A Model for Call Quality Computation and Collection in Mobile Telecommunication Networks

Akram Aburas & Prof. Khalid Al-Mashouq

Abstract—Call Quality parameters extraction from end-users perspective and analyzing at the operator end is new area of research. The parameters that are considered in this research are intuitive and are very much helpful for the operator in deciding the quality as perceived by the end user. The parameters are average signal strength during the active call and call drop information. A model to address the call quality escalation and locating them on the map enabling the user-groups and operators to benchmark the network has been proposed and implemented. A novel model to collect the call quality information for further utilization by the operator is proposed.

Keywords Call Quality Measurement, Signal Strength, Call drop, Landmarks, LAC (Location Area Code), ME (Mobile Equipment)

1. Introduction

Traditional speech quality measurement techniques use the subjective listening tests called Mean Opinion Score (MOS). It’s based on the human perceived speech quality based on the scale of 1 to 5, where 1 is the lowest perceived quality and 5 is the highest perceived quality. Subjective listening tests are expensive, time consuming and tedious.

So, currently most of the systems use objective evaluation of speech quality using some mobile computing techniques. Objective testing systems are use automated speech quality measurement techniques. The three well known objective measurement techniques are Perceptual Speech Quality Measure (PSQM), Perceptual Analysis Measurement System (PAMS) and Perceptual Evaluation of Speech Quality (PESQ).

Objective speech quality measurement techniques mostly are based on input-output approach [1]. In input-output objective measurement techniques basically works by measuring the distortion between the input and the output signal. The input signal would be a reference signal and output signal would be a received signal. Input-output based speech quality assessment in objective speech quality measurement gave good correlations with reaches up to 99% in some cases [2]. Estimating the speech quality without the presence of input signal or reference signal is latest area of research.

Input-output based speech quality assessment in objective speech quality measurement gave good correlations with reaches up to 99% in some cases [3]. The performance of objective measurement is basically achieved by correlating their results with the subjective quality measure. Estimating the speech quality without the presence of input signal or reference signal is latest area of research.

Jin Liang and R. Kubichek [4] published a first paper on output-based objective speech quality using perceptually based parameters as features. The results were quiet appreciable with 90% correlation.

R. Kubichek and Chiyi Jin [5] used the vector quantization method with 83% correlation achievement. An output based speech quality measurement technique using visual effect of a spectrogram is proposed in [6]. An output-based speech quality evaluation algorithm based on characterizing the statistical properties of speech spectral density distribution in the temporal and perceptual domains is proposed in [7]. The correlations results achieved with subjective quality scores were 0.897 and 0.824 for the training data and testing data set respectively.

A time-delay multilayer neural network model for measuring the output based speech quality was proposed by Khalid Al-Mashouq and Mohammed Al-Shayee in [8]. The correlation achieved for speaker and text independent was 0.87.

In this Paper, we presented our work for determining the call quality parameters such as average signal strength, Call drop information. Then final call quality is computed from the extracted parameters.

This research is continuation of the work that has been proposed in [9]-[17]. Call Quality measurement, escalation and analysis is the research being conducted from past few years and the QMeter® is registered software developed as a part of this research.

2. Call Quality Computation and Escalation

The proposed research parameters and the proposed methodology address the call quality issues by the mobile operator’s from end-users perspective. The system logs the signal strength information for every 5ms if there is change in the signal strength information.

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and calculates the score at every 5ms based on the below Table 1 and calculates the average signal strength at the end of the call. The call drop information such as normally dropped from either of the party or dropped due to network issues or during the cell change is also recorded and is reported in Table 2.

Table 1: Signal Strength Score

<table>
<thead>
<tr>
<th>Signal Range (dBm)</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>-120 to -95</td>
<td>Extremely Bad</td>
</tr>
<tr>
<td>-95.00 to -85.00</td>
<td>Bad</td>
</tr>
<tr>
<td>-85.00 to -75.00</td>
<td>Average</td>
</tr>
<tr>
<td>-75.00 to -65.00</td>
<td>Good</td>
</tr>
<tr>
<td>-65.00 to -55.00</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

Table 2: Call Drop Score

<table>
<thead>
<tr>
<th>Call Drop</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop due to Network issue</td>
<td>1 (Extremely Bad)</td>
</tr>
<tr>
<td>Normally Dropped</td>
<td>5 (Excellent)</td>
</tr>
</tbody>
</table>

The call quality is derived from the scores computed from the above parameters as below:

\[
\text{Call Quality} = \frac{\text{Signal Strength Score} + \text{Call drop Score}}{2}
\]

The below Table 3 shows final call quality classification.

Table 3: Call Quality Score

<table>
<thead>
<tr>
<th>Score</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1</td>
<td>Extremely Bad</td>
</tr>
<tr>
<td>1 - 2</td>
<td>Bad</td>
</tr>
<tr>
<td>2 - 3</td>
<td>Average</td>
</tr>
<tr>
<td>3 - 4</td>
<td>Good</td>
</tr>
<tr>
<td>4 - 5</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

The basic flowchart for the Call Quality computation is depicted in Fig. 1.

The system has the ability to send the call quality information to a particular number as a call quality escalation. It has the provision of setting the mobile number, to which the sms would be sent automatically at the end of call. The system has the option of setting to send the sms always, less than bad etc. It has also the provision to use the call quality based on call statistics, where the call quality is computed at the end of 10 calls and the call statistics can also be sent as sms. This flexibility allows the operator to fix the parameter values that can be escalated for immediate action. The sms call quality module is depicted in Fig. 2.

3. Collection Model for Call Quality

The parameters average signal strength score and call drop information scores are calculated and the final call quality score is derived as per the average scores proposed in previous section at the end-user mobile. The application at the end of the call, all the parameters, cell id and GPS cords will be sms'ed to some predefined short code at the operator end. All the information that
has been collected at the operator will be retrieved and stored in the database and would be available to the operator which would be very helpful to analyze the call quality for benchmarking and addressing other issues related to call quality. Various reports can be derived based on different parameters at different cell id’s and GPS coordinates, which would be very useful for the operators. Further, the call quality below threshold as perceived by the end-user can be used by the operator to apply the tariff redemption or adding bonus amount or minutes to the subscribers based on the policies defined by them. A block diagram showing the flow of call quality from mobile equipment to QMeter Application at the operator has been shown in Fig. 3. Also the tariff redemption and bonus minutes can be used as a marketing tool by the operators. Different tariff redemption methods were proposed in [14] based on call quality parameters.

![Call Quality Collection Model](image)

**Fig. 3. Call Quality Collection Model**

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**References**


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