiving-end voltage will continue to rise with increase in the line length until a quarter of wavelength (/4) or 1200Km is attained, when the rise becomes infinitely high. And beyond this value to about 1500Km, it may even turn to negative. This rise in voltage at the receiving end is due to the flow of line charging capacitive current through the line inductance. This phenomenon is called Ferranti effect.

5.0 CONCLUSION

From the analysis results, reactive power compensation not only maintain substantially flat voltage profiles at all levels of a.c. transmission system as can be seen from the figures in 30km – 180KM lines, the result is that it increases the transmission line efficiency, maintains steady state and temporary over-voltage, and can avoid disastrous blackouts.

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